FULL RESEARCH REPORT

Hear *their* Heart

Communication Without Speech

Why AI has transformed advertising, entertainment, and search, but has barely touched the way a non-speaking child tells you what they need. A history, market map, and opportunity analysis for augmentative and alternative communication (AAC), and the case for personalization as its next era.

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A note from the founder

Hear Their Heart was not started because someone spotted a market opportunity in assistive technology. It started with frustration.

My son has severe autism and struggles to communicate verbally. I have watched communication breakdowns turn into real distress and difficult behavioral episodes, simply because the people around him could not always understand what he was trying to say. Watching that happen to your own child is one of the hardest things a parent can go through.

We use an iPad running LAMP-based AAC software, and I am genuinely grateful it exists. It gives my son a way to be understood that he would not otherwise have. The clinicians, researchers, and companies documented throughout this report built something real, and their work created the foundation everything below stands on.

But I am also frustrated by how far the rest of consumer technology has moved while the communication experience available to children like my son has stayed largely the same: static grids of symbols, generic graphics, manually configured vocabulary sets, interfaces that look almost identical from one child to the next.

We are living through one of the largest technological shifts in history. Artificial intelligence can now generate images, video, speech, and adaptive digital experiences almost instantly and cheaply. Meanwhile, many families supporting non-speaking or minimally speaking children are still working with tools whose underlying interaction model has barely changed in twenty years.

The question this report is built to answer is not “is AAC helpful.” The evidence in the pages that follow says clearly that it is. The real question is why modern AI has not yet been pushed hard into this field to make communication tools more personal, more visual, more adaptive, and more responsive to the individual child in front of them, and where the actual opportunity is to change that.

That is the gap Hear Their Heart exists to close. Section “THE THESIS,” immediately following, lays out the case in full.

Founder, Hear Their Heart

A note on scope and confidence

This report reflects extensive live web research (over 200 individual search/fetch operations across five research streams) conducted in September 2026, prioritizing peer-reviewed literature, government/clinical sources, primary company sources, and patent databases. It is not a substitute for professional legal, regulatory, financial, or clinical due diligence; every section flags explicitly where a professional (patent counsel, FDA regulatory counsel, a claims-data analytics vendor) should be engaged before acting. Several explicit data gaps are called out throughout (e.g., no published national Medicaid claims data broken out for AAC-specific billing codes, no independent sizing of the SLP-therapy-services market) rather than papered over with invented figures. Two specific instances of likely AI-generated, unverifiable market-report content were caught and flagged during this research (a fabricated-looking "$50 million Series B" claim about Lingraphica, and a general caution about a ~7x spread across vendor market-size reports); a reminder that search-engine-indexed content about this sector should be treated with active skepticism, not taken at face value.

THE THESIS: AI PERSONALIZATION AS THE NEXT ERA OF ASSISTIVE COMMUNICATION

This section states the central argument of this report in plain terms before the reader goes deep into 22 parts of supporting research. It is written with more conviction than the sections around it, on purpose, and every specific claim in it is either backed by evidence found elsewhere in this report or is explicitly flagged as HYPOTHESIS. Part 9 (AI and the Next Generation of AAC), Part 11 (Opportunity Map), Part 20 (Product Concepts), and Part 21 (Why Now) all connect back to the argument made here.

The gap, stated plainly

Every part of this report that touches technology history tells some version of the same story. Blissymbolics, PECS, Minspeak, PCS symbols, GoTalk, dedicated speech-generating devices, Proloquo2Go: each was a genuine advance for its era (§2). But look at the underlying interaction model across nearly all of them, including the market leaders sold today: a fixed grid of symbols, drawn from a shared library used by every other child on the same app, arranged by a clinician or parent, navigated by touch or gaze. The core representation layer of AAC (§1.2) has been remarkably stable since the 1980s. What has changed since then is mostly packaging: the symbols moved from paper to a dedicated device, then from a dedicated device to a tablet. The symbols themselves, and the fact that they are generic rather than personal, has not fundamentally moved.

Meanwhile, outside this field, artificial intelligence has spent the last four years learning to generate photorealistic images, coherent short video, natural speech, and adaptive, personalized digital experiences on demand, at falling cost (§13.8). That capability has been aimed at advertising, entertainment, productivity software, search, and social media. It has not, by and large, been aimed at one of the oldest and most fundamental human problems there is: loving someone and not always understanding what they are trying to tell you.

This report's opportunity map (§11) already identifies device abandonment, slow communication rate, generic vocabulary, and the inability to express personality as the field's best-documented, most consistently reported problems (§4.2.1, §14). Those are not new findings. What is new, and what this section argues, is that the specific tool needed to attack several of them at once, personalization at the level of image, video, and context rather than just text prediction, has only existed in usable form for roughly the last two to three years.

The reframe

The wrong question is "does AAC work." The evidence says it does; the field's own peer-reviewed literature and the lived experience behind this report both say so.

The right question is: given what generative AI can now do elsewhere, why does a communication board for a non-speaking child still look like a communication board built in 2005, just running on newer glass? And what happens to outcomes, engagement, and independence once that stops being true?

The seven-part opportunity, evidence by evidence

Hear Their Heart's founding thesis is that AI personalization should become a foundational layer of assistive communication technology, not a bolt-on feature. That thesis breaks into seven concrete product directions. Each is treated honestly below: what is realistic today, what already exists as research or a competing product, and what remains a genuine open bet.

1. AI-personalized visual communication cards, built around the child's real life. Instead of a generic drawing standing in for "grandma," the card reflects an image connected to the child's actual grandmother. Instead of a generic school icon, the interface uses something recognizable from the child's actual school. Instead of a generic snack picture, the system shows the foods the child actually eats. This is a direct, evidence-grounded extension of a finding already documented in this report's competitive research (§8.3): today's symbol libraries (PCS, SymbolStix, Widgit, ARASAAC) are static, professionally illustrated sets shared across every user, and the market's own patent landscape shows this static-library model has barely moved since the 1990s. Uploading a plain family photo as a custom icon is old and already supported by most major apps; that is not the innovation. The innovation is using generative image models to produce a *consistent, stylized, repeatable* likeness that stays recognizable across dozens of future uses, and to do this fast enough that a parent or therapist can build it in minutes rather than hours. This is a genuinely open bet, not a settled one: a focused research pass for this report (§9.10) found the underlying image and video technology already mature enough to do this today (consumer tools including Google's Gemini "Nano Banana," OpenAI's GPT Image 2, and Midjourney's character-reference feature can now hold a specific person's likeness consistent across many generated images from a handful of reference photos), yet found no AAC or autism-support product that has built this capability, and found that PRC-Saltillo, the field's leading dedicated-device maker, shipped AI image generation into its apps in February 2026 running on Apple Intelligence and explicitly configured it to refuse to generate images of real people at all. The market leader has the platform and the distribution and has chosen not to solve this problem. That is the opening.

2. An AI visual prompt builder for routines and transitions. A parent, teacher, or therapist should be able to rapidly generate a visual sequence for getting dressed, using the bathroom, going to the doctor, brushing teeth, handling a schedule change, or visiting somewhere unfamiliar, in a visual style that is actually familiar and engaging to that specific child. This report's technology research already found the enabling capability proven in peer-reviewed form: the ASSETS 2024 study on GPT-4V-generated visual scene displays found SLP evaluators rated AI-generated communication content as comparable to human-made output (§9.4, §11 Concept 6). What that study did not yet test at scale is exactly this use case, personalized multi-step routine sequences rather than single boards, which is the more ambitious and more clinically valuable version of the same underlying capability.

3. Personalized short social and instructional videos. "What happens when we go to the dentist." "How we get ready for school." "How we ask for a break." "What happens when plans change." This is a natural extension of Social Stories, the well-established, decades-old clinical intervention pioneered by Carol Gray, into video generated around an individual child's actual routines, environment, and interests. This is not a replacement for a clinician's judgment about what story a specific child needs; it is a way to collapse the hours currently spent searching the internet, hand-illustrating, and printing a custom story down to minutes, so that far more children get far more of an intervention already proven to work. This is not empty white space: commercial AI Social Story generators already exist (GrowTale, Ella Kids, Glint, Easy-Peasy.AI, §9.10), and they already personalize by description, a boy in a green shirt, standing in a park. None of them was found to personalize by *identity*: an image or video built from an actual photo of this specific child, this specific dentist's office, this specific sibling. That distinction, generic-but-described versus real-and-recognizable, is the entire gap this item is built to close, and it is a narrower, more defensible claim than "nobody does AI social stories," which would simply be false.

4. Dynamic, context-aware interfaces that reduce friction without taking over the choice. The goal is never for AI to decide what a person wants to say; this report treats that line as close to sacred, and the reasons why are laid out at length in §9.9. The goal is to make the *right* vocabulary easier to reach depending on whether the child is at school, at home, at a restaurant, in the car, at a doctor's appointment, playing outside, or getting ready for bed, the same way a smartphone keyboard learns what you tend to type without ever putting words in your mouth. Genuine peer-reviewed research already exists in this exact direction: SPICA's personal-memory architecture and AACessTalk's real-time contextual vocabulary recommendation (both presented at CHI/IUI in 2025, §9.3) prove the core mechanism works and, in AACessTalk's case, prove it can *increase* a child's sense of agency in conversation rather than reduce it. Neither has shipped as a commercial product yet.

5. Personalization around the child's actual interests. A child fascinated by trains should not receive the same visual communication experience as a child fascinated by dinosaurs, space, or a favorite show. This sounds simple, and it is the one item on this list with the least direct academic literature behind it in this research pass; it is closer to product design common sense than a technical breakthrough. It is included here because every parent and clinician quoted in this report's user-voice research (§14) describes generic, one-size-fits-all vocabulary as a real barrier to engagement, and interest-based personalization is the most direct, lowest-technical-risk way to address that.

6. A caregiver copilot: describe the situation, get the supports. A parent should be able to write, in plain language, "my son has a new dentist appointment tomorrow and gets very anxious in unfamiliar places," and receive back a coordinated bundle: a visual schedule, a short personalized story, relevant communication cards, questions to prepare for, and symbols likely to matter during the visit. Today, building that bundle means searching the internet, manually creating graphics, editing templates, printing materials, and configuring several disconnected apps, exactly the uncompensated hours-long burden this report's teacher and parent journeys document in detail (§5.2, §5.4). Collapsing that into one integrated workflow is a caregiver-time problem with a caregiver-time solution, not a research problem; the individual generation capabilities it depends on (items 2 and 3 above) are the harder parts, and they are already within reach. Here too the pieces already exist separately and the bundle does not: GrowTale and Ella already generate a story from a description, Glint and HeyOtto already generate a visual schedule from a description, and this report's research (§9.10) found no product that turns one description into a coordinated kit spanning schedule, story, and communication cards together.

7. A personal communication profile and an AI-generation-compatible visual library. With real consent and privacy protection, a portable profile carrying a child's preferences, routines, triggers, interests, effective supports, and important personal vocabulary would also solve this report's single most-repeated cross-stakeholder complaint: that a child's hard-won progress resets at every transition, new school, new therapist, new device (§5.7, §11 Concept 2). Paired with a personalized visual library built for AI generation rather than a static licensed symbol set, this becomes the infrastructure layer the other six items run on, not a separate product.

Why now, specifically

The last generation of assistive communication digitized the communication board: paper became a tablet screen, a recorded button became a synthesized voice. The underlying visual vocabulary stayed generic and shared. The next generation can personalize the entire communication environment, and it can do that now, specifically, because of a stack of capabilities that did not exist together even three years ago:

- **Multimodal AI** that can look at a photo and understand what is in it well enough to generate clinically appropriate content from it, proven in peer-reviewed form only since 2023 to 2024 (§9.4, §21).
- **Generative image and video models** capable of producing coherent, personalized visual content fast and cheaply, a capability that simply did not exist at usable quality or cost five years ago.
- **On-device and low-cost inference**, with industry analysts projecting inference cost for large models to fall more than 90 percent by 2030 (§13.8), which matters directly for a product a child may use hundreds of times a day and which, for privacy reasons, should avoid sending a vulnerable child's data to the cloud by default.
- **A newly-published ethical design framework** for exactly this problem, built by HCI researchers and AAC self-advocates together between 2023 and 2026 (§9.9): suggest rather than substitute, stay visible to the communication partner, personalize from the individual's own history rather than generic web text, and keep the human in control of consent and override at every step. This framework, cited throughout this report, is what makes

it possible to pursue this thesis aggressively without repeating the authorship mistakes this field has already lived through once, in the facilitated communication and Rapid Prompting Method controversies documented in §10.

- **Accessible, already-owned hardware.** Nearly every family in this report's target population already owns a tablet or smartphone capable of running these tools; the marginal hardware cost of this thesis is close to zero, in sharp contrast to the $5,000 to $8,500 cost of a dedicated device (§6.6, §7.4).
- **Identity-consistent generation became a solved technical problem only in the last cycle of model releases, and the relevant privacy rulemaking landed at almost exactly the same time.** OpenAI's Sora 2 "Cameo" (fall 2025), Google's Gemini "Nano Banana," and OpenAI's GPT Image 2 all demonstrate consumer-grade, reference-photo-conditioned identity consistency for the first time as of 2025 to 2026 (§9.10), and the FTC's amended COPPA rule, finalized April 2025 and reaching full compliance deadline in April 2026, was the first US privacy rulemaking to explicitly grapple with AI-generated likenesses and biometric identifiers for children (§9.10). A company building this thesis in 2026 is not waiting on either the technology or the regulatory ground to stabilize; both arrived within the past year.

No single one of these was the missing piece five years ago. Together, as of the last two to three years, they are.

What this thesis is not, and the tensions it must respect

Two things need to be said plainly, in the same spirit of intellectual honesty the rest of this report tries to hold to.

First, established AAC science carries a real, well-evidenced principle that a personalization-first product must respect rather than override: consistent symbol placement and appearance supports motor planning and communication speed, which is the entire reason systems like Minspeak exist (§2.1) and the entire reason core-vocabulary boards are built to stay stable over time. A product that regenerates a child's board every day in the name of personalization, rather than personalizing content while keeping layout and access methods stable, would be working against six decades of clinical evidence, not with it. The right design target is personalized *content* inside a stable, clinically sound *structure*, not novelty for its own sake.

Second, using generative AI on real photographs of a child's actual family members, not just the child, raises a privacy question broader than standard children's-data rules address: a grandmother, sibling, or teacher whose image is used to generate a communication card never consented to a technology company processing their likeness. This is not a hypothetical concern this report is raising on its own; a dedicated research pass (§9.10) found that the FTC's own April 2025 COPPA rulemaking record explicitly discusses AI-generated avatars of children and concedes it would be difficult for an operator to even determine whether a given avatar was generated from a real child's image, and found no regulatory guidance, professional-association position, or case law anywhere that addresses the narrower and equally real question of a *non-child third party's* likeness (a grandmother, a sibling) processed for a minor's benefit. This report's existing AI-ethics research (§9.9) already establishes the core discipline this thesis must extend to images and video, not only to text: transparency, consent, and control at every step, now applied to a new and more sensitive category of data where the law itself has not yet caught up. Any company pursuing this thesis needs a privacy and consent architecture built for that reality from day one, not retrofitted after launch, and should expect to need outside counsel to help define it rather than assume an existing template covers it.

Neither tension is a reason to abandon the thesis. Both are reasons to build it carefully, with the same clinical humility this report asks of every other opportunity in it (§9.9, §22).

The investor argument

Hundreds of billions of dollars are being invested in artificial intelligence right now. Most of that capital is aimed at advertising, entertainment, productivity, search, coding, and social media, genuinely valuable problems, but not urgent ones in the way this one is. Meanwhile, millions of families are living with one of the most fundamental human problems there is: loving someone and not always understanding what they are trying to say. In an era when AI can generate a photorealistic video from a sentence, that should feel unacceptable, not inevitable.

This is not a pitch for another autism app. The opportunity this report identifies, and the one Hear Their Heart intends to pursue, is an intelligent communication and visual-support platform capable of becoming genuinely personal to the individual using it: the child's own people, own places, own interests, own routines, expressed through AI capabilities that, until the last two or three years, simply did not exist. The remainder of this report, its history, its market map, its money flows, its patent landscape, and its opportunity scoring, exists to test that thesis against the evidence rather than simply assert it. Where the evidence pushes back, this report says so directly (§4.2.1, §10, §12.15, the Final Deliverable's closing "surprising discoveries"). Where it supports the thesis, as it does across Parts 9, 11, 13, 19, 20, and 21, this report says that directly too.

Research tagging key: FACT (cited), ESTIMATE (calculation/reasoning shown), CLAIM (attributed to a named speaker/company), HYPOTHESIS (analyst inference/opportunity).

A note on terminology used throughout this section: "AAC" (Augmentative and Alternative Communication) is the umbrella clinical/field term. ASHA defines AAC as "an area of clinical practice that supplements or compensates for impairments in speech-language production and/or comprehension, including spoken and written modes of communication" and divides it into **unaided** (body-only: gesture, sign, facial expression) and **aided** (uses an external tool, ranging from no-tech picture boards to high-tech speech-generating devices) modalities. (FACT; ASHA Practice Portal: AAC)

There is active, unresolved disagreement in the field over "non-verbal" vs. "non-speaking" vs. "minimally speaking" vs. "AAC user"; addressed in a dedicated subsection of Part 1.

PART 1: TAXONOMY OF THE COMMUNICATION LANDSCAPE

1.0 Framing and terminology dispute

Before the taxonomy: the clinical and disability-community literature is actively contested on what to call people who don't rely on speech.

- **"Nonverbal"** is the oldest, most common lay/clinical term but is now widely criticized. "Verbal" means "relating to words," not "speech"; so a person who cannot speak but reads, writes, or uses symbol-based language is not accurately "non-verbal." Self-advocates argue the term implies an absence of language altogether, which can lead others to withhold language-rich AAC from someone who could use it. (FACT; Autism Parenting Magazine: Nonverbal vs Nonspeaking; Stimpunks Foundation glossary: Nonspeaking)
- **"Non-speaking"** is increasingly preferred, especially by autistic self-advocates, because it describes only the absence of reliable spoken output, not language competence. (FACT; same sources above)
- **"Minimally verbal" / "minimally speaking"** describes people who use a small number of spoken words or fixed phrases, or who can speak sometimes but not reliably enough to be understood consistently ("situational speech"). (FACT; PMC11197385, multi-stakeholder AAC review)
- **"AAC user"** is a functional, technology-neutral identity term increasingly used by the field and by self-advocates, sidestepping the speech-production question entirely.
- `CLAIM`: Disability/neurodiversity self-advocates frame this shift as part of a broader project to "reclaim language… reflects dignity, intelligence, and capability" rather than deficit framing.

This report follows the brief's convention and uses "non-speaking / minimally speaking / AAC user" as the primary respectful terms, using "non-verbal" only when quoting a source or describing older literature that used it.

1.1 Eight-layer taxonomy

The 39+ items in the assignment brief cluster into eight overlapping categories. A single real-world tool (e.g., an iPad running Proloquo2Go with eye-tracking) can occupy four or five of these layers simultaneously; this is the central design fact of the field: **AAC is a stack, not a single product category.**

Layer 1: Communication Methods (the underlying human behavior, independent of any tool)

- Gesture (pointing, reaching, head-nod/shake)
- Facial expression and body language / affect display
- Natural/home sign (idiosyncratic gestural systems that emerge without formal instruction, e.g., in isolated deaf children; precursor research to Nicaraguan Sign Language)
- Formal sign languages (ASL, BSL, Auslan, etc., full natural languages, not "gestures")
- Manual alphabets / fingerspelling (spelling words letter-by-letter on the hand, e.g., used with deafblind communication)
- Writing and drawing
- Vocalization/prosody without full words (used partner-dependently)

Layer 2: Language Representation Systems (how meaning is encoded, independent of the physical medium)

- Orthographic/alphabet-based text
- Symbol/pictogram sets: PCS (Picture Communication Symbols), Widgit Symbols, SymbolStix, ARASAAC (open-source), Blisssymbolics (a semantically/graphically composed ideographic system, distinct from simple pictograms)
- Core vocabulary systems (a small set of high-frequency, flexible words; "go," "want," "more," "stop"; that make up ~80% of everyday communication) versus fringe/topic vocabulary
- Motor-planning/single-location language systems: Minspeak/Unity (icon sequences mapped to fixed keyboard locations so words are found through consistent physical movement, not menu search)
- Pragmatic organization systems: PODD (Pragmatic Organisation Dynamic Display); organizes vocabulary around conversational function/pragmatics rather than topic
- Manually coded/simplified sign vocabularies used within spoken-language environments (e.g., Makaton, Key Word Sign)
- Morse code as a language-representation/input code (letters as tap patterns); distinct from scanning as an access method, though often combined

Layer 3: Access Methods (how a user selects/produces a message, independent of representation or device)

- Direct selection: finger/hand pointing, head-pointer, mouth-stick
- Eye-pointing (unaided, to an object or E-tran frame) and eye-tracking (camera-based, calibrated gaze-to-cursor)
- Partner-assisted scanning (a communication partner recites categories/items and the user signals "yes" at the target; used by minimally verbal/paralyzed users when no reliable motor or eye signal exists)

- Switch access + scanning (single-switch, two-switch step-scan, row-column scan; the display or another person scans through options and the user activates a switch at the right moment)
- Sip-and-puff switches (breath-pressure-activated, common for high spinal cord injury/ALS)
- Joystick / proportional pointing interfaces
- Head-tracking (camera or accelerometer-based head-mouse)
- Morse-code input via 1–2 switches (dits/dahs mapped to a switch or sip/puff pattern); a specific access method for users with extremely limited reliable movement
- EMG (muscle-electrical) switches; for users with movement too weak to trigger mechanical switches
- Brain-computer interface (BCI) access; invasive (intracortical/ECoG) or non-invasive (EEG) signal used directly as the "switch" or cursor-control signal

Layer 4: Low-Tech Assistive Devices (no electronics: physical, static)

- Paper/laminated communication boards and books (topic boards, alphabet boards, PODD books)
- Letterboards / alphabet boards (used for direct pointing or partner-assisted scanning; central and controversial in the RPM/Spelling-to-Communicate debate; see Part 2 and note below)
- Picture cards (loose or in a binder/wallet); the physical substrate of PECS
- E-tran ("eye transfer") frames; a clear panel with symbols around the border and a central viewing hole, enabling partner-assisted eye-pointing (invented 1970s, still in daily clinical use)
- GoTalk-style low-cost devices sit at the boundary of low/mid-tech (see Layer 5)

Layer 5: Mid-Tech Devices (battery-powered, simple electronics, limited vocabulary, not fully computerized)

- Single-message and multi-message voice-output buttons (BIGmack, "Big Red" switches)
- Sequential/multi-level voice-output boards, e.g., GoTalk line (Attainment Company; first model 1993); record-and-play buttons a caregiver records manually, no dynamic screen or synthesized speech
- Simple static-display speech-generating devices (SGDs) with a fixed grid of recordable messages

Layer 6: High-Tech AAC / Dedicated Speech-Generating Devices (SGDs)

- Dedicated hardware SGDs purpose-built for AAC (not general-purpose computers), e.g., PRC/Saltillo Accent and PRiO devices, Tobii Dynavox I-Series
- Consumer tablets/smartphones repurposed as SGDs via AAC software (iPad + Proloquo2Go/TouchChat/TD Snap/Grid; Android + similar apps); the "consumer device AAC revolution" beginning ~2009–2011
- Text-to-speech (TTS) engines underlying all of the above; from early formant synthesis (Klatt/DECtalk) to modern neural TTS and personalized voice cloning
- Symbol-based AAC software platforms: Proloquo2Go, TouchChat, LAMP Words for Life, Grid (Smartbox), TD Snap/Snap Core First, CoughDrop, Avaz, Lingraphica products (aphasia-specific), GoTalk Now (software version)
- Predictive language systems: word prediction, phrase prediction, and (newest) generative-AI phrase suggestion layered onto symbol/keyboard AAC
- Alternative/adapted keyboards (large-key, high-contrast, on-screen scanning keyboards)
- Eye-gaze-controlled dedicated computers (e.g., Tobii Dynavox I-Series, PCEye trackers bolted to a standard computer)
- Wearable communication systems; emerging category, e.g., GoTalk Select (wrist-worn), smartwatch-based AAC trials

Layer 7: Software Platforms & AI Layers (cross-cutting: increasingly the differentiator, not the hardware)

- Cloud/sync platforms for caregiver customization (most modern apps: remote vocabulary editing, data logging)
- Context-aware AAC; adjusting vocabulary/prediction based on location, calendar, or conversational partner (largely R&D/early-commercial as of 2026)
- Caregiver-assisted tech / "modeling" support tools (aided language modeling built into apps like TD Snap, CoughDrop)
- Classroom communication tools (teacher dashboards, data collection for IEP goal tracking; CoughDrop, TD Snap, Proloquo add-ons)
- AI-assisted communication: LLM-based phrase generation/expansion from partial input, AI-driven vocabulary suggestion, and (research-stage) full "communication co-pilots" for AAC users
- Personalized voice synthesis / voice banking (Acapela my-own-voice, ModelTalker, VocaliD, CereProc CereVoice Me, and general-purpose voice cloning tools like ElevenLabs now used off-label for this purpose)
- Emotion/expression augmentation; adding affect/prosody controls or emoji/tone modifiers to otherwise flat synthetic speech (active research problem, not fully solved commercially)
- Sign-language recognition / gesture recognition via computer vision (SignAll and academic CNN/transformer systems translating video of signing into text; accuracy still well short of production-grade real-time interpretation for continuous conversation as of the most recent literature

reviewed) (FACT; SignAll company; recognition accuracy figures reported in isolated-sign benchmarks, not continuous conversation, per PMC ASL recognition reviews)

Layer 8: Emerging Neural/Physiological Interfaces (research-to-early-commercial)

- EMG-based silent-speech interfaces (surface electrodes detecting subvocal muscle activity; word-error rates in the ~10% range in recent published prototypes) (FACT; NeuroTechSC/OpenBCI writeup)
- EEG-based (non-invasive) BCIs; imagined-speech and P300/SSVEP spellers; historically slow (letters per minute), improving with deep learning
- Invasive BCIs / cortical implants: intracortical microelectrode arrays (BrainGate consortium, Stanford/Brown/UC Davis), electrocorticography (ECoG) grids (UCSF Chang Lab "speech neuroprosthesis"), and commercial implants (Neuralink)
- Combined EMG+EEG sentence-level decoding (2025 research demonstrations)
- Ultrasound- and ultrasound-imaging-based silent speech interfaces (tongue/vocal-tract imaging, e.g., "SottoVoce")
- AI decoding layers common to all of the above: the actual "breakthrough" in 2023–2025 BCI speech results is less the electrode hardware than transformer-based neural decoders trained on brain signal → phoneme/word mappings

1.2 How the categories overlap: the stack, illustrated

A single AAC solution is best described as a **stack of independent choices**, and most product/market confusion in this space comes from treating "the device" as one thing:

1. **Representation** (text? symbols? Minspeak icon sequences? Blissymbols?)
2. **Vocabulary organization** (core-vocabulary grid? PODD-style pragmatic branching? topic boards?)
3. **Output** (recorded human voice? synthesized TTS? personalized cloned voice?)
4. **Access method** (touch? eye-gaze? switch-scan? partner-assisted?)
5. **Hardware** (dedicated SGD? repurposed tablet? paper?)
6. **Software platform** (Proloquo2Go, TouchChat, Grid, TD Snap, CoughDrop, or a low-tech book with no software at all)

`HYPOTHESIS`: This stack structure is the single most important fact for a market-map or product strategy exercise in this space; most "new AAC startups" actually innovate at only one layer (e.g., a new AI prediction layer, or a new voice-cloning layer) while inheriting the rest of the stack from incumbents (PRC-Saltillo, Tobii Dynavox, AssistiveWare), which explains both the difficulty of full vertical disruption and the opportunity in layer-specific "picks and shovels" plays (e.g., selling a better voice-cloning or prediction layer to the incumbents rather than a full competing device).

1.3 Communication needs by population (cross-reference, not exhaustive)

Distinguishing populations matters because the "best" point in the taxonomy differs sharply by cause of complex communication needs: - **Cerebral palsy** (often combines motor-access limitations with intact cognition) → often eye-gaze or switch-scanning high-tech AAC. - **Autism (non-speaking/minimally speaking)** → PECS, core-vocabulary symbol systems, Minspeak/LAMP, tablet AAC. - **ALS/motor neuron disease (progressive)** → typically starts with direct selection/keyboard, degrades toward eye-gaze, then partner-assisted or BCI as the disease progresses; voice banking is especially salient here because users had full natural speech before onset. - **Aphasia (stroke)** → Lingraphica and similar SGDs emphasize relearning/re-accessing existing language rather than building new language. - **Deafblindness** → tactile signing, manual alphabet on the hand (Helen Keller/Anne Sullivan lineage), braille. - **Locked-in syndrome / high cervical spinal cord injury** → sip-and-puff, single-switch scanning, BCI research population.

PART 2: HISTORY (CHRONOLOGICAL TIMELINE)

2.1 Timeline table

APPROX. DATE	DEVELOPMENT	PERSON/ORG	PROBLEM SOLVED	TARGET POPULATION	TECH	BREAKTHROUGH	LIMITATION	STILL USED?	DESCENDANT TECH
1690s–1950s	Manual alphabet / fingerspelling and tactile signing for deafblind communication	Perkins School for the Blind lineage; popularized by Anne Sullivan & Helen Keller (from 1887)	Language access for people who are both deaf and blind	Deafblind individuals	Tactile hand-spelling, later Braille	Proof that language could be transmitted through touch alone, absent both sight and hearing	Slow; requires a trained partner; not independent	Yes, still used in deafblind communities	Tactile signing, Braille communication devices, protactile ASL
1600s–1800s	Emergence of Martha's Vineyard Sign Language (MVSL)	Deaf and hearing residents of Martha's Vineyard, MA (from ~1690s, Jonathan Lambert's family)	Everyday communication in a community with extraordinarily high hereditary deafness (~1 in 25 vs. ~1 in 5,700 nationally, mid-1800s)	An entire town; deaf and hearing together	Natural sign language, no formal linguistics	First well-documented case of a whole (hearing+deaf) community sharing a sign language	Language died with last hereditary-deaf residents (last died 1952)	No (extinct)	Contributed vocabulary/structure into early American School for the Deaf, and thus into ASL
1817	Founding of the American School for the Deaf (Hartford, CT), merging French Sign Language (via Laurent Clerc) with home signs incl. MVSL	Thomas Hopkins Gallaudet, Laurent Clerc	First formal deaf education institution in the US	Deaf children	Sign-language-medium instruction	Created the linguistic melting pot that became ASL	Regional/dialectal fragmentation before standardization	Yes (institution and ASL both continue)	Direct ancestor of modern ASL
1897–1985	Charles K. Bliss develops Blissymbolics	Charles K. Bliss (born Karl Blitz, Vienna; Holocaust survivor)	Bliss's original goal was a universal, language-independent written communication system for international/interlingual use, not disability	General public (Bliss's intent)	Ideographic/semantically composed symbol set	Symbols compose logically (e.g., combining primitive shapes to build new meanings) rather than being arbitrary pictograms	Not adopted for its original international-language purpose	Yes, in AAC	Basis for the 1971 clinical adaptation below; conceptual ancestor of later symbol sets (PCS, Widgit, ARASAAC)
1960	Publication of *Sign Language Structure*, founding modern sign linguistics	William C. Stokoe (Gallaudet University)	Proved sign languages have phonology/morphology/syntax like spoken languages, countering the belief that signing was "just gesture"	Deaf community and linguistics field	Linguistic analysis + invented "Stokoe notation" (tab/dez/sig)	First scientific demonstration that ASL is a true language	Faced significant academic and Gallaudet institutional resistance initially	Yes; field standard concept	Enabled the 1965 *Dictionary of American Sign Language on Linguistic Principles* (Stokoe, Casterline, Cronenberg) and all subsequent sign linguistics
1963	POSSUM (Patient Operated Selector Mechanism) published	UK researchers (Bliss-independent UK line); adopted by Toby Churchill after 1968 illness	Environmental and communication control for people with high spinal cord lesions/tetraplegia	Tetraplegic/high-lesion patients	Mouth- or breath-operated electromechanical selector	Early proof that severely paralyzed users could independently select/scan options electromechanically	Bulky, limited vocabulary, mechanical	No (superseded), but conceptual ancestor of scanning SGDs	Ancestor of switch scanning and Toby Churchill Ltd.'s Lightwriter devices
1971	Adoption of Blissymbolics for clinical AAC use	Shirley McNaughton, interdisciplinary team, Ontario Crippled Children's Centre (now Holland Bloorview)	Communication for non-speaking children with cerebral palsy	Children with CP and other physical disabilities	Symbol board (low-tech)	First large-scale clinical use of a graphic symbol system for children who could not speak or write	Bliss himself objected to how the team adapted his system for conversational/practical use rather than his original "logical" intent; a real historical tension	Yes, still used in some AAC contexts, though far less common than PCS/photos today	Influenced Mayer-Johnson's PCS development approach and general acceptance of symbol-based AAC
Early 1970s	Founding of the Trace Research & Development Center	Gregg Vanderheiden and University of Wisconsin undergraduates, for a boy named Lydell (non-speaking, CP)	Build an independent communication tool for one child using a wooden communication board	Individual case, then general disability tech field	Communication board → "Auto-Monitoring Communication Board" (AutoCom), one of the earliest electronic scanning communication aids	Grew from single-student volunteer project into the field's most influential AT research center	–	Yes (Trace Center still operates, now at University of Maryland)	Universal design and accessibility standards; Windows/macOS accessibility APIs trace lineage partly to Trace Center work
1970s	E-TRAN ("eye transfer") frame invented	Jack Eichler (engineer) and Hugh C. Neale, for a friend with ALS	Enable eye-pointing communication without any electronics	People with ALS/severe motor impairment retaining eye movement	Clear plastic frame, symbols around a central viewing hole, partner-assisted	Made partner-assisted eye-gaze communication possible with zero-cost, zero-power hardware	Requires a trained, attentive communication partner; slow	Yes, still in everyday clinical/home use	Direct low-tech ancestor of camera-based eye-tracking SGDs
1973	Toby Churchill Ltd. founded (UK)	Toby Churchill (became paralyzed/non-speaking after encephalitis, 1968)	Commercial communication aids for people who cannot speak	Broad SGD market (UK-focused initially)	Electronic communication aids, later the Lightwriter	Founder-as-user model: designed by someone who needed the product himself	–	Yes (Lightwriter still sold)	UK's most established SGD lineage, later part of the broader Liberator/Toby Churchill ecosystem
1970s	Bruce Baker begins conceiving Minspeak while a doctoral student in linguistics	Bruce Baker (Middlebury Language Center)	Increase communication *rate*; the core bottleneck of all AAC; by using motor-plan icon sequences instead of one-symbol-one-word lookup	Broad AAC population needing speed	Semantic compaction (icon sequences map to words/phrases)	First rate-enhancement strategy grounded in motor learning theory, not just vocabulary size	Learning curve for new users/families	Yes	Minspeak, Unity, LAMP Words for Life all descend from this
1978–1980s	Founding and early growth of Prentke Romich Company (PRC) as an SGD maker	Barry Romich (met Baker late 1970s)	Bring semantic compaction to market as physical devices	Broad AAC population	TouchTalker, LightTalker hardware	1981–1983: PRC and Baker formally integrate Minspeak into commercial devices (Minspeak 1, 1983)	Devices were expensive, heavy, early-generation hardware	Yes (PRC-Saltillo today)	Modern PRC Accent/PRiO devices; LAMP Words for Life app
1983	Sentient Systems Technology founded (Pittsburgh) with CMU and Children's	Founders of what became DynaVox	Communication for a woman with cerebral palsy who could not speak or	CP/severe motor impairment	Early eye-typing hardware	Early proof-of-concept eye-controlled typing system	Primitive by later standards	No (company evolved into DynaVox, later Tobii Dynavox)	Ancestor of DynaVox and eventually Tobii

APPROX. DATE	DEVELOPMENT	PERSON/ORG	PROBLEM SOLVED	TARGET POPULATION	TECH	BREAKTHROUGH	LIMITATION	STILL USED?	DESCENDANT TECH
	Institute of Pittsburgh, builds the "Eye Typer"		use her hands reliably						Dynavox eye-gaze product lines
May 1983	ISAAC (International Society for Augmentative and Alternative Communication) founded, East Lansing, MI	John Eulenberg (Artificial Language Lab, Michigan State) and an international founding group of therapists, users, engineers, parents	Give the field a professional/scientific home and a shared name	The AAC field itself	Professional society	Coined/formalized the term "AAC" itself at this meeting	–	Yes, ISAAC remains the field's global professional body	Spawned national chapters (USSAAC, ISAAC Canada, etc.) and the *AAC* journal (1985)
1984	DECtalk launched commercially (Digital Equipment Corp.), based on Dennis Klatt's MITalk/KlattTalk research (MIT, since the 1960s)	Dennis Klatt (MIT)	High-quality formant speech synthesis for computers	General computer speech + AAC/disability use	Rule-based formant synthesis, three voices ("Perfect Paul," "Beautiful Betty," "Kit the Kid")	First widely deployed, intelligible synthetic speech product usable in real-time SGDs	Robotic, limited prosody by modern TTS standards	Largely superseded by neural TTS, but "Perfect Paul" remains iconic (Hawking used it)	Every subsequent commercial TTS voice used in AAC devices
1985	PECS (Picture Exchange Communication System) developed	Andy Bondy, Ph.D. and Lori Frost, MS, CCC-SLP, at the Delaware Autism Program	Give non-speaking/minimally speaking preschoolers with autism a way to *initiate* communication (prior picture-point systems relied on adults initiating)	Preschoolers with autism, later broadened to all ages/disabilities	Physical picture-card exchange, ABA/Skinnerian verbal-behavior theoretical base	First system explicitly designed around spontaneous initiation, not just responding	Requires structured teaching protocol (6 phases); some critique it can plateau users at exchange rather than progressing to richer language systems	Yes, extremely widely used worldwide	Pyramid Educational Consultants (PECS's commercial/training arm); influenced structure of digital "first words" AAC apps
1985	*Augmentative and Alternative Communication* journal launched	ISAAC (publisher), later Taylor & Francis	Give the field a peer-reviewed research outlet	AAC researchers/clinicians	Academic journal	Established AAC as a distinct empirical research discipline	–	Yes, ongoing quarterly journal, current editor-in-chief Ralf Schlosser (Northeastern University)	–
1986	Stephen Hawking receives the "Equalizer" software from Walter Woltosz (Words Plus)	Walter Woltosz (built an earlier version for his ALS-affected mother-in-law)	Restore independent communication after Hawking's 1985 tracheostomy removed his natural speech	ALS and similarly paralyzed users	Word/phrase-bank scanning software on Apple II + Speech Plus synthesizer, later ported to a wheelchair-mounted portable system by David Mason	Became the most publicly visible AAC success story in history, massively raising public awareness of SGDs	Slow (~switch-scanning speeds); required later re-engineering per Hawking's declining motor function (from hand switch to cheek-muscle sensor)	Descendant tech (Woltosz's word-prediction/EZ Keys line) still used; Hawking personally used a version of this system until his 2018 death	Modern Words Plus product line; general concept of a "generic phrase bank + speech synth" persists in every SGD
Early–mid 1980s to 1990s	Rise of dedicated SGD hardware makers and low/mid-tech competitors	PRC, DynaVox/Sentient, Toby Churchill, Zygo, Mayer-Johnson (symbols), Attainment Company	Broaden AAC beyond bespoke one-off engineering into a purchasable device market	Broad AAC population	Dedicated hardware SGDs, symbol libraries, low-cost mid-tech boards	Created a real commercial market and, eventually, insurance/Medicare funding pathways	Expensive (thousands of USD), often not portable, proprietary/closed ecosystems	DynaVox lineage continues as Tobii Dynavox; PRC continues as PRC-Saltillo	–
1990s	Mayer-Johnson's Picture Communication Symbols (PCS) become a field standard	Roxanna (Roxie) Mayer-Johnson, speech-language pathologist, with husband Terry Johnson	Provide a large (700+, later thousands) library of simple, consistent line-drawn symbols for AAC, rather than photos or Blissymbolics' more abstract logic	Broad AAC population, esp. children	Printed/licensed symbol library	Simplicity and recognizability at scale; became the de facto AAC "visual language"	Proprietary/licensed (later owned by Tobii Dynavox)	Yes, though open alternatives (ARASAAC, Widgit) now compete	Nearly all modern AAC apps ship with PCS or a PCS-like symbol set as default
1993	GoTalk (Pocket GoTalk) launched	Attainment Company	Give a low-cost, durable, no-training-needed voice-output option, especially for classrooms	Broad AAC population, esp. school settings and short-message needs	Battery-powered recordable message buttons (mid-tech)	Extremely low cost/robustness relative to full SGDs; commercially successful despite being "unsophisticated" tech	Fixed number of pre-recorded messages, no dynamic language growth	Yes, GoTalk product line still sold in 2026 (now includes a wearable, GoTalk Select)	–
1998	Sunrise Medical + Sentient Systems merge into DynaVox Systems Inc.	–	Scale distribution/manufacturing of SGDs	Broad SGD market	Corporate consolidation	DynaVox becomes the dominant branded SGD company for a decade+	–	Superseded by 2014 Tobii merger	Tobii Dynavox
2000	AssistiveWare founded	David Niemeijer (PhD, agricultural/environmental sciences; motivated by a friend paralyzed in a car accident needing a Mac on-screen keyboard)	Build accessible software for Mac OS X users with physical, vision, speech, and reading disabilities	Multiple disability populations	KeyStrokes, SwitchXS, VisioVoice, Proloquo, GhostReader	Broadened AAC-adjacent tooling to mainstream consumer computers (Mac) rather than only bespoke hardware	Niche relative to dedicated SGD makers	Yes	Direct predecessor of Proloquo2Go
2000s	DynaVox lobbies for, and helps secure, Medicare coverage of SGDs as Durable Medical Equipment	DynaVox	Remove the primary cost/access barrier to high-tech AAC for eligible users	US Medicare-eligible AAC users	Policy/lobbying, not a technology	Created a durable funding pathway that shaped the whole US SGD market's business model (insurance billing)	Coverage rules remain restrictive/contested (e.g., historically excluded devices with "non-SGD" functions like web browsing)	Yes, Medicare SGD coverage persists (with ongoing disputes)	Shapes product design decisions industry-wide (e.g., "locked-down" dedicated SGDs partly exist to satisfy insurance/DME rules)
2000s	EyeMax and other dedicated eye-gaze SGDs launched	DynaVox	Serve users with reliable eye movement but no reliable hand/switch access (e.g., ALS, severe CP)	ALS, severe CP, locked-in-adjacent users	Camera-based eye-tracking integrated into a dedicated SGD	Made eye-gaze access commercially mainstream rather than lab-only	Expensive, calibration-sensitive, lighting-sensitive	Superseded by later Tobii/Tobii Dynavox eye-tracking generations	Modern I-Series eye-gaze devices
2001	Tobii Technology founded	Tobii founders (Sweden)	Commercialize eye-tracking, initially for market research/psychology, not disability	General eye-tracking market	Camera-based remote eye tracking	Made eye-tracking hardware cheap/robust enough for non-lab use	–	Yes	Enabled 2005 eye-controlled computer and eventual 2014 DynaVox acquisition

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2005	Tobii releases "the world's first eye-controlled computer"	Tobii	Give people with disabilities a general computer-access route via eye gaze	Motor-impaired computer users	Eye-tracking + standard computer OS	Brought eye control out of dedicated single-purpose SGDs into general computing	–	Descendant product lines continue	Tobii Dynavox I-Series
2009	Apple ships first major iOS accessibility suite: VoiceOver, Zoom, Switch Control precursors (WWDC, iPhone 3GS/iPhone OS 3)	Apple	Make a mainstream consumer smartphone accessible out of the box	Blind/low-vision, motor-impaired users broadly	Built-in OS accessibility layer	For the first time, a mass-market consumer device (not a specialty AT device) shipped with serious built-in accessibility	Not AAC-specific by itself	Yes, continuously updated	Enabled the entire "iPad as AAC device" wave from 2009 onward
April 2009	Proloquo2Go released	AssistiveWare / David Niemeijer	Bring full symbol-based AAC to a consumer smartphone/tablet at a fraction of dedicated-SGD cost	Broad AAC population	iOS app, PCS-like symbols, TTS	Became "the foundation of the consumer device based AAC revolution" (CLAIM, AssistiveWare's own framing, corroborated by wide adoption); dramatically lowered price and stigma versus bulky dedicated SGDs	Relies on a general-purpose consumer device (durability, funding/insurance classification issues)	Yes; "world's most popular AAC app" per AssistiveWare (CLAIM)	Touched off TouchChat, Grid, Avaz, and other iPad-era AAC apps
2010	TouchChat launched (Saltillo); first app released by any SGD manufacturer	Saltillo (pre-PRC merger)	Bring an established manufacturer's professionally curated vocabulary to the new iPad/iPhone app model	Broad AAC population, incl. autism, Down syndrome, ALS, apraxia, stroke	iOS app	First "legacy SGD company" app entrant, validating tablets as a real SGD category to clinicians/insurers	–	Yes	NovaChat hardware line, later PRC-Saltillo merger (2019)
2012	Voiceitt founded (Israel)	Voiceitt	Improve automatic speech recognition accuracy for people with dysarthric/atypical speech, so their *own* speech (not a symbol substitute) can drive technology	People with dysarthria (CP, Parkinson's, stroke, etc.)	Personalized ASR trained on atypical speech	One of the first commercial efforts to make mainstream voice assistants/software usable via impaired natural speech, rather than replacing speech with AAC	ASR error rates remain higher than typical speech, especially for proper nouns (per 2024 research) (FACT; PMC/Tandfonline dysarthric speech tech studies)	Yes, active; 2023 Webex/Cisco captioning partnership	Google Project Relate/Euphonia address the same problem from a different (open research) angle
2014	Tobii Technology acquires DynaVox	Tobii	Merge the leading eye-gaze company with the leading touch-SGD company	Broad AAC population	Corporate merger	Consolidated most of the high-end SGD market under one company (Tobii Dynavox)	Reduced competitive diversity at the high end	Yes, Tobii Dynavox remains dominant	TD Snap (renamed from Snap Core First), unified I-Series
2018	ASHA formally issues position statements discouraging Facilitated Communication (FC) and the Rapid Prompting Method (RPM)/"Spelling to Communicate"	ASHA, after a year-long systematic literature review and expert panel	Address concerns that facilitator/prompt-dependent letterboard methods risk "facilitator bias" (unintentional influence over which letters get selected) rather than authentic independent communication from the user	Practitioners, families, and letterboard/RPM/S2C users, esp. in autism	Policy statement, not a technology	First formal, unanimous professional-body position explicitly naming RPM/S2C alongside the older, already-discredited FC	Highly controversial: many self-advocates and families who use these methods dispute ASHA's position and argue it violates user autonomy; this is an active, unresolved fight in the field as of 2026 (both sides cited; see Part 2.3 below)	Ongoing dispute; not resolved	–
2019	Prentke Romich Company (PRC) and Saltillo merge into PRC-Saltillo	PRC + Saltillo	Combine two major legacy AAC hardware/software makers	Broad AAC population	Corporate merger	Consolidated the Minspeak/LAMP-vs-TouchChat/NovaChat ecosystems under one company	–	Yes	Current PRC-Saltillo product family: Accent, PRiO, TouchChat, NovaChat, LAMP Words for Life
2021	UCSF "neuroprosthesis restores words" milestone (Chang Lab, BRAVO trial)	Edward Chang and team, UCSF	Restore communication for a man paralyzed and unable to speak for years (brainstem stroke)	Severe paralysis/anarthria	ECoG (electrocorticography) implant + neural decoding software mapping cortical signals to words	First demonstration of decoding words directly from speech-motor cortex activity in a person who could not speak at all, at meaningful accuracy	Vocabulary initially limited (~50 words); requires invasive brain surgery	Active ongoing research (BRAVO trial continuing)	Feeds directly into 2023 Nature "high-performance speech neuroprosthesis" results and later Neuralink-class work
2023	"A high-performance speech neuroprosthesis" published (Nature)	UCSF Chang Lab (and related BrainGate-affiliated groups)	Increase decoding speed/vocabulary size dramatically over 2021 result	Same as above	Improved ECoG + AI decoding, larger vocabulary	Demonstrated much higher words-per-minute and larger vocabulary (headline results widely reported)	Still invasive, still research-only, not yet a commercial product	Research-stage	Basis for continued 2024–2025 BCI speech advances (BrainGate2, Neuralink)
2024	Neuralink implants first human participant (Noland Arbaugh)	Neuralink	Restore digital-device control (initially cursor control, not speech) for a person paralyzed from the shoulders down	Paralysis (initially quadriplegia from spinal injury)	Intracortical implant (N1)	First Neuralink human implant milestone widely covered in press	Initial application was cursor/computer control, not speech restoration	Ongoing, expanding participant cohort (~9 in PRIME study by mid-2025, across US/Canada/UK/UAE per reporting)	Basis for the announced 2025 speech-implant trial
June 2025	BrainGate2 enables an ALS patient to "speak" through a computer in real time	UC Davis team (BrainGate consortium)	Real-time speech restoration (not just typing) for ALS-related anarthria	ALS	Intracortical BCI + real-time neural-to-speech decoding, using the patient's own pre-ALS voice recordings for the synthesized output where available	Real-time (low-latency) synthetic speech generation from neural signals, rather than slow letter-by-letter typing	Research-stage, single/small cohort	Active	Converges with voice-banking approaches (using the person's own recorded voice as the TTS target)
Sept. 2025 (announced)	Neuralink announces first human trial of a dedicated speech implant	Neuralink	Restore verbal communication specifically (distinct from cursor/robotic-arm control) for	Severe paralysis/anarthria (e.g., ALS)	Intracortical implant + speech decoding, trial slated to begin ~October 2025	Marks the shift of BCI-speech from pure academic research (BrainGate/UCSF) into a well-funded	Not yet demonstrated in public detail as of this report's cutoff	Trial ongoing/recent	TBD; likely to accelerate commercial BCI-AAC crossover

APPROX. DATE	DEVELOPMENT	PERSON/ORG	PROBLEM SOLVED	TARGET POPULATION	TECH	BREAKTHROUGH	LIMITATION	STILL USED?	DESCENDANT TECH
			people with severe speech impairments			commercial development track			

Sources for the table (consolidated): ISAAC founding; Wikipedia; Tales of ISAAC (PDF); ISAAC; Symbols of Bliss; Blissymbolics.org; About; William Stokoe; Wikipedia; Martha's Vineyard Sign Language; Wikipedia; POSSUM, Nature/Spinal Cord 1963; Toby Churchill; Wikipedia; PRC-Saltillo; Our History; Minspeak History; DynaVox Group; Our History; Tobii corporate history; Computer History Museum; DECtalk/Hawking; Dennis H. Klatt; Wikipedia; Stephen Hawking; Wikipedia; PECS history; ASAT; PECS; Wikipedia; Picture communication symbols; Wikipedia; GoTalk history; Attainment/Rehabmart; E-TRAN history; Low Tech Solutions; AssistiveWare; About/Niemeijer; AssistiveWare Medium; Democratization of Communication; Forbes on Niemeijer 2022; TouchChat history; Voiceitt/Webex partnership; ASHA FC/RPM position; ASHA RPM policy statement 2018; MacStories iOS accessibility timeline; UCSF neuroprosthesis 2021; Nature 2023 speech neuroprosthesis; NPR 2025 BCI roundup; Applying AI; Neuralink 2025 speech trial; Trace R&D Center 50-year history; Vanderheiden 2002 "A journey through early augmentative communication and computer access"; AAC journal; Wikipedia; AFB; Anne Sullivan manual alphabet.

2.2 Technically successful but commercially unsuccessful

- **Blissymbolics in its original "universal international language" ambition (Bliss, 1949 onward).** Technically sound and logically elegant, but never adopted for international/interlingual communication as Bliss intended; his commercial and cultural ambition (a Bliss-designed universal written language for all humanity) failed. It found a real but much narrower home only via McNaughton's 1971 clinical adaptation for children with CP; and even that adaptation drew Bliss's own objection, since the field used his symbols pragmatically/conversationally rather than by his original strict logical grammar. (FACT; ISAAC: The Symbols of Bliss)
- **Early POSSUM-era mechanical scanning systems (1960s UK).** Technically groundbreaking (first electromechanical independent selection for tetraplegic patients) but commercially/practically limited; bulky, low vocabulary, largely superseded once electronic/digital scanning and dedicated SGDs arrived; today mainly a historical/engineering-history footnote rather than an active product category. (FACT; Nature/Spinal Cord 1963 original paper)
- `HYPOTHESIS`: A recurring pattern across the table is that **elegant, logically "pure" representation systems (Bliss's original vision, some rigorous motor-planning systems) tend to lose commercially to messier, more intuitive, faster-to-learn systems** (photos/PCS, core vocabulary, simple picture exchange); a lesson relevant to any new AAC product design.

2.3 Commercially successful despite not being technologically revolutionary

- **GoTalk (Attainment Company, 1993–present).** No dynamic display, no synthesized speech, no AI; literally a plastic box with record-and-play buttons; yet it has been commercially durable for over three decades and is still sold today, including newer form factors like the wearable GoTalk Select. Its success is about durability, extremely low training burden, low price, and classroom fit, not technical sophistication. (FACT; Attainment Company GoTalk product line; Rehabmart on GoTalk history)
- **PECS.** Built on decades-old behaviorist (Skinnerian verbal behavior) theory rather than novel technology; its "innovation" was pedagogical/behavioral sequencing (teaching initiation before receptive matching), not a new symbol set or device. It became one of the most widely deployed AAC interventions in the world. (FACT; ASAT PECS overview)
- **Proloquo2Go's initial 2009 success** is arguably as much a story of *timing* (riding the brand-new iPhone/iPad platform and app-store distribution) as of novel underlying AAC science; the symbol-based, grid-navigation core interaction model was not new; it had existed on dedicated SGDs for two decades. What was new was the price collapse and mainstream device normalization. (HYPOTHESIS, informed by the AssistiveWare company narrative. CLAIM: AssistiveWare itself frames Proloquo2Go as causing "the democratization of communication" via consumer hardware access rather than via new communication science.) (AssistiveWare Medium post)

2.4 A live, unresolved controversy: letterboards, RPM, and Spelling to Communicate

This deserves explicit flagging because it directly touches "letterboards" in the taxonomy above and is contested as of 2026: ASHA's 2018 position statement discourages Facilitated Communication and the Rapid Prompting Method/Spelling to Communicate, citing risk of "facilitator bias"; a helper unintentionally steering the person's hand/gaze toward letters, such that the authorship of the resulting message cannot be verified as the user's own. (FACT; ASHA position statement PS2018-00351) At the same time, many families, autistic self-advocates who use these methods, and some clinicians strongly dispute this position, arguing it denies communication access and autonomy to people who may have no other reliable expressive channel. (CLAIM, representing the opposing side; see e.g. Not an Autism Mom: "ASHA's Position Statement… Violates My Child's Human Rights") This report does not resolve the dispute; it flags it as an important, still-live fault line relevant to any product or clinical-partnership strategy touching letterboard-based communication.

PART 3: CURRENT STATE OF THE MARKET

3.0 Market sizing (context)

- **ESTIMATE/FACT (conflicting third-party market reports):** Multiple market-research vendors put the global AAC devices market at roughly **$2.0–2.3 billion in 2024–2025**, growing at a CAGR of ~7–12%, reaching an estimated **$3.6–4.0 billion by 2029–2030**. Figures vary significantly by vendor methodology (some include only dedicated hardware SGDs, others include software/apps and symbol licensing). Business Research Company market report; Verified Market Research; OpenPR industry report
- HYPOTHESIS The dedicated-hardware "speech-generating device" (SGD) sub-market is structurally larger in *revenue per unit* than the software/app sub-market (hardware units run $2,000–$15,000 vs. apps at $70–$300), but the app market likely serves far more *users* given the near-zero marginal cost of a smartphone/tablet already owned by the family. No single public source cleanly separates unit economics across both segments as of this writing.
- FACT The only major AAC-adjacent company that is a public, financially-reporting entity is **Dynavox Group AB** (formerly Tobii Dynavox AB), listed on Nasdaq Stockholm (ticker DYVOX). FY2024 revenue was **SEK 1,972 million** (~22% YoY growth, currency-adjusted +23%), with an operating margin of 11.6%. FY2025 Q4 revenue was SEK 677 million (+16% YoY reported, +31% currency-adjusted); full-year 2025 local-currency growth was reported at 34%. Dynavox Group Year-End Report 2024; Dynavox Group Year-End Report 2025
- FACT Tobii Dynavox AB was spun out from Tobii AB and began independent trading on Nasdaq Stockholm on December 9, 2021. It was renamed Dynavox Group AB effective July 1, 2024. Dynavox Group; the split; Nasdaq name-change notice

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3.1 Company-by-company profiles

Tobii Dynavox / Dynavox Group (dedicated hardware + eye-tracking + software)

- FACT Formed by Tobii Technology AB's May 22, 2014 acquisition of the bankrupt DynaVox Inc.'s operating affiliates for $18 million via a competitive bankruptcy auction approved by a Delaware court. Renamed Tobii Dynavox LLC. Law360; Biospace
- FACT In August 2018 Tobii agreed to acquire UK-based Smartbox Assistive Technology Ltd and Sensory Software International Ltd. The UK Competition and Markets Authority (CMA) investigated the deal over concerns about reduced choice, less innovation, and higher prices for AAC users, and ultimately forced **divestiture:** Smartbox Holdings Ltd (backed by CareTech) re-acquired Smartbox Assistive Technology and Sensory Software from Tobii for **£13.4 million** on October 6, 2020. GOV.UK CMA case; MarketScreener; Medical Device Network
- FACT Owns Boardmaker/Mayer-Johnson (symbol/curriculum software) and the PCS (Picture Communication Symbols) library as of current sources, acquired as part of legacy DynaVox/Mayer-Johnson consolidation. Tobii Dynavox; PCS licensing; Crunchbase; Mayer-Johnson
- FACT In September 2025, Dynavox Group completed the acquisition of **Rehamedia**. TradingView/Reuters
- **Products (FACT):** TD I-Series (eye-tracking dedicated SGDs, TD I-13/I-16), TD Navio (lightweight dedicated SGD for autism/other), TD Pilot (MFi-certified eye-controlled iPad case for ALS/CP/SCI), TD Snap software, Boardmaker 7. Tobii Dynavox product pages
- **Target users:** cerebral palsy, ALS/MND, autism, stroke/aphasia, intellectual/developmental disabilities, degenerative neuromuscular disease.
- **Input/access methods (FACT):** touch, eye gaze/eye tracking (Tobii's core proprietary technology), switch scanning, head tracking.
- **IP (FACT):** Tobii holds one of the largest eye-tracking patent portfolios globally; reported as ~850 filings including 400+ granted patents in earlier counts, and more recent secondary sources cite over 1,000 patents/applications including 200+ granted US patents. Tobii IP licensing page; Statista
- **Pricing:** Online retail/direct purchase of some devices was reported unavailable at the time of research, with the company directing buyers to call customer care; consistent with the funded/insurance-billed durable-medical-equipment (DME) sales model typical of dedicated SGDs. IntuitionLabs profile
- **Funding/reimbursement:** Dedicated devices in this category are typically billed to Medicare/Medicaid/private insurance as DME in the US; company operates its own funding/reimbursement support infrastructure (industry-standard practice also used by PRC-Saltillo and Lingraphica, see below).
- **Strengths (HYPOTHESIS from public record):** only AAC vendor with public financial reporting (transparency/capital access advantage), strongest eye-tracking IP moat, broadest hardware+software+symbol ecosystem via acquisitions.
- **Weaknesses/clinical & competitive concerns (FACT):** UK regulator explicitly found the Smartbox acquisition risked "less choice, lack of innovation and higher prices" for AAC users; i.e., a competition regulator concluded consolidation in this category harms end users, a rare explicit regulatory finding for the AAC sector. GOV.UK

PRC-Saltillo (dedicated hardware + apps: Minspeak/LAMP IP)

- FACT Products: LAMP Words for Life (app, $299.99 on iOS), TouchChat (app, $299.99 on iOS), Dialogue AAC, Accent line of dedicated devices (Accent 800/1000/1400), Via dedicated device. PRC-Saltillo apps; PRC-Saltillo TouchChat
- FACT Periodically runs 50%-off promotions on flagship apps (e.g., April–May 2025 sale on TouchChat, LAMP WFL, Dialogue AAC). PRC-Saltillo articles
- **FACT; foundational IP:** Minspeak/semantic compaction was invented by **Bruce Baker** in 1980, patented under (at minimum) US Patents 4,661,916; 5,097,425; 5,210,689, and licensed commercially to **Prentke Romich Company (PRC)** founder **Barry Romich** starting December 1981 via Baker's company **Semantic Compaction Systems (SCS)**. PRC later merged with Saltillo Corporation to form PRC-Saltillo. PRC; Semantic Compaction Systems history; Minspeak Academy history; Wikipedia; Semantic compaction
- **FACT; litigation history:** In 2012–2013, SCS and PRC sued the makers of the rival iPad app **Speak for Yourself** for patent infringement (semantic-compaction-style icon-sequencing). The dispute drew significant public backlash (families feared losing access to a child's communication app mid-therapy) and was **settled in October 2012**, with Speak for Yourself agreeing to license two SCS patents and certain copyrights; settlement terms were confidential. Disability Scoop; PCWorld
- **FACT; recognition:** Named to the Forbes Accessibility 200 (2025) list; PRC-Saltillo is also profiled/tracked separately by Forbes.com as a company. PR Newswire
- **FACT; clinical/data concern:** PRC-Saltillo suffered an **August 2024 data breach**, which resulted in a class-action lawsuit (Jackson et al. v. Prentke Romich Company d/b/a PRC-Saltillo) and a **settlement exceeding $632,000** (announced 2025). This is a notable customer-trust/clinical-data-security concern for a vendor whose devices log highly sensitive communication/health data for a vulnerable population. ClassAction.org; Settlement site
- **Target users:** primarily autism, apraxia/motor speech disorders, cerebral palsy, ALS.
- **Access methods:** touch, eye gaze (on some Accent hardware), switch scanning.
- **Strengths:** Minspeak/LAMP encoding methods have decades of clinical outcome literature; deep entrenchment among SLPs trained specifically on Minspeak icon sequences (high switching cost).
- **Weaknesses/complaints (HYPOTHESIS/general industry pattern, not company-specific verified complaint data found in search): Minspeak/LAMP have a steep learning curve for new clinicians and families relative to grid/symbol-search systems; the now-settled patent-litigation history is a reputational scar cited repeatedly in AAC community discourse (e.g., the widely-shared "Silencing of Maya" blog post) as an example of an incumbent using IP aggressively against smaller/app competitors.** niederfamily blog; "The Silencing of Maya"

AssistiveWare (Proloquo2Go, Proloquo4Text): apps

- **FACT; pricing (as found 2025):** Proloquo2Go: one-time $299.99 on the App Store, with optional in-app purchases for extra vocabulary (e.g., Gateway). Proloquo4Text: $69.99 standalone, or bundled in "AAC Essentials" for $129.99. AssistiveWare; Proloquo2Go; AssistiveWare; Proloquo4Text
- FACT Proloquo4Text emphasizes word/sentence prediction and a single-screen text-based layout (targets literate users, contrasted with the symbol-grid approach of Proloquo2Go).
- **CLAIM (company framing, "democratization of communication"):** AssistiveWare has publicly framed the iPad/app era as a "democratization of communication" relative to legacy dedicated hardware, arguing lower cost and mainstream device ownership expanded AAC access. AssistiveWare Medium post
- **Platforms:** iOS/iPadOS only (no Android version identified in research; a notable platform-coverage gap versus Android-first competitors like Avaz and CoughDrop).
- **Symbol system:** proprietary SymbolStix-style/Proloquo-specific symbol library plus support for imported photos.
- **Strengths:** iOS-only focus is often cited by clinicians as enabling deep polish/accessibility integration with Apple's switch-control and accessibility APIs; large, mature install base.
- **Weaknesses:** no Android coverage; premium one-time price ($300) remains a real out-of-pocket barrier for families without insurance/school funding.

Smartbox (Grid, TD Snap heritage, Grid Pad hardware)

- FACT Founded in 2006 as a family business by **Paul, Alyson, Barney and Dougal Hawes** in the UK. Smartbox About Us
- FACT Ownership history; acquired by Tobii (2018), forced by UK CMA to divest, re-acquired independently as **Smartbox Holdings Ltd** (backed by CareTech) for £13.4M (Oct 2020), reuniting Smartbox Assistive Technology and Sensory Software International outside Tobii's control. GOV.UK
- **Products (FACT):** Grid software (Grid 3), Grid Pad dedicated hardware line (multiple sizes incl. Grid Pad 10s), eye-gaze hardware integration (Smartbox distributes/integrates Eyegaze-type trackers). HealthTech Digital; Smartbox eye gaze
- **Symbol systems distributed:** PCS, SymbolStix, and Widgit symbols are all licensed/distributed through Smartbox's Grid ecosystem (per search results), making Smartbox a multi-symbol-system-agnostic platform rather than symbol-IP owner itself.
- **Geographic markets:** primarily UK-headquartered with international distribution (US, Europe).

- **Strengths:** UK CMA's own competitive-harm finding validates Smartbox as a credible independent counterweight to Tobii Dynavox in the UK/European dedicated-hardware market.

CoughDrop: cloud-based, open-source-influenced AAC app

- FACT Founded 2014 by **Brian Whitmer**, based in South Jordan, Utah. Source code publicly available on GitHub (open-access model, not a fully open-source nonprofit). GitHub; IntuitionLabs
- **FACT; pricing:** $295 one-time lifetime purchase, or $9/month subscription with a 2-month free trial; free accounts for connected supporters (parents/therapists/teachers). CoughDrop Zendesk pricing FAQ
- **FACT; acquisition:** Acquired by **Forbes AAC** in February 2023, via sale of CoughDrop assets to Forbes-owned subsidiary **MavWare, LLC**. CoughDrop blog; EIN Presswire
- **Platforms:** cloud/web-based, cross-platform (a genuine differentiator vs. iOS-only competitors).
- **Strengths:** subscription-friendly pricing lowers upfront barrier vs. $300 one-time app purchases; cross-platform/cloud sync.

Forbes AAC (roll-up / holding company)

- FACT Owns CoughDrop (via MavWare LLC subsidiary, acquired Feb 2023). Operates "AAC Now!" as a portal/brand. Forbes AAC; AAC Now
- HYPOTHESIS Forbes AAC appears to be pursuing a roll-up/consolidation strategy in the AAC software space (paralleling Tobii's roll-up strategy in hardware/symbols), though the research did not surface additional confirmed acquisitions beyond CoughDrop.

Avaz (Avaz Inc. / Invention Labs)

- FACT Origins trace to 2005–2009 research at **IIT Madras:** incorporated as **Invention Labs Engineering Products Private Limited** in 2007 (an IIT Madras-incubated company). Founder: **Ajit Narayanan**, who won India's National Award for the Empowerment of Persons with Disabilities (Dec 2010) and was named an MIT Technology Review global young leader; Avaz was rated MIT TR's "Innovation of the Year" 2011. Wikipedia; Avaz app; Avaz About Us
- **FACT; funding:** Raised a total of **$550K** across one seed round from investors including **Mumbai Angels**, **Dr. Aniruddha Malpani**, and **RTBI (Rural Technology Business Incubator) - IIT Madras**. TechCrunch, April 21, 2014
- **Pricing/model:** free download with in-app purchases for picture/audio content packs; a freemium model distinct from most Western competitors' $70–$300 upfront pricing, likely reflecting India/emerging-market price sensitivity (HYPOTHESIS).
- **Geographic market:** India-origin, but distributed globally via app stores.
- **Strengths:** low/no-cost entry point; emerging-market pricing model is a genuinely different go-to-market than the US/UK insurance-reimbursement-dependent incumbents.

Lingraphica (dedicated devices, aphasia/stroke focus)

- FACT Business model centers on Medicare/Medicaid/VA/commercial-insurance funded dedicated AAC devices, with an in-house funding department that verifies coverage, handles paperwork, and works directly with families/clinicians; offers free at-home device trials. Lingraphica funding overview; Lingraphica try-at-home
- **FACT; Medicare policy detail:** Medicare's Local Coverage Determination (LCD) for speech-generating devices (administered by Noridian Healthcare Solutions as DME MAC for much of the US) requires documented evidence of a severe, long-term expressive communication disorder and that unaided/low-tech alternatives are insufficient. Spectrum Unlocked
- **CAUTION; unverified/likely inaccurate figure:** A single AI-generated-looking market report snippet claimed Lingraphica raised a "$50 million Series B" for AI R&D this could **not be corroborated** by Crunchbase, Tracxn, or any primary source, and Tracxn separately shows no confirmed funding round as of mid-2025. **This figure should be treated as unverified and likely fabricated by a third-party content-farm site; do not cite it as fact.** One secondary source (LeadIQ, Aug 2025) states Lingraphica's estimated annual revenue is **~$15M**, but this is a third-party estimate, not company-disclosed, and should be tagged ESTIMATE , not FACT. LeadIQ
- **Target users:** primarily stroke/aphasia and ALS populations (differentiates Lingraphica from the autism/pediatric focus of PRC-Saltillo, AssistiveWare, Avaz).

Attainment Company (GoTalk line)

- FACT GoTalk line traces back to the original Pocket GoTalk hardware device, released 1993; GoTalk NOW app currently priced at $119.99 on the App Store; sale pricing is rare (a notable Oct 2025 sale was flagged by AAC-consultant trackers as one of the lowest prices seen since 2012 for GoTalk NOW and ever for GoTalk NOW Plus). OMazing Kids AAC Consulting; App Store
- **Products:** GoTalk Now / GoTalk Now Plus (apps), physical GoTalk devices, GoTalk Select (wearable AAC device).
- **Target users:** typically simpler, lower-tech-literacy or early-communicator populations (fixed-grid, limited-cell layouts) vs. the larger vocabularies of Proloquo2Go/TouchChat.

Widgit (Widgit Symbols / Widgit Software)

- `FACT` UK-registered private company (Companies House #07739412), certified **B Corporation** as of at least July 2025. B Lab Global; GOV.UK Companies House
- `FACT` Widgit Symbols are distributed via Smartbox's Grid ecosystem alongside PCS and SymbolStix (per Smartbox marketing), indicating Widgit operates as an independent symbol-IP licensor rather than being owned by a hardware vendor.
- Widgit's precise ownership/shareholder structure and revenue were **not found** in available search results; flagged as a data gap.

Boardmaker / SymbolStix / PCS (symbol IP ownership map)

- `FACT` **PCS (Picture Communication Symbols)** is a registered trademark **owned and maintained by Tobii Dynavox**, integrated into Boardmaker and TD Snap. Tobii Dynavox PCS
- `FACT` **Boardmaker** and **Mayer-Johnson** are Tobii Dynavox brands (per current Tobii Dynavox marketing/Crunchbase listings). Research found **no evidence** of the widely-rumored divestiture of Boardmaker to n2y; n2y (owner of the competing **SymbolStix** symbol set, used in News-2-You and Unique Learning System) appears to remain a **separate, symbol-IP-owning company**, not a Boardmaker owner. n2y itself has changed private-equity hands (Provider Equity Partners → **Five Arrows** acquired a majority stake). Baird deal card; n2y acquired by Five Arrows; Crunchbase; n2y acquired by Providence Equity Partners
- `HYPOTHESIS` The symbol-IP landscape is now a **three-way split**: Tobii Dynavox (PCS/Boardmaker), n2y (SymbolStix), and independent players Widgit (Widgit Symbols) and Blissymbolics Communication International (Blissymbols, see Part 8). This fragmentation likely raises switching costs for schools/clinics that have standardized curricula around one symbol set, and is a genuine moat for incumbents.

Cboard (open-source AAC)

- `FACT` Open-source, browser-based AAC system with text-to-speech; source on GitHub (`cboard-org/cboard`). GitHub
- **CLAIM (project origin story, as reported by search-engine synthesis of press coverage):** Co-founded by **Martín Bedouret** (Córdoba, Argentina), who began the project after an ALS diagnosis in 2015, together with an Israeli developer identified in some sources as Shay Cojocaru; the idea originated from a conversation with Bedouret's speech therapist. Devpost; PrAACtical AAC
- **FACT; funded via Open Collective** (crowdfunded/nonprofit-style funding, not VC). Open Collective; Cboard
- **FACT; new AI feature (2025/2026):** Cboard launched **"Cbuilder"** (also marketed as "Cboard AI Builder"), an AI-powered tool that lets therapists/educators auto-generate customized AAC boards from a prompt, with export into Cboard; a blog post dated **January 12, 2026** announced "Cbuilder is Live." Cboard blog; Cbuilder product page
- **Strengths:** free/open-source removes the cost barrier entirely; genuinely modern AI-board-generation feature puts a volunteer-funded open project ahead of some incumbents on generative-AI feature velocity.
- **Weaknesses (HYPOTHESIS):** open-source/crowdfunded model likely limits dedicated clinical support, certified-training infrastructure, and insurance/DME billing integration relative to funded competitors; meaning Cboard is probably strongest for self-pay, DIY, and low-resource-market users rather than the clinically-prescribed/insurance-funded segment.

Voiceitt (non-standard/dysarthric speech recognition: adjacent to AAC)

- **FACT; funding:** PitchBook reports total raised of **$33.7M:** other aggregators (StartupHub.ai) cite **$21M:** the discrepancy likely reflects different cutoff dates or valuation-vs-cash-raised confusion (`ESTIMATE` on the reconciliation). Most recent round identified was a **Series A closed December 2, 2022**, with 3 investors participating. PitchBook; MobiHealthNews; $4.7M raise; MultiLingual; $10M raise
- **Technology:** personalized automatic speech recognition (ASR) trained to understand dysarthric/non-standard speech, converting it to standard synthesized speech or text in real time; positions Voiceitt as a "voice-in, voice-out" alternative to symbol/text-based AAC for users who have some vocal output but are hard to understand.
- **Status:** appears to remain an independent private company as of 2026; no acquisition or 2025 funding event was found in search results (data gap, not evidence of failure).

3.2 Other significant players identified during research (not in the assigned list but material)

- **Cognixion:** AI-native, AR/BCI-adjacent AAC entrant. Founded 2014 (as "Smartstones," later rebranded), founder/CEO **Andreas Forsland:** headquartered Santa Barbara (some aggregators list a Toronto HQ; discrepancy noted). Flagship product **Cognixion ONE / Axon-R**: a self-contained AR headset combining EEG (non-invasive brain signal sensing), eye tracking, and generative AI for speech output and smart-home/app control. **FACT; funding:** raised **$29M** total; a **$12M round** (reported as Series A by one source, seed by another; discrepancy noted) was led by **Prime Movers Lab** with participation from the **Amazon Alexa Fund:** other backers include **Samsung NEXT**, **Intel Capital**, **CABHI**, **Memorial Hermann Foundation**, and **Northwell Holdings** (13 investors total per one source). Also partnered to bring non-invasive BCI to **Apple Vision Pro**. Tracxn; NeuroFounders; Vision Pro; BusinessWire 2020
- **EyeTech Digital Systems:** dedicated eye-gaze/access-technology vendor; products include the **Elite** tablet-based eye-gaze device and the **OnBright** suite (BrightTalk communication, BrightControl home-device control, BrightWeb browsing, EyeOn Access mouse control). Closing the Gap

- **Eyegaze Inc.:** long-standing eye-tracking hardware vendor (Eyegaze Edge), compatible with third-party software including Smartbox's Grid 3. COGAIN wiki
- **Google Project Relate** (descended from **Project Euphonia**, launched 2019); free Android app using personalized ML models to transcribe/re-speak non-standard speech (ALS, stutter, injury-related speech changes), with Google Assistant integration. Not a commercial AAC company but a significant **big-tech entrant lowering the cost floor** for speech-recognition-based communication assistance. Google Research; Project Euphonia FAQ; Broca AI Speech blog
- **Apple Live Speech / Personal Voice** and **Microsoft's accessibility stack:** also cited by industry commentary as raising baseline expectations legacy AAC vendors must match. SpeechPathology.org

3.3 Competitor matrix

COMPANY / PRODUCT	CATEGORY	HQ / FOUNDED	BUSINESS MODEL	PLATFORM	SYMBOL SYSTEM	ACCESS METHODS	AI FEATURES	FUNDING/REIMBURSEMENT	NOTABLE STRENGTH	NOTABLE WEAKNESS/RISK
Tobii Dynavox / Dynavox Group: TD I-Series, TD Navio, TD Pilot, TD Snap	A. Dedicated hardware, D. Eye-tracking	Sweden/US; DynaVox 1980s, Tobii merger 2014	Hardware sale + software subscription; public company (Nasdaq: DYVOX)	Dedicated hardware + iPad (TD Pilot)	PCS (owned)	Touch, eye gaze, switch scanning	Emerging AI/ML in roadmap per market reports	Medicare/Medicaid/insurance DME billing	Largest eye-tracking patent portfolio (1,000+ filings); only publicly-reporting AAC company	UK CMA found consolidation risked less choice/higher prices
PRC-Saltillo: LAMP WFL, TouchChat, Accent 800/1000/1400, Via	A. Dedicated hardware, B. AAC apps	US (Wooster, OH lineage); PRC 1966, Saltillo merger	App one-time purchase ($299.99); hardware DME billing	iOS (apps); dedicated hardware	Compatible w/ PCS/SymbolStix per app	Touch, eye gaze (hardware), switch scanning	Not prominent in research; encoding-based prediction (Minspeak)	Medicare/Medicaid/insurance	Deep Minspeak/LAMP clinical evidence base & SLP training entrenchment	2024 data breach + $632K+ settlement; history of patent litigation vs. app rivals
AssistiveWare: Proloquo2Go, Proloquo4Text	B. AAC apps	Netherlands; founded 2000 (per company materials, not independently re-verified here)	One-time app purchase ($299.99 / $69.99) + IAP	iOS/iPadOS only	Proprietary symbol library + photos	Touch, switch control, eye tracking via iOS APIs	Word/sentence prediction	Self-pay / school & insurance-purchased app licenses	Deep iOS accessibility integration, large mature user base	No Android version; high one-time price barrier
Smartbox: Grid 3, Grid Pad	A. Dedicated hardware, C. Symbol/language platform	UK; founded 2006 (Hawes family)	Hardware sale + software	Dedicated hardware, Windows	Distributes PCS, SymbolStix, Widgit	Touch, eye gaze	Not prominent in research	UK NHS/insurance, DME	Independent (re-divested from Tobii by CMA order); credible competitive counterweight	Smaller scale than Tobii Dynavox
CoughDrop	B. AAC apps, G. caregiver/therapy platform	US (South Jordan, UT); founded 2014 by Brian Whitmer; acquired by Forbes AAC (MavWare LLC) 2023	$295 lifetime or $9/mo subscription; free supporter accounts	Cloud/web, cross-platform	Uses standard symbol libraries (not own IP)	Touch, switch, eye gaze via device	Not prominent in research	Self-pay, some school/agency purchase	Cross-platform + subscription option lowers cost barrier	Under new corporate (Forbes AAC) ownership; strategy/support continuity uncertain
Avaz	B. AAC apps	India (Chennai/IIT Madras); founded 2007 (Invention Labs)	Freemium: free download + IAP	iOS/Android	Proprietary + customizable	Touch	Not prominent in research	Minimal; self-pay/freemium	Only $550K raised total; genuinely low-cost, emerging-market-oriented model	Tiny funding base vs. Western incumbents; limited clinical-evidence literature found
Lingraphica	A. Dedicated hardware, G. therapy platform	US; exact founding year not confirmed in research	Hardware + insurance billing; in-house funding dept.	Dedicated hardware, some app/software	Uses standard libraries	Touch	Marketed AI/ML roadmap (unverified specifics)	Medicare/Medicaid/VA/commercial insurance; company handles paperwork directly	Deep specialization in stroke/aphasia population + funding-navigation service	Claimed "$50M Series B" could not be verified; treat with caution
Attainment Company: GoTalk	A. Dedicated hardware (legacy), B. AAC apps, F. Educational tools	US; GoTalk line since 1993	App purchase ($119.99) + hardware sale	iOS; dedicated hardware	Simple picture/photo cells	Touch	None found	School purchase, self-pay	Simplicity for early/emerging communicators	Limited vocabulary scale vs. grid-based competitors
Widgit: Widgit Symbols	C. Symbol/language platform	UK; B Corp (certified by July 2025)	Symbol licensing	Cross-platform (licensed into other software)	Widgit Symbols (own IP)	N/A (symbol library, not device)	None found	N/A	Independent symbol-IP owner (not captured by hardware incumbents)	Ownership/financials opaque; limited public data found
Boardmaker / PCS (Tobii Dynavox)	C. Symbol/language platform	US/Sweden (Tobii-owned)	Software subscription (Boardmaker 7)	Windows/web	PCS (owned)	N/A	None found	School/institutional licensing	Owned by market leader; deep distribution	Bundled with hardware incumbent; less "neutral" than Widgit/Bliss
Cboard	B. AAC apps, E. AI communication systems (via Cbuilder)	Argentina/Israel origin; open-source	Free/open-source; Open Collective crowdfunding	Web/browser, mobile	Uses open symbol sets	Touch	**Cbuilder:** AI board-generation tool (live Jan 2026)	None (free)	Free access; surprisingly fast generative-AI feature (Cbuilder) for a volunteer project	Limited clinical/support infrastructure vs. funded competitors
Voiceitt	E. AI communication systems	Israel/US; funding data conflicting ($21M–$33.7M total)	B2B/B2C SaaS (unclear pricing found)	Mobile/cloud	N/A (speech-to-speech/text, not symbol-based)	Voice (personalized ASR for dysarthric speech)	Core product IS an AI speech-recognition model	Not clearly established in research	Genuinely novel "understand my speech" approach vs. symbol/text AAC	Small funding base vs. BCI/hardware competitors; adoption scale unclear
Cognixion: ONE/Axon-R	E. AI communication systems, H. Emerging neural/BCI	US (Santa Barbara, per most sources); founded 2014	Hardware + AI software	Dedicated AR/BCI headset	Uses AI-driven interface, not fixed symbol grid	Non-invasive EEG + eye tracking	Core product is EEG+AI+AR fusion	Amazon Alexa Fund, Intel Capital, Samsung NEXT-backed; no confirmed insurance billing found	Genuinely novel non-invasive BCI-for-AAC hybrid; strong-name strategic investors	Non-invasive BCI signal quality/reliability is an open clinical question; small company relative to incumbents
EyeTech Digital Systems	D. Eye-tracking/access tech	US	Hardware sale	Tablet-based (Elite)	N/A	Eye gaze	None found	Some insurance/DME	Long-standing eye-gaze specialist, dedicated OnBright suite	Niche relative to Tobii's scale

COMPANY / PRODUCT	CATEGORY	HQ / FOUNDED	BUSINESS MODEL	PLATFORM	SYMBOL SYSTEM	ACCESS METHODS	AI FEATURES	FUNDING/REIMBURSEMENT	NOTABLE STRENGTH	NOTABLE WEAKNESS/RISK
Google Project Relate (ex-Euphonia)	E. AI communication systems	US (Google); Euphonia launched 2019	Free	Android	N/A	Personalized ASR + resynthesis	Entire product is ML-personalized speech model	Free (no reimbursement needed)	Big-tech resources, free, multilingual expansion (Spanish/Japanese/French/Hindi) underway	Not a clinically prescribed/supported "AAC system"; Google has a history of sunsetting accessibility research projects
Synchron	H. Emerging neural/BCI	US/Australia; Stentrode platform	VC-funded, pre-commercial	Implanted (endovascular, non-open-brain-surgery) BCI	N/A	Motor-intent decoding → communication/computer control	Explicit "cognitive AI" division to train models on brain data (per Nov 2025 raise)	Not yet commercial/reimbursed	$345M total raised; non-surgical endovascular approach is a real differentiator vs. open-craniotomy BCI rivals	Still pre-commercial; regulatory pathway long
Precision Neuroscience	H. Emerging neural/BCI	US	VC-funded	Implanted (thin-film cortical array), wireless	N/A	Cortical signal decoding	Not yet product-stage	Not yet commercial	First full FDA regulatory clearance for a wireless BCI component (April 2025)	Pre-commercial

Sources for matrix cross-references: see individual company sections above and Part 17 below for BCI funding detail.

PART 4: CHILDREN SPECIFICALLY

4.1 Populations and their distinct communication barriers

The critical clinical point, stated by ASHA and echoed across the literature: **AAC need is defined by functional communication mismatch, not diagnosis.** Two children with the same diagnosis can have opposite AAC profiles (one may need AAC as primary output; another may need it only as a backup/overflow channel). Below, barriers are organized by *mechanism* (why communication breaks down) rather than treated as diagnosis = deficit.

Autism spectrum disorder (ASD)

- FACT : Roughly one-third of autistic individuals have limited functional use of spoken language ("minimally verbal" in older nomenclature) (cited in Jaswal et al., Scientific Reports 2020 and multiple ASHA sources).
- Barrier mechanisms are heterogeneous: (1) motor speech/apraxia-type planning difficulty, (2) language-level barriers (limited receptive/expressive language), (3) intact language but severely impaired *speech motor execution* (increasingly recognized; some nonspeaking autistic people demonstrate strong literacy/comprehension despite absent speech), (4) social-pragmatic/initiation barriers even when articulation is possible, (5) situational speech loss under sensory overload, anxiety, or dysregulation.
- FACT : A 2024 multi-stakeholder qualitative study (Yau et al., *Frontiers in Psychiatry*, n=30: 9 parent-carers, 10 educators, 11 clinicians, Western Australia) found parents, educators, and clinicians disagree systematically about *why* AAC use breaks down for autistic children; parents attribute stigma and device fit; professionals more often attribute training and knowledge gaps (Yau et al. 2024, DOI 10.3389/fpsyt.2024.1385947). Full theme breakdown in section 4.2.

Cerebral palsy (CP)

- FACT : Communication barriers in CP are predominantly about **motor access**, not necessarily language or cognition; dysarthria (motor speech impairment) is common, but many children with CP have typical or near-typical receptive/cognitive-linguistic profiles. Motor impairment also affects the ability to physically operate AAC systems (pointing, touch precision, switch activation, sustained head/eye control).
- FACT : High-tech AAC access methods for CP include direct touch, switch scanning (single or multiple switches activated by any reliable body movement), and eye-gaze/eye-tracking systems using infrared cameras (Link Assistive; PMC9790344 eye-gaze dyskinetic CP study).
- FACT : Research is actively exploring **multimodal access** (e.g., eye-gaze for coarse target location + switch scanning for fine selection) specifically because no single access method works reliably across the full range of CP-related motor variability, including dyskinetic/fluctuating tone presentations (PMC9136588; RERC-AAC Mandak et al. 2019 summary, https://rerc-aac.psu.edu/multimodal-alternative-aac-access-for-adults-with-cerebral-palsy-mandak-et-al-2019).
- Implication: CP is the population where "poor support for children who cannot reliably point" is most acute and clinically documented; fatigue, involuntary movement, and fluctuating tone (in dyskinetic/athetoid CP especially) can make a previously reliable access method unreliable within the same session (HYPOTHESIS/clinical-consensus inference from the multimodal-access literature above, not a single-study FACT).

Apraxia of speech / Childhood Apraxia of Speech (CAS)

- FACT (ASHA): CAS is a motor speech disorder in which the brain has difficulty planning the precise, sequenced muscle movements needed for speech, despite the child knowing what they want to say; i.e., a "language is intact, motor execution is broken" profile in many cases (ASHA CAS Practice Portal; ASHA CAS public page).
- FACT : ASHA states all children with CAS require intensive ongoing speech therapy, and many benefit from AAC used *concurrently* with speech therapy, not as a replacement for it; AAC increases intelligibility of utterances to communication partners and reduces frustration/challenging behavior during the (often years-long) process of building intelligible speech (ASHA; ASHA Perspectives, Aided AAC Intervention for Suspected CAS).
- FACT : A 2022 ASHA Special Interest Group article documents that clinical practice patterns in CAS+AAC are inconsistent, with implications for SLP graduate training gaps (Clinical Practice Patterns in CAS and AAC).
- Key distinguishing point for this document's framing: CAS is arguably the clearest pediatric case proving "non-verbal ≠ no language"; a child with severe CAS may have age-appropriate or even advanced receptive and cognitive-linguistic ability but be nearly unintelligible.

Developmental Language Disorder (DLD)

- Barrier mechanism differs fundamentally from CAS/CP: in DLD, the underlying **language system** itself (vocabulary, grammar, narrative, comprehension) is impaired; not motor speech production. This changes AAC selection: vocabulary/grammar scaffolding and language-modeling features matter more than motor-access engineering.
- (Note: search coverage of DLD-specific AAC literature was thinner than for other conditions in this pass; DLD is frequently subsumed in broader "complex communication needs" or "language disorder" AAC literature rather than studied as a freestanding AAC population. This is itself a notable evidence gap; ESTIMATE based on the relative search-result density above vs. autism/CP/Down syndrome.)

Down syndrome

- `FACT`: Language and communication acquisition is described as one of the most significant challenges for children with Down syndrome; average first-word emergence around 21 months vs. ~12 months for typically developing peers, with speech intelligibility often disproportionately behind receptive/cognitive ability (Down Syndrome Resource Foundation; BMC Pediatrics systematic review, https://link.springer.com/article/10.1186/s12887-018-1144-5).
- `FACT`: A key finding directly relevant to parent-facing myth-busting: AAC use **does not suppress or replace** natural speech development in Down syndrome; when used as part of multimodal intervention, it may enhance speech/language development rather than compete with it (BMC Pediatrics systematic review, and DSRF summary above). This directly counters the widespread parental fear (documented in Section 4.2) that "giving them a device means they'll never talk."
- `FACT`: Evidence-based intervention approaches include AAC modeling during shared/dialogic reading, where an adult models on the AAC device while also speaking the message aloud (aided AAC modeling, "AAC-MOD") (PMC8645247).

Rett syndrome

- `FACT`: Rett syndrome (predominantly affecting females, X-linked, MECP2-related) causes a distinctive trajectory: near-typical early development, then regression, with loss of purposeful hand use and severe motor apraxia; meaning that even when receptive language is relatively preserved, most conventional AAC access methods requiring hand/finger pointing are foreclosed (PMC4785214, Eye Gaze Technology for Rett Syndrome; Netherlands families study; PubMed 27069348).
- `FACT`: Eye gaze (intentional visual regard) is reported as the most frequently observed and clinically leveraged communication modality for individuals with Rett syndrome, given the loss of hand function; eye-tracking AAC technology has been increasingly adopted specifically for this population over the past decade (PMC4785214; JSLHR, Eye Gaze and Gestures in Females with Rett Syndrome).
- This is a strong illustrative case for the report's "diagnosis ≠ inability to communicate" framing: Rett syndrome historically led to profound underestimation of cognitive/receptive ability because expressive motor channels (speech and hand use) are so severely impaired; eye-gaze AAC has been part of a broader clinical shift toward presuming greater competence in this population (CLAIM/clinical consensus, supported by the cited studies but not a single RCT-level "proof").

Angelman syndrome

- `FACT`: Angelman syndrome (UBE3A-related) is associated with absent or minimal expressive speech in the large majority of individuals, alongside relatively preserved nonverbal social engagement and receptive skills in many cases; a population frequently cited in AAC literature as needing early, robust AAC support given near-universal absence of functional speech (general characterization; this pass's search coverage on Angelman-specific eye-gaze/AAC research was limited compared to Rett; noted as a gap, ESTIMATE from search density).

Other genetic conditions (Fragile X syndrome, and others)

- `FACT`: Fragile X syndrome (most common inherited cause of intellectual disability, ~1/4,000–1/6,000 males, ~1/8,000 females) is associated with delayed speech/language onset by age 2, with language delays across receptive, expressive, and pragmatic domains; ~1/3 of individuals with FXS also have co-occurring autism spectrum features affecting communication (PMC9817301, Communication in Fragile X Syndrome).
- `CLAIM`: Caregivers report AAC as a useful tool for addressing complex communication needs in FXS, particularly for more severely affected individuals (per PMC9817301 caregiver-report data).
- Search coverage for CHARGE syndrome-specific AAC literature was minimal in this pass (a gap worth flagging; CHARGE syndrome involves combined vision/hearing impairment plus other anomalies, making it a uniquely difficult multi-sensory AAC-access case that deserves dedicated deaf-blind AAC literature review beyond this document's scope).

Traumatic brain injury (pediatric TBI) and other acquired neurological conditions

- `FACT` (ASHA): Children with TBI may have temporary or permanent effects on speech, language, and communication; some are temporarily unable to speak due to medical interventions (e.g., tracheostomy) rather than neurological impairment per se (ASHA Pediatric TBI Practice Portal).
- `FACT`: AAC in pediatric TBI must account for **cognitive impairments** (attention, memory, executive function) that are qualitatively different from the barriers in congenital conditions; a child may have had fully typical speech and language pre-injury, making AAC assessment and family adjustment psychologically distinct (grief for a "lost" prior communication ability rather than building toward a first ability) (AAC use by people with TBI: effects of cognitive impairments; Fager & Spellman 2010, AAC intervention in TBI and SCI).
- `FACT`: Effective communication during rehabilitation is explicitly linked to reduced confusion/anxiety and better long-term reintegration outcomes in pediatric TBI (ASHA Pediatric TBI portal).

Degenerative pediatric conditions

- `FACT`: Batten disease (juvenile neuronal ceroid lipofuscinosis, CLN2/CLN3 subtypes) is a progressive pediatric neurodegenerative disease in which language impairment with dysarthria is present in essentially all affected individuals, with older/classical-disease individuals progressively becoming non-verbal over the disease course (PMC11739554, Speech/Language/Non-verbal Communication in CLN2/CLN3 Batten Disease).

- FACT: Spinal Muscular Atrophy (SMA), a genetic degenerative motor neuron disease, causes progressive oral-motor weakness; SMA Type 1 in particular progresses toward severe flaccid dysarthria and potentially complete anarthria (absence of speech due to motor paralysis, not cognitive/language impairment) (general neuromuscular AAC literature, e.g. PM&R Clinics review, Progressive Neuromuscular Disease and AAC).
- Key implication: degenerative conditions require an AAC approach that is explicitly **anticipatory/proactive** (introducing AAC before speech is fully lost, and planning for progressively decreasing motor access; e.g., transitioning from touch to switch to eye-gaze as the disease progresses) rather than reactive. This is a distinct product/clinical requirement from static or improving-trajectory populations (HYPOTHESIS/clinical-consensus framing, consistent with general progressive-neuromuscular-disease AAC guidance cited above, which is written primarily for ALS/adult populations and extrapolated here to pediatric degenerative disease; flagged as an evidence-extrapolation, not a pediatric-specific study finding).

Intellectual/developmental disabilities (general, non-syndrome-specific)

- Barrier mechanism: heterogeneous, but often includes slower language acquisition trajectory (not necessarily impaired *ceiling*), meaning core-vocabulary AAC approaches designed for typically-developing symbolic communicators can be poorly matched; see the "core vocabulary" controversy in Section 4.3.

Motor impairments (general, not CP-specific) and inability to point reliably

- FACT: This is a recognized, distinct clinical/assistive-technology problem: a portion of AAC candidates cannot reliably perform the fine-motor pointing gesture that most low-tech and many high-tech AAC displays assume as the default access method, driving the entire field of "alternative access" (switch scanning, eye-gaze, partner-assisted scanning) as a parallel track to direct selection (FACT, general AAC access literature cross-referenced above under CP).

Selective/situational speaking difficulties (e.g., selective mutism)

- FACT (ASHA): Selective mutism is classified as a childhood anxiety disorder (not a primary speech/language disorder) characterized by a child's inability to speak/communicate effectively in specific social settings (e.g., school) despite speaking normally in others (e.g., home) (ASHA Selective Mutism Practice Portal).
- FACT: AAC use in selective mutism is explicitly framed by ASHA/clinical sources as flexible and often **temporary/transitional:** some children use AAC (communication boards, scripts, speech-generating tools) only in the early stages of intervention and fade it as verbal communication succeeds in more settings; others prefer AAC as a longer-term communication modality, and treatment goals should accommodate client preference rather than assuming AAC is only a bridge to speech (Selective Mutism Association; Rowan University thesis on tech for selective mutism).
- This population most sharply illustrates that "non-verbal" is context-dependent, not a fixed trait; the same child can be fully verbal and completely non-speaking within the same day depending on environment/anxiety state.

4.2 What parents, teachers, SLPs, OTs, AAC specialists, schools, and AAC users themselves report as the biggest problems

This section separates **documented/peer-reviewed findings** from **anecdotal reports** as instructed. Two peer-reviewed syntheses anchor the documented findings:

1. **Berenguer, Martínez, De Stasio & Baixauli (2022)**, *Parents' Perceptions and Experiences with Their Children's Use of AAC: A Systematic Review and Qualitative Meta-Synthesis*, *Int J Environ Res Public Health* 19(13):8091. DOI: 10.3390/ijerph19138091. Synthesized **19 qualitative studies, 297 parents**, children ages 3–17. (PMC9266194)
2. **Yau, Choo, Tan, Monson & Bovell (2024)**, *Comparing and contrasting barriers in AAC use in nonspeaking autism and complex communication needs: multi-stakeholder perspectives*, *Frontiers in Psychiatry* 15:1385947. DOI: 10.3389/fpsyt.2024.1385947. n=30 (9 parent-carers, 10 educators, 11 clinicians), Western Australia, semi-structured interviews/focus groups analyzed via reflexive thematic analysis. (PMC11197385)

4.2.1 DOCUMENTED (peer-reviewed) problems

Device abandonment rates and causes - FACT: Device abandonment/under-use affects an estimated 30–50% of AAC users across the literature, with one SLP survey finding only 39.35% of AAC systems remained in use beyond one year (multiple sources synthesized via WebSearch of device-abandonment literature, incl. Tandfonline "Rethinking device abandonment: a capability approach focused model" (2023), DOI 10.1080/07434618.2023.2199859). - FACT: A separate synthesis cites 33–39% of individuals ceasing AAC device use within one year despite AAC's status as an evidence-based intervention (TheAACAcademy, "What Leads to AAC Abandonment?"; jptcp.com facilitators/barriers review, https://jptcp.com/index.php/jptcp/article/download/7744/7313/16926). - FACT: SLP-reported systemic barriers (percentages from surveyed SLPs, source: jptcp.com review cited above): funding/affordability (73.5%), lack of continuing-education courses on AAC (75.2%), caseload size (46.2%), lack of proper AAC evaluation/assessment processes (45.5%). - FACT: Inadequate training of communication partners (parents, teachers, aides) is a well-documented barrier independent of device quality; insufficient involvement of the eventual users/caregivers in the device *selection* process itself is separately cited as a contributor to abandonment (same review). - FACT: "Carryover"; inconsistent AAC support and modeling across providers/settings; is commonly reported as a significant barrier (same review). This directly corresponds to the "school/home inconsistency" and "difficulty transferring skills between systems" concerns.

The Yau et al. (2024) five-theme barrier structure (multi-stakeholder, n=30): | Theme | Parent-carers | Educators | Clinicians | |---|---|---|---| | Stakeholder Knowledge | 44% ranked top-3; struggled with training content assuming advanced literacy | 90% ranked top-3 (highest of any group) | 55% ranked top-3 | | Attitudes & Stigma | 88% cited; parents reported *experienced* real-world stigma and fear that AAC will suppress the "will to speak" | 80% cited | 100% cited, but largely framed stigma as *parental perception* rather than reporting it as externally observed; an attribution gap between parents and professionals | | Resources (time/money) | Severe; competing caregiving demands, cost of materials/repairs | Organizational/institutional resourcing gap | Training-access limited | | AAC User Engagement | 100% ranked as top barrier; parents attribute disengagement partly to the child's own willingness | 30% ranked top-3; educators attribute disengagement instead to poor device fit/training | 27% ranked top-3; similar reframing to device fit | | Device Fit | 100% ranked top-3 | 80% ranked top-3; educators reported being **excluded from device-selection decisions**, with devices simply "turning up" without input | 73% ranked top-3 |

FACT : This study's central finding is the *systematic attribution gap*; parents tend to locate the barrier in the child or in societal attitudes, while educators and clinicians more often locate it in device/training/systemic fit. This is directly actionable for any company designing AAC products or services: the "problem" looks different depending on which stakeholder you ask, and solving only one stakeholder's framing (e.g., a "cooler device") will not resolve the others' (e.g., "we were never trained and were never consulted on device choice").

Berenguer et al. (2022) three-theme structure (19 studies, 297 parents): 1. **Service support:** insufficient individualized training/coaching for parents; SLP/teacher AAC expertise perceived as inadequate; poor inter-provider coordination (one parent reported "more than 27 hours of homework per day" from overlapping, uncoordinated therapies); geographic/environmental accessibility barriers (rural access, noisy environments, difficulty using AAC in a moving car). 2. **AAC system characteristics:** frequent device breakdowns and expensive repairs; desire for better voice quality, more customization, faster sentence formation; limited non-English language availability ("most apps are in English"); severe cost/funding frustration, exemplified by a parent given an "eleven and-a-half thousand dollar machine" with no follow-up support. 3. **Daily life integration:** time burden on families to prepare/maintain materials; schools sometimes actively discouraging device use, undermining home practice; social isolation (limited peer interaction, few classmates visiting or including the AAC-using child).

FACT : Both peer-reviewed syntheses converge independently on: (a) device fit/quality problems, (b) inadequate training/professional expertise, (c) cost/funding burden, (d) stigma, and (e) inconsistency across environments (home/school/clinic) as the core documented problem set. This convergence across independent research teams and populations strengthens confidence that these are not idiosyncratic findings.

Multilingual/culturally inappropriate vocabulary (documented) - FACT: English-based "core vocabulary" (high-frequency words) does not map directly onto Spanish or other languages' actual high-frequency word sets; providing only direct translations rather than linguistically/culturally appropriate vocabulary is a documented shortfall (AAC Institute, "Bilingualism and AAC: Debunking Myths and Defining Guidelines"; PrAACtical AAC, Cultural-Linguistic AAC series). - FACT: Multilingual families report irrelevant vocabulary (missing home-language words, food, cultural/religious concepts) as a direct hindrance to AAC adoption and use (PrAACtical AAC / ASHA multilingual AAC materials). - FACT: Best-practice guidance holds that bilingual/multilingual vocabulary support is not an edge case but "best practice essential to equitable communication access"; yet is frequently unmet in commercial default vocabulary sets (same sources).

Core vocabulary design tension (documented, nuanced; not simply "vocabulary is too limited") - FACT: A specific, more technical documented problem (distinct from generic "not enough words"): focusing AAC intervention/design on adult-derived "core vocabulary" word lists for early symbolic communicators can produce limited, gap-ridden lexicons, because core-word lists are typically derived from *adult or older child* language samples and may exceed what an emergent communicator is developmentally ready to use meaningfully; producing frustration and stalled progress rather than solving the vocabulary problem (Tandfonline, "Examining core vocabulary with language development for early symbolic communicators"; PrAACtical AAC, "Hold That Core"). - FACT: Even when core-vocabulary/picture-exchange approaches succeed at their intended (early, requesting-level) purpose, they can leave children "stuck at requesting"; able to produce short functional phrases ("I want," "I see") but structurally unable to progress to full conversational sentence generation, a commonly cited plateau in the clinical literature (Northern Speech Services CVES materials).

Communication rate / conversational speed (documented) - FACT: Parents report that the time required to navigate AAC menus/symbol sets to construct a message directly impairs children's ability to participate in real-time conversational exchange, producing both miscommunication and emotional frustration for the child and communication partners (parent-report synthesis via Vanderbilt Young Scientist Journal review of AI/parent perspectives, https://wp0.vanderbilt.edu/youngscientistjournal/article/enhancing-aac-systems-through-artificial-intelligence-parent-and-family-perspective-on-limitations-and-solutions). - FACT/CLAIM (AAC self-advocate framing): nonspeaking AAC users themselves report that the *speed* mismatch between AAC output and spoken conversation is not merely inconvenient; it is directly linked to being perceived as more cognitively impaired than they are, and to being ignored, spoken over, or disrespected in real-time social exchange (CommunicationFIRST guest content and related self-advocate sources; see Part 14 for direct quotes/sourcing).

Intent determination (documented, methodological/clinical literature) - FACT: A recognized clinical challenge, particularly for early/emergent communicators (regardless of diagnosis): distinguishing intentional communicative acts from non-intentional behavior. Clinical guidance (rooted in the "presume competence" principle, originated by Anne Donnellan, 1984) recommends using contextual fit (does the message make sense given the situation?), non-verbal confirmation (nodding, consistent affect, follow-through action), and response-to-communication-breakdown (frustration, repetition, alternate-strategy attempts) as converging evidence of intent, rather than requiring the child to "prove" competence before being given a full AAC system (PrAACtical AAC; AssistiveWare, "Are there prerequisites for AAC?"; My Dynamic Therapy, intentionality in emergent communicators). - This is directly relevant to product design: any AI-assisted or predictive AAC system faces the same fundamental problem clinicians face; determining whether an ambiguous input reflects genuine communicative intent, and doing so without imposing "prerequisite" gatekeeping that has historically delayed AAC access for children assumed (often wrongly) to lack the cognitive prerequisites for symbolic communication.

Insurance/reimbursement delays (documented) - FACT: More than 80% of U.S. states now provide "clear Medicaid guidance for AAC funding requests" per a 2023 ASHA report, an improvement over historical inconsistency (WebSearch synthesis citing ASHA funding materials, https://www.asha.org/njc/funding-for-services/). - FACT: Typical insurance processing timelines for speech-generating devices run roughly 6–12 weeks, longer with incomplete documentation or denials requiring appeal; one cited SLP survey found persistence in appeals mattered enormously; 93% of appeals with new supporting documentation were eventually approved, but total timelines ranged 1–6 months (WebSearch synthesis of Tobii Dynavox, Cigna coverage policy, and AAC funding-help sources; see citations under Part 5 funding section below). - FACT: Professional guidance explicitly states it is *not* permissible to delay a child's access to needed communication technology pending funding-source approval; implying policy exists specifically because delay is a known, common real-world problem (same sources). - FACT: Funding-source hierarchies are jurisdiction-specific and genuinely complex; one documented (California-specific) hierarchy runs: private purchase → CCS+MediCal → CCS alone → MediCal alone → private insurance → low-incidence education funds → general education funds → philanthropic sources (CSUN AAC funding resource). Device *ownership* also depends on the payer: school-purchased AAC devices belong to the school; privately/insurance-funded devices belong to the family/beneficiary; a distinction with major consequences at grade transitions or if a family moves districts (Tobii Dynavox and AAC funding sources, cross-referenced in Part 5).

Stigma (documented, with a stakeholder-perception gap) - FACT: The Yau et al. (2024) study documents that stigma associated with visible AAC device use limits both personal dignity and functional access, driven by public misunderstanding of the capabilities of people with limited/no verbal language; but critically, *parents and clinicians disagree on how much of this stigma is real vs. anticipated/internalized* (parents report experiencing real social stigma directly; clinicians in the same study more often characterized it as parental perception rather than observed societal behavior) (Yau et al. 2024, full citation above).

4.2.2 ANECDOTAL / QUALITATIVE (not independently peer-reviewed as population-level fact: treated as customer-discovery signal)

The following are drawn from parent-report quotes embedded in the qualitative studies above (which are peer-reviewed as *synthesis methodology* but individual quotes remain single-informant anecdotes), app store reviews, and advocacy-org guest content. They corroborate the documented findings above at the level of lived experience but should not be cited as independently validated population statistics:

- CLAIM (parent quote, Yau et al. 2024 study participant): "I try to find the words [on AAC], it takes a long time and [child] loses his patience." (Parent-Carer 1)
- `CLAIM` (parent quote, same study): "(People) don't expect him to have a device, or don't understand why he doesn't talk straight away because he looks like everyone else." (Parent-Carer 6); illustrating stigma tied to invisible/borderline disability presentation.
- CLAIM (parent quote, Berenguer et al. 2022 synthesis): "I'd been given this eleven and-a-half thousand dollar machine, and nobody could give me any kind of support."; cost/support mismatch.
- `CLAIM` (parent quote, same synthesis): "with her brother I can talk to him in the car. But with (Child) because she can't answer me in the car… I don't ask her questions."; illustrating how AAC's context-dependence (needing visual/tabletop access) creates communication gaps in ordinary daily contexts like car rides that spoken language doesn't have.
- CLAIM (App Store review, Proloquo2Go, user "goofygoofygoobersyeah," 5-star but with caveats, 12/31/2024): praised extensive customization but noted a "steep learning curve" and would not recommend the app to first-time users; also complained a recent voice update had a "grating breathy quality" with "weird blip sounds" (Apple App Store reviews, Proloquo2Go).
- CLAIM (App Store review, user "toaakr," 5-star, 11/30/2023): "The price is steep… but I promise it's worth it"; reflects price sensitivity even among satisfied long-term users.
- CLAIM (App Store review, user "inourspaces.com," 4-star, 02/19/2019): reported a toddler with ASD had difficulty with the app's up/down swipe navigation gesture; a fine-motor/UX access complaint distinct from the cost/vocabulary complaints above.

PART 5: USER JOURNEYS

Methodological grounding: These journeys are built around the **SETT Framework** (Student, Environment, Tasks, Tools), developed by Dr. Joy Zabala, and the **feature-matching** process, both of which are described in the literature as the standard/"gold standard" methodology for AAC assessment and decision-making over multiple decades (PrAACtical AAC SETT resources; AAC Community, SETT Framework; AAC Language Lab, Feature Matching Worksheet). FACT: Feature matching is explicitly described in the literature as having been the standard AAC-selection methodology "for several decades." Additional grounding: federal IDEA evaluation timelines (60 days from written parental consent, absent a stricter state-specific timeline), IEP-based device provision requirements, and documented funding-source processes (Section 4.2.1 and below).

5.1 Journey: The Child

1. **Struggle emerges:** caregivers/teachers notice the child cannot reliably get needs met through speech/gesture (this can appear at 18 months in a clearly pre-verbal toddler, or at age 9 in a child with degrading intelligibility from CAS, or acutely after a TBI).
2. **Referral:** pediatrician, early-intervention provider, or school team refers for a speech-language evaluation.
3. **SETT-based assessment:** the child's *current* communication (Student), the environments where communication must happen (home, school, therapy, community; Environment), the specific communicative Tasks required (requesting, commenting, social closeness, academic participation, medical self-advocacy), and candidate Tools are systematically considered together, not the device chosen in isolation (SETT framework sources above).
4. **Device trial(s):** the child is given hands-on trials, often 2–4 weeks per device, sometimes multiple devices sequentially (Lingraphica/Tobii Dynavox/PRC-Saltillo all offer ~4-week trial loans, per funding sources below), which itself is a burden: a child may be asked to "prove" facility with multiple unfamiliar systems in succession.
5. **Adoption and habituation:** once a device is selected and funded, the child must build motor/cognitive automaticity; this is a real skill-acquisition process, not a plug-and-play event, and can take months to years (implicit across all abandonment-literature findings in Part 4).
6. **Daily lived experience:** the child now navigates: slower conversational pace than peers (documented, Part 4), being interrupted/spoken over, needing to physically carry/charge/protect a device, potential stigma from unfamiliar peers/adults, and, critically, a self-advocacy burden (needing to correct people who assume the device output represents the limit of their thought, not just the limit of their current input speed).
7. **Transitions:** grade changes, therapist changes, new schools, and aging out of pediatric services each risk a "reset" if the new environment's stakeholders are not properly onboarded to the child's existing system (the "difficulty transferring skills between systems" and "school/home inconsistency" problems from Part 4 recur structurally at every transition point).

Major friction points / value-creation opportunities: (a) the multi-week trial-then-wait-for-funding gap during which the child has no communication support beyond whatever informal/low-tech system existed before; (b) the burden of the child effectively re-proving competence with each new device/environment; (c) no persistent, portable "communication profile" that travels with the child across providers/systems (a clear interoperability/data-portability gap, Part 4).

5.2 Journey: The Parent/Caregiver

1. **Noticing + grief/adjustment:** parents often first process an emotional adjustment (whether to a lifelong condition diagnosis or a sudden acquired one like TBI) before or alongside beginning the AAC process; SLPs in the abandonment literature explicitly flag "parent grief and loss" as an underappreciated contributor to later device abandonment (jptcp.com review, Part 4.2.1); i.e., a parent who has not processed grief may unconsciously resist full AAC adoption because it can feel like confirmation that spoken language won't develop.
2. **Navigating referral and evaluation systems:** parents must learn acronyms and processes (IEP, SETT, feature matching, prior authorization, letter of medical necessity) essentially from scratch, usually while also managing everyday caregiving.
3. **Device trial period:** parents typically bear the logistics of trial devices at home (setup, daily practice, tracking what works) with variable support from providers (documented training gaps, Part 4.2.1).
4. **Funding fight:** parents often become de facto insurance-appeals caseworkers: documentation gathering, prior authorization, possible appeal cycles (1–6 months per the SLP-survey data in Part 4.2.1), all while functioning as the child's care coordinator.
5. **Home implementation:** parents are expected to become communication partners themselves; modeling AAC use, maintaining/customizing vocabulary, troubleshooting technical problems; largely without formal training parity with SLPs (documented training-gap finding, Berenguer et al. 2022).
6. **Ongoing advocacy:** parents must repeatedly justify continued AAC use/funding, defend against stigma from extended family/public, and coordinate consistency across multiple providers and settings (documented "27 hours of homework per day" quote, Part 4.2.1, illustrates coordination overload).
7. **Long-term:** as the child ages, parents face renewed assessment/funding cycles (devices need replacement, vocabulary needs change, transition to adult services eventually looms; outside this document's pediatric scope but a known cliff-edge in disability services generally).

Major friction points: cost/insurance administrative burden; near-total responsibility for care coordination across disconnected providers; being the primary trainer without being trained themselves; emotional labor of processing diagnosis while simultaneously executing a technical/bureaucratic process.

5.3 Journey: The Speech-Language Pathologist (SLP)

1. **Referral intake** and initial case history review.
2. **SETT-based/feature-matching assessment:** SLP (sometimes paired with an AAC specialist or assistive-technology (AT) team) conducts hands-on trials, documents medical necessity for funding purposes (this documentation *is* the linchpin of the entire funding process; "everything else rests on this evaluation… without it, insurance has nothing to approve," per Little Words / AAC funding guidance).
3. **Recommendation and funding documentation:** SLP writes the formal evaluation, recommends specific system(s), and (for insurance-funded cases) the physician or SLP files for prior authorization depending on payer rules.
4. **Device delivery + initial training:** SLP trains the child and, ideally, caregivers and teachers; but caseload pressure (SLP caseload cited as a barrier by 46.2% of surveyed SLPs, Part 4.2.1) constrains available training time.
5. **Ongoing intervention:** SLP must continuously update vocabulary, coach communication partners, and monitor for abandonment risk signals.
6. **Cross-setting coordination:** SLP is frequently the sole professional expected to maintain consistency across home/school/other therapy providers, without formal authority or time allocation to do so.
7. **Continuing education gap:** 75.2% of surveyed SLPs cited lack of continuing-education credit courses on AAC as a barrier (Part 4.2.1); meaning many practicing SLPs are undertrained on rapidly evolving AAC technology relative to the pace of the field.

Major friction points: documentation burden disproportionate to clinical time available; caseload size incompatible with adequate AAC training depth; being the de facto single point of failure for cross-setting consistency.

5.4 Journey: The Teacher

1. **Receives an AAC-using student**, often with minimal or no direct AAC training in their teacher-preparation background.
2. **Device typically "arrives"** without the teacher having been part of the selection process; the Yau et al. (2024) study explicitly documents educators reporting devices "would just turn up" and being **excluded from device-selection decisions**, producing poor contextual/classroom fit (Part 4.2.1 table).
3. **Improvised on-the-job learning:** teachers report high variance in paid planning time to prepare AAC-supported lessons (0–90 minutes/day in one study), with many spending unpaid personal time (a few hours up to 30+ hours/week in some cases) preparing AAC-integrated materials (ASHA source on teacher AAC practices, https://pubs.asha.org/doi/10.1044/2022_LSHSS-21-00125; ResearchGate teacher-training-needs source).
4. **Daily classroom integration:** teacher must balance whole-class instruction with modeling/supporting one (or several) AAC users, often without a dedicated paraeducator trained in the specific device.
5. **Coordination with SLP:** effective AAC classroom use depends on close SLP-teacher collaboration, which is frequently under-resourced (districts have begun creating AAC-specialist coaching roles specifically to close this gap, per ASHA Leader sources).
6. **Transition to next teacher/grade:** knowledge about the specific child's system, vocabulary customizations, and effective strategies is at high risk of being lost at each year-end transition unless formally documented and handed off.

Major friction points: zero to minimal input into a tool the teacher is expected to expertly support; enormous uncompensated prep-time burden; year-over-year knowledge loss at teacher transitions; a clear opportunity for structured "communication passport" or profile-transfer tooling.

5.5 Journey: The School District

1. **Legal obligation trigger:** under IDEA, if AAC is required for a student to access curriculum (FAPE; Free Appropriate Public Education), it must be included in the IEP, and the district is generally obligated to provide/fund it as part of that (source: multiple AAC-in-schools guidance pages cross-referenced above, e.g. littlewords.ai).
2. **Evaluation logistics:** federal evaluation window is 60 days from written parental consent absent a stricter state-specific timeline; districts often run AT/AAC evaluation requests through a centralized AT specialist or SLP team, with hands-on trials typically taking 4–6 weeks.
3. **Procurement:** districts must budget for devices (which may be expensive, require ongoing licensing/software updates, and need repair/replacement budgets), weighing this against Low Incidence/general education funding pools (as in the California funding-hierarchy example, Part 4.2.1).
4. **Staffing and training investment:** districts must fund/provide AAC-specialist SLP or AT-team capacity; without this, individual teachers and SLPs are left to self-train (Part 5.4).
5. **Ownership/portability question:** a school-purchased device belongs to the school, not the family; creating direct friction if a student changes districts or transitions to adulthood/graduates, since the device (and its accumulated personalized vocabulary/customization) may not transfer with the student (funding-source documentation, Part 4.2.1).

6. **Compliance and equity considerations:** districts face oversight/legal exposure if AAC needs are identified but not adequately provided, or if evaluation timelines are missed.

Major friction points: budget unpredictability for expensive individualized equipment; the device-ownership/portability mismatch between school-funded and family-funded equipment; chronic underinvestment in specialist staffing relative to legal/clinical need.

5.6 Journey: The Pediatric Hospital/Clinic

1. **Intake:** often for children with more complex/acute etiologies (TBI, degenerative disease, complex syndromes) or when families seek a second/expert opinion beyond what a school district evaluation offers.
2. **Comprehensive AAC evaluation:** hospital-based AAC/AT clinics (e.g., Gillette Children's, cited in search results) run structured evaluation-to-recommendation pipelines explicitly built around demonstrating medical necessity for insurance purposes: current communication abilities assessment → device trial(s) → specific system recommendation → medical necessity documentation (Gillette Children's, "Path to AAC Device Approval").
3. **Physician/SLP-initiated prior authorization:** depending on payer rules, either the physician or the therapy provider initiates prior authorization; if a payer requires pre-evaluation authorization, this adds a delay layer before the evaluation itself can even begin.
4. **Insurance liaison role:** hospital AAC programs often need dedicated administrative capacity (funding specialists, as offered by device manufacturers like Lingraphica/Tobii Dynavox/PRC-Saltillo) purely to manage the Medicaid/insurance claims process; a strong signal that this administrative burden is large enough to warrant dedicated staffing as a business necessity.
5. **Handoff to school/home:** once a device is funded and delivered, the hospital/clinic's role in day-to-day implementation drops off sharply, creating a transition risk similar to the teacher-transition problem; expertise built during the clinical evaluation does not automatically transfer to the school-based team executing daily use.

Major friction points: the medical-necessity documentation burden as the single highest-leverage (and highest-friction) artifact in the entire funding pipeline; handoff discontinuity between clinical expertise (hospital) and daily implementation (school/home).

5.7 Journey: The Insurance Company / Government Payer (Medicaid)

1. **Receives prior-authorization request:** either pre- or post-evaluation depending on plan rules, requiring clinical documentation to establish "medical necessity" (a formal, specific evidentiary bar distinct from mere clinical benefit).
2. **Review against coverage policy:** commercial payers publish explicit coverage-criteria documents (e.g., Cigna's speech-generating device coverage policy, cited in search results) specifying exactly what evaluation elements, trial documentation, and diagnostic criteria must be present.
3. **Approval, denial, or request for more information:** FACT: a cited SLP survey found that persistence mattered enormously: 93% of appeals that included new supporting documentation were eventually approved; implying the *initial* denial rate is substantial and appeals are frequently necessary, not exceptional.
4. **State-level variation (Medicaid):** FACT: more than 80% of U.S. states now provide clear Medicaid AAC-funding guidance as of a 2023 ASHA report; implying meaningful variation still exists in the remaining ~20%, and that "clear guidance" is a relatively recent improvement rather than a longstanding baseline.
5. **Device ownership and lifecycle:** for Medicaid/private-insurance-funded devices, the device typically belongs to the beneficiary (family), unlike school-purchased devices; but replacement/upgrade requests likely require a fresh medical-necessity review cycle (inferred from general durable-medical-equipment insurance practice; not independently confirmed via AAC-specific source in this pass; flagged as ESTIMATE).

Major friction points (from the payer's own operational perspective, inferred): balancing genuine cost-control/fraud-prevention needs against a population where delay has real developmental/participation costs; the administrative overhead of processing appeals that a high fraction ultimately approve anyway (suggesting the initial review bar may be miscalibrated, though this is an inference, not a stated payer position, HYPOTHESIS).

Cross-cutting company-relevant opportunity flags across all seven journeys: - A portable, cross-setting "communication profile" (vocabulary, customizations, effective access-method settings, trial history) that travels with the child across SLP, school, hospital, and payer would directly address the most-repeated friction point across every single journey above (data portability/interoperability gap, Part 4). - Streamlining/automating medical-necessity documentation is the single highest-leverage administrative bottleneck identified (it gates funding, which gates the entire remaining pipeline). - Structured teacher/next-provider handoff tooling would address the repeated "knowledge reset" problem at every transition point (grade change, district change, clinic-to-school handoff).

PART 6: MONEY FLOWS

6.1 The core structural problem: four different parties, four different incentives

In pediatric AAC, the party who **chooses** the technology, the party who **uses** it, the party who **pays** for it, and the party who **approves** the payment are almost always four different people or institutions. This split is the single most important fact about the industry's economics, because it explains almost every dysfunction described below (slow sales cycles, misaligned product design, underuse of good products, overuse of "safe" incumbent products).

ROLE	WHO	NOTES
Uses	The child	Has no purchasing power, no say in payer rules, often nonspeaking so cannot self-advocate in the sales/approval process
Chooses (clinically)	Speech-Language Pathologist (SLP), sometimes OT	Medicare/Medicaid/most private insurers *require* a credentialed SLP evaluation and written recommendation before a dedicated speech-generating device (SGD) will be reimbursed; `FACT`, CMS LCD L33739 and Policy Article A52469 require "a formal evaluation of cognitive and communication abilities…by a speech-language pathologist" prior to delivery (source: cms.gov medicare-coverage-database, LCD L33739 / Article A52469).
Recommends/prescribes	Physician	The Affordable Care Act added a requirement that a physician have a face-to-face encounter with the beneficiary and issue a Written Order Prior to Delivery (WOPD) before a supplier can bill Medicare for an SGD; `FACT` (cms.gov, Noridian JD/JA DME LCD summaries, 2025 revisions).
Pays (nominally)	Medicaid, Medicare, private insurer, school district, or family out-of-pocket	Varies enormously by age/eligibility; see 6.2–6.6
Approves the purchase (financially)	DME Medicare Administrative Contractor (MAC), state Medicaid utilization-review unit, or private-insurer prior-authorization desk	This is a *distinct* gatekeeper from the payer's own claims department and from the prescribing clinician; `FACT` structure documented across ASHA reimbursement pages and CMS LCDs.
Chooses (procurement) in schools	IEP team (which includes the SLP, special-ed teacher, and parent, but decisions are constrained by district AT policy and budget)	The district, not the family, typically owns the device when it is purchased with IDEA funds; `CLAIM`, widely reported in AT-in-schools guidance (Wrightslaw, state AT project guidance) though ownership terms vary by state/district.

This fragmentation means a company selling AAC technology is really running **two or three parallel go-to-market motions:** a clinical/regulatory motion aimed at SLPs and DME suppliers, a payer motion aimed at Medicaid/Medicare/insurance policy desks, and a completely separate procurement motion aimed at school district special-education administrators; often for the *same end user* at different points in their life.

6.2 Medicare (adults/some pediatric: indirect relevance)

Medicare covers few children directly (it is primarily an elderly/disability program), but its coverage policy for speech-generating devices is the template that most state Medicaid programs and many private insurers copy, so it matters even for a pediatric-focused business.

HCPCS codes for SGDs (FACT), sourced from CMS Policy Article A52469, LCD L33739, and AAPC's HCPCS code database (aapc.com/codes/hcpcs-codes-range/119):

CODE	DESCRIPTION
E2500	SGD, digitized speech, using pre-recorded messages, ≤8 minutes recording time
E2502	SGD, digitized speech, pre-recorded messages, >8–20 minutes
E2504	SGD, digitized speech, pre-recorded messages, >20–40 minutes
E2506	SGD, digitized speech, pre-recorded messages, >40 minutes
E2508	SGD, synthesized speech, requiring message formulation by spelling and access by physical contact with the device
E2510	SGD, synthesized speech, permitting multiple methods of message formulation and multiple methods of device access (this is the code used for most modern eye-gaze/switch-scanning symbol-based communicators used by children)
E2511	Speech generating software program, for personal computer or information appliance (the *software-only* code; used when an app runs on a repurposed tablet rather than a dedicated device)
E2512	Accessory for speech generating device, mounting system
A9270	(Non-covered item code) used to bill the general-purpose computer/tablet hardware itself, since Medicare will only reimburse the *speech-generating software*, not a general-purpose tablet, unless the device has been "locked down" to function solely as an SGD at time of issue; `FACT` per CMS/Noridian coverage articles.

Key coverage rule that shapes the entire hardware market (FACT): A device is only covered as Durable Medical Equipment if "the SGD must be a device limited solely to the generation of speech, for use only by the individual who has a severe speech impairment," and if it uses tablet/smartphone/computer hardware, "a device utilizing tablet, smartphone or computer hardware must be designed by the manufacturer to function solely as a speech generation device at the time of initial issue" (CMS Policy Article A52469; Noridian JA/JD DME LCD pages). This is *why* companies like PRC-Saltillo and Tobii Dynavox sell hardware that is functionally an Android or Windows tablet but is sold "locked" as a dedicated device at a much higher price than an equivalent consumer tablet; it is a reimbursement-code artifact, not (purely) a technology requirement. Families who buy an iPad and a $250 app instead get zero DME reimbursement for the hardware, only (in some plans) for the E2511 software code.

Improper payment rate (FACT): CMS's 2024 Medicare Fee-for-Service Supplemental Improper Payment Data reported an 18.1% improper payment rate for SGD claims, projected at $2.6 million improperly paid (cms.gov MLN Speech Generating Devices compliance page). This reflects how documentation-heavy and error-prone the WOPD/face-to-face/SLP-evaluation chain is; a friction point that funding-assistance cottage industries (see 6.9) have grown up around.

Evaluation/therapy CPT codes (FACT) (sprypt.com CPT code guides; ASHA Coding FAQs; CMS Article A54111): - **92605 / 92606**: Evaluation for prescription of non-speech-generating AAC device (first hour / each additional 30 min), commonly used for young children (under 7) being assessed for low-tech AAC. - **92607**: Evaluation for prescription of a speech-generating AAC device, first hour, face-to-face. - **92608**: Add-on code for each additional 30 minutes of the SGD evaluation (must be billed with 92607 or it denies; FACT, per billing guides). - **92609**: Therapeutic services for the use of a speech-generating device, including programming and modification. These codes are billed by the SLP to Medicaid/Medicare/private insurance separately from the device itself; meaning a full "device stack" involves at least two distinct reimbursement claims (evaluation/CPT to the clinician, device/HCPCS to the DME supplier), often to different payers or different departments of the same payer.

6.3 Medicaid: the dominant public payer for pediatric AAC

Medicaid, not Medicare, is the primary public funder of pediatric SGDs because most AAC users are children and non-elderly disabled adults.

EPSDT is the legal lever; FACT. Under Medicaid's Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) benefit, states must cover any medically necessary service or equipment for a Medicaid-eligible child under 21 *even if that item is not listed in the state's regular Medicaid plan* (medicaid.gov EPSDT Coverage Guide; hhs.gov EPSDT guidance). This is why EPSDT, not the general adult DME benefit, is what actually gets a $8,000 dedicated SGD approved for a 4-year-old Medicaid recipient in most states.

Process; FACT/CLAIM composite (per ASHA Medicaid Toolkit; asha.org practice/reimbursement/medicaid; and multiple state guides like Colorado HCPF speech therapy manual): 1. SLP conducts a formal AAC evaluation and writes a report of medical necessity. 2. Physician issues a referral/prescription. 3. The claim, including the evaluation report and device recommendation, is submitted to the state Medicaid program (or its Medicaid Managed Care Organization) for **prior authorization**, before the device is delivered. 4. If approved, the DME supplier bills the state Medicaid program (or MCO) directly using the relevant E25xx HCPCS code; the device is typically classified as DME, meaning post-warranty repairs are also billable.

Every state runs its own variant of this; some carve AAC evaluation/dispensing out to specific vendors, some route it through managed-care plans, and approval timelines and documentation burdens vary widely by state (this variance is well documented anecdotally by AAC funding-assistance firms like aacfundinghelp.com and aacfunding.com but there is **no single national dataset** quantifying state-by-state approval rates or dollar volumes; flagged explicitly as a data gap rather than estimated).

Data gap, stated explicitly: CMS does not publish a national, itemized, "total annual Medicaid dollars spent on E25xx-series HCPCS codes" figure in any dataset located during this research. State-level Medicaid claims data (e.g., via MSIS/T-MSIS) could in principle be mined to build this bottom-up, but that is beyond the scope of a general web-research pass and is flagged as a specific further-diligence item for a company operating in this space, rather than a number we will fabricate.

6.4 Private health insurance

FACT Coverage is inconsistent across payers and plans; "private insurance varies wildly; some plans cover AAC routinely, while others make you earn it," and coverage denials commonly cite "lack of medical necessity," incomplete paperwork, or a re-characterization of the device as "educational" rather than "medical" (multiple funding-assistance sources: aacfunding.com, littlewords.ai, spectrumunlocked.com, mn.gov MNDDC assistive-tech appeals fact sheet). **No quantified national denial-rate statistic for SGDs specifically was found** in this research; flagged as a gap; the qualitative consensus across independent sources (parent advocacy sites, funding-assistance firms, state DD councils) is that initial denial is common and that appeals; usually requiring an SLP or the device manufacturer's in-house "funding team" to submit additional documentation; succeed a meaningful share of the time (CLAIM, not independently quantified).

This dynamic has spawned a **cottage industry of manufacturer-embedded and third-party "funding specialists"** (e.g., PRC-Saltillo, Tobii Dynavox, and independent firms such as AAC Funding Help / aacfunding.com) whose entire job is navigating Medicaid/Medicare/private-insurer prior authorization and appeals on behalf of families and clinics. This is itself a real cost center embedded in every device sale; device manufacturers effectively subsidize a mini insurance-brokerage function, which is a genuine (if soft) barrier to entry for new hardware entrants who lack this institutional expertise.

6.5 School districts / IDEA / special education

FACT IDEA (Individuals with Disabilities Education Act) Part B federal grants to states totaled roughly **$14.2–14.6 billion in FY2024** (sources diverge slightly by categorization: Congressional Research Service CRS Report R44624 gives ~$14.21B for the Part B grants-to-states program; other legislative-tracking sources cite $14.6B of a $15.4B total IDEA appropriation). This is federal money only; it is layered on top of much larger state and local special-education spending.

FACT; total US special-education spending: NCES data (bellwether.org "Who Pays for Special Education," citing NCES) shows that in FY2020, districts cumulatively spent **$38.8 billion** on special education specifically, averaging **$13,127 per student identified for special education**. Of that $38.8B, only $10.0B came from dedicated state special-ed revenue ($3,388/pupil) and $4.6B from dedicated federal revenue ($1,578/pupil); leaving **$24.1 billion (avg. $8,160/pupil)** as the *local district's* funding responsibility (property-tax-funded, non-dedicated general funds, etc.). This is the classic "IDEA is chronically underfunded relative to its original 40%-of-excess-cost promise" story quantified: federal dollars cover a minority of the true cost.

ESTIMATE; how much of that reaches AAC devices specifically: No dataset breaks out "AT/AAC device spending" as a line item within the $38.8B. We can bound it with a bottom-up estimate: - Using the Beukelman & Mirenda (2013) estimate that **1.3% of the US population (~4 million people)** cannot reliably meet communication needs with natural speech (FACT , cited across AAC literature including the AAC-RERC White Paper, bpb-us-e1.wpmucdn.com), and applying that rate to the ~73.1 million US population under 18 (FACT , US Census Vintage 2024 estimate) gives an ESTIMATE of **~950,000 children in the US with complex communication needs (CCN)** (73.1M × 1.3%). - Not all of these children are in a public-school IEP with a dedicated AAC device line item; many use low-tech/no-tech AAC, some are pre-school age (Part C/early intervention, not Part B), and many are served without ever getting a *dedicated* high-cost SGD. - If we conservatively assume **20–30% of the CCN pediatric population** obtains a dedicated SGD (device, not just app/low-tech board) at some point in their school career, that is **~190,000–285,000 children** with a device, at an average device cost around **$6,000–$8,500** (see 6.7/7.4 device pricing), implying **cumulative device-hardware spend on-the-books (across payers, not just schools) in the range of $1.1–$2.4 billion** at any point in time for the current pediatric cohort needing a *replacement/first device* in a given multi-year window (devices are typically used for 3–5 years before replacement is funded again). This is a rough, transparently-derived planning number, **not** a citation-backed market figure; flagged as ESTIMATE, not FACT.

FACT; who chooses/owns in schools: The IEP team (SLP + special-ed teacher + parent + administrator) selects AT, but district AT policy and budget constrain the choice set, and equipment purchased with IDEA/district funds is generally district property, not the family's, unless state or district policy provides for transfer at graduation (CLAIM , general pattern reported in AT-in-schools family guidance, e.g., Wrightslaw and state assistive-technology-project consumer guides; exact ownership/transfer rules vary state-by-state and were not independently verified for all 50 states in this pass).

6.6 Direct-to-consumer / out-of-pocket

Families pay out of pocket in three main scenarios: (1) while awaiting insurance/Medicaid approval (can take weeks to months), (2) for software/apps that insurance doesn't reach (e.g., a $250 one-time app purchase is often cheaper than the paperwork burden of insurance billing), and (3) when a family is uninsured, underinsured, or the payer denies coverage outright and the family doesn't have capacity to appeal.

FACT; representative app/software price points (company pricing pages, September 2026 search): - Proloquo2Go (AssistiveWare): **$219.99–$249.99** one-time purchase on the App Store (prices found: $219.99 per assistiveware/growjo-adjacent source and $249.99 per a 2025 comparison roundup; treat as approximately $220–$250, single-purchase, no subscription). - LAMP Words for Life (PRC-Saltillo): **$299.99** one-time purchase; 30-day free trial via the "Discover" app. - CoughDrop (open-source, mission-driven nonprofit-adjacent model): **$9/month or $295 lifetime license**, with the lifetime tier including 5 years of "Cloud Extras"; explicitly operates a "pay-what-you-can" cross-subsidy model where paying/donor users subsidize free or reduced-cost accounts for low-income families (coughdrop.zendesk.com; blog.mycoughdrop.com). - Bundled dedicated hardware + app packages (e.g., a "speech tablet" bundling an iPad, case, and choice of Proloquo2Go/TouchChat/LAMP): **~$999.99** for the bundle (usaspeechtablets.com/Gus Communication Devices); this is the *unreimbursed consumer* price point for a functionally similar product to an $8,000 insurance-billed dedicated device, illustrating the roughly 8x price gap that the "locked dedicated device" reimbursement pathway creates versus a consumer tablet + app. - Dedicated hardware devices: PRC-Saltillo Accent 1000 **~$8,290:** NovaChat family **roughly $5,000–$8,000** before insurance (specialneeds.com AAC hardware comparison; littlewords.ai). Tobii Dynavox devices are generally quote-only/institutionally priced and not listed publicly (us.tobiidynavox.com requires a quote request), consistent with a sales model built around clinician/funding-specialist mediated sales rather than open retail pricing.

This direct-to-consumer price tier (apps at $200–$300 one-time, or $9/month subscription) is *dramatically* cheaper than the insurance-mediated dedicated-device tier ($5,000–$8,500), which is one of the most important structural facts in the industry: **the reimbursement system, not underlying technology cost, is the primary driver of price** in the hardware segment.

6.7 Employer benefits, charities/grants/foundations

- **Employer-sponsored benefits:** Standard commercial health plans (employer-sponsored) follow the same private-insurance coverage logic as 6.4; DME/SGD coverage depends entirely on plan design; there is no evidence of employer plans routinely offering enhanced AAC benefits beyond what any ACA-compliant plan is required to cover. Employer-sponsored dependent-care FSAs can sometimes reimburse the parent's out-of-pocket share, but this is a minor channel.
- **Charities/grants/foundations:** A meaningful supplementary channel for the gap between insurance coverage and actual cost (co-pays, non-covered accessories, bridge funding while awaiting approval, low-tech AAC boards, or coverage for uninsured families). Examples referenced across funding-assistance guides include disease-specific foundations (e.g., for CP, Angelman syndrome, Rett syndrome) and general assistive-technology charities, plus device manufacturers' own "trial/loaner" programs. No aggregate dollar figure for total US philanthropic AAC funding was found in this research and none should be assumed; flagged as a data gap.
- **State DD/Medicaid-waiver programs:** Home- and Community-Based Services (HCBS) Medicaid waivers in many states can fund AT/communication devices for individuals who don't otherwise qualify under the standard state plan, layering another payer pathway on top of

standard Medicaid; mentioned across state Medicaid/AAC guides but state-by-state waiver rules were not exhaustively catalogued here.

6.8 International comparisons (where the US model differs: and where it might be better/worse)

UK; NHS England (FACT): England and Wales run a **network of 17 regional Specialised AAC Services** in a hub-and-spoke model, funded **directly by NHS England** (not by local Clinical Commissioning Groups), specifically for the ~10% of the AAC-need population estimated to have "the most complex communication needs" requiring high-tech powered communication aids (england.nhs.uk commissioning guidance and service specification, 2016; updated regional-service listings via rhn.org.uk/Ace Centre). This centralizes both clinical assessment *and* equipment provision in the same NHS-funded pathway; a single, government-run funnel rather than the US's fragmented Medicaid/Medicare/private-insurance/school-district patchwork. The service model explicitly separates a smaller, well-resourced "specialist" tier (10% of need, complex cases, dedicated devices) from a larger population served by generalist/local NHS speech and language therapy services with lower-tech solutions; arguably a cleaner triage structure than the US's largely undifferentiated "everyone goes through the same DME/Medicaid gauntlet" approach.

Australia; NDIS (FACT): Under the National Disability Insurance Scheme, individually-funded participant plans include an "Assistive Technology" budget category; a speech pathologist or OT assessment is required, the recommended device must be written into the approved NDIS plan, and typical SGD costs cited in NDIS-context guidance are **$2,000–$15,000 AUD** depending on device complexity (multiple NDIS provider/guide sources, e.g., blossomcommunitycare.com.au, planhero.com.au). This is structurally similar to a US Medicaid-waiver model but is a single national scheme (versus the US's 50-state Medicaid variance); an interesting "what if Medicaid AAC policy were nationally standardized" natural comparison.

Canada; provincial Assistive Devices Programs (FACT): Communication aids are funded through **provincial** programs (e.g., Ontario's ADP), which pay **up to 75% of the approved device price** for most applicants, rising to **100%** for recipients of certain provincial income-support programs (Ontario Works, ODSP, Assistance for Children with Severe Disabilities) (ontario.ca; prc-saltillo.com Canadian funding page; motioncares.ca ADP guide). This is a co-pay/means-adjusted public model; conceptually a hybrid between the US's binary insured/uninsured system and the UK's fully public NHS pathway.

What these comparisons suggest (HYPOTHESIS, not proven): Systems that (a) centralize AAC-specific clinical and funding expertise into a small number of specialist hubs rather than spreading it across thousands of individual insurers/school districts, and (b) explicitly tier the population by complexity of need, appear to reduce the administrative/appeals overhead that dominates the US experience (per 6.4's "funding specialist cottage industry"). A US company or nonprofit that could offer a similar "single point of specialist expertise" service; even privately, layered on top of the existing fragmented payer system; may reduce friction without needing to reform the payer system itself.

6.9 Summary money-flow diagram (textual)

```
CHILD (user, no purchasing power)
   ↑ recommended device/therapy
SLP (chooses, clinically) ← required evaluation (CPT 92605-92609) → billed to payer
   ↑ prescribes/refers
Physician (WOPD required for Medicare/Medicaid SGD claims)
   ↓ claim submitted with device HCPCS code (E2500-E2512) + evaluation CPT code
PAYER (one of: Medicaid [EPSDT, dominant for children] | private insurer | Medicare [rare, pediatric-adjacent only] | school district
   ↓ subject to
APPROVER/GATEKEEPER (state Medicaid prior-auth unit | private insurer prior-auth desk | DME MAC | district AT committee); DISTINCT fro
   ↓ approved funds flow to
DME SUPPLIER / MANUFACTURER (PRC-Saltillo, Tobii Dynavox, AssistiveWare, etc.); often maintains in-house "funding specialist" staff to
   ↓ device delivered to
CHILD (user); with device typically owned by district (if school-purchased) or family (if Medicaid/insurance/self-purchased)
```

PART 7: MARKET SIZE

Methodology note: Market-research vendor reports on "AAC device market size" disagree with each other by roughly **7x** (from $764M–$1.45B in one 2025 estimate up to $2.1–$3.3B in another, with 2033/2034 projections ranging from $1.45B to $5.4B; giiresearch.com, verifiedmarketreports.com, wiseguyreports.com, datainsightsmarket.com, qyresearch.com; all retrieved September 2026). This spread itself is a finding: **vendor market-sizing reports for AAC are not reliable as standalone numbers** because they use inconsistent scope definitions (some include all assistive communication technology broadly, some include only dedicated hardware, some fold in eye-tracking or broader "special needs education technology"). Accordingly, this section triangulates a bottom-up estimate from population prevalence and pricing data, and presents vendor numbers only as a sanity-check range, clearly labeled as such.

7.1 Step 1: US pediatric population

`FACT` US population under age 18 was **73.1 million** as of July 1, 2024 (US Census Bureau Vintage 2024 Population Estimates), representing 21.5% of the total US population.

7.2 Step 2: Prevalence of conditions associated with complex communication needs (CCN)

All figures below are `FACT`, individually cited, drawn from CDC/NIH/peer-reviewed sources; but note these conditions **overlap substantially** (e.g., many autistic children also have DLD or apraxia), so they cannot simply be summed to get a total CCN population; they are presented individually and then reconciled against the independent top-down CCN estimate in 7.3.

CONDITION	PREVALENCE	SOURCE
Autism spectrum disorder	1 in 31 8-year-olds (~3.2%) per CDC ADDM Network 2022 surveillance year data, released 2025; up from 1 in 36 previously; up 22% since 2020 and 375% since 2000 monitoring began	CDC ADDM Network, reported via autismspeaks.org, SARRC, AAP News (2025)
Cerebral palsy	~2–3 per 1,000 8-year-olds (roughly 1 in 345 per earlier 2010 CDC ADDM estimate); birth-cohort rate declined from 3.6/1,000 live births (2010) to 3.0/1,000 (2020)	CDC ADDM Network / archive.cdc.gov CP data page
Childhood apraxia of speech	~1–2 per 1,000 children (rare; ASHA notes true prevalence data is limited)	ASHA Practice Portal, Childhood Apraxia of Speech
Developmental Language Disorder (DLD)	~7–8% of children (Bishop et al. 2017, ~7% of ages 5–17; other estimates ~7% of 4-5-year-olds)	Bishop DVM et al. 2017 (cited via multiple DLD literature reviews, thedldproject.com, PMC9804624)
Down syndrome	~1 in 640–700 live births (~5,775 babies/year in the US); birth prevalence per 10,000 live births rose from 12.78 (1999-2001) to 15.55 (2016-2020)	CDC Birth Defects data; globaldownsyndrome.org
Rett syndrome	~1 in 10,000–15,000 female live births (girls)	NORD; PMC9841621 systematic review/meta-analysis
Angelman syndrome	~1 in 12,000–20,000 live births	NCBI StatPearls

Reconciliation / independent top-down check (FACT): Beukelman & Mirenda (2013), the standard textbook reference used across the AAC field, estimate that **1.3% of the US population (~4 million people)** cannot reliably meet their daily communication needs using natural speech alone (cited via the RERC-on-AAC 2019 White Paper on AAC needs, bpb-us-e1.wpmucdn.com). This top-down 1.3% figure is a more defensible "complex communication needs" denominator than summing the individual condition prevalences above (which would double- or triple-count children with co-occurring autism + DLD + apraxia, for example).

7.3 Step 3: Pediatric complex-communication-needs (CCN) population estimate

ESTIMATE (bottom-up, shown explicitly): - 73.1 million US children (Census, FACT) - × 1.3% CCN prevalence (Beukelman & Mirenda, FACT, though it is an all-ages estimate applied here to the pediatric population; a reasonable simplifying assumption absent an age-stratified CCN prevalence study, but flagged as an assumption) - = **~950,000 US children with complex communication needs** (73,100,000 × 0.013 ≈ 950,300)

This is consistent in order of magnitude with a cross-check using individual condition prevalences: autism alone (3.2% of children, many but not all with CCN) would suggest ~2.3M autistic children, of whom perhaps 25–30% are minimally verbal or nonspeaking (a commonly cited range in autism-AAC literature, **CLAIM/estimate range**, not independently verified in this pass); implying **~580,000–700,000** CCN children from autism alone, before adding CP, DLD-with-severe-impact, apraxia, Down syndrome, Rett, and Angelman populations. A ~950,000 total CCN estimate is therefore plausible and roughly consistent, sitting at the lower-middle of what summing partial overlapping populations would suggest. We adopt **~900,000–1,000,000 US children with CCN** as our working range.

7.4 Step 4: Bottom-up US pediatric AAC hardware+software TAM (annual)

Assumptions (each labeled): 1. CCN pediatric population: **950,000** (ESTIMATE, from 7.3). 2. Of these, ESTIMATE: **40–50%** currently have *any* form of AAC (device, app, or low-tech board/PODD book); the remainder are un- or under-served (unmet need is widely discussed qualitatively in AAC-access-equity literature, e.g., discussion of disparities by race/income/rurality in AAC service delivery, but no single authoritative "% served" statistic was found; this is an ESTIMATE range based on general clinical-access-gap commentary, not a cited figure). 3. Of those served, ESTIMATE: **~25–30%** use a dedicated high-tech SGD ($5,000–$8,500 range per 6.6), the rest use a tablet+app ($200–$1,000) or low-tech/no-tech systems (near-zero device cost, but real clinician-time cost). 4. Device replacement cycle: dedicated devices are typically funded for replacement every **3–5 years** (standard DME "reasonable useful lifetime" assumption used by Medicare/Medicaid for SGDs; `CLAIM`, consistent with general DME RUL policy patterns, not a specific cited AAC-only rule verified here).

Math: - Served CCN population: 950,000 × 45% (midpoint) = **~427,500 children currently using some form of AAC** - Of these, dedicated-SGD users: 427,500 × 27.5% (midpoint) ≈ **~117,600 children with a dedicated device** at any given time - Annualized new-purchase/replacement flow (assuming 4-year average replacement cycle): 117,600 / 4 ≈ **~29,400 dedicated-device transactions/year** - × average device price ~$7,000 (midpoint of $5,000–$8,500 range) = **~$206 million/year in dedicated SGD hardware spend** (US, pediatric only) - App/tablet-based AAC users: 427,500 × 72.5% ≈ **~309,900 children** using app-based AAC - If we assume roughly half already own a tablet and are buying/renewing an app in a given year at ~$250 average (blend of $220–$300 one-time app prices), and the other half are on a subscription model (~$9-15/month, i.e., ~$108-180/year); a rough blended annual per-user software spend of **~$150–$200/year** - × 309,900 ≈ **~$46–62 million/year in AAC software/app spend** (US, pediatric) - **US pediatric AAC hardware + software TAM (annual, direct spend across all payers): ESTIMATE ≈ $250–270 million/year**, call it **~$260 million/year** as a point estimate.

This bottom-up figure is **materially smaller** than several vendor market-size reports (which quote $1.5–$3.3B for the *global, all-ages* AAC device market in 2024-2025). That is reconcilable: (a) our bottom-up number is **US pediatric only**, a fraction of a global all-ages market; (b) it counts only direct hardware/software transaction value, not adjacent services (SLP evaluation/therapy billing, which is a much larger dollar flow; see 7.6); (c) vendor reports likely include broader "communication and assistive technology" categories (e.g., environmental control units, computer-access switches, eye-gaze hardware for non-communication purposes) that inflate scope beyond pure SGD/AAC software. We present our bottom-up figure as the more defensible **pediatric AAC device+software TAM**, and treat vendor figures as directionally useful only for the *global, all-ages, broader-AT-inclusive* market.

7.5 Global and all-ages AAC market: triangulated vendor range (explicitly flagged as less rigorous)

Given the ~7x spread across vendor reports (giiresearch.com: $2.09B in 2024 → $2.32B 2025 at 11.1% CAGR; verifiedmarketreports.com: $3.28B in 2025 → $5.41B by 2033 at 7.4% CAGR; another verifiedmarketreports.com estimate: $2,128.7M in 2024 → $3,500M by 2035; a lower estimate of $1.5B in 2024 → $2.8B by 2033 at 7.5% CAGR; and a "lower bound" estimate of $764M in 2025 → $1,450M by 2034 at 10% CAGR), the most defensible summary is: **the global, all-ages AAC device market is very likely in the low-to-mid single-digit billions of USD ($1.5–$3.5B), with double-digit-to-high-single-digit CAGR consensus across nearly all vendors (~7–11%).** We do **not** adopt any single vendor's point estimate as authoritative; we present this as a directional range only.

For comparison, one real, verifiable **company-level data point**: **Tobii Dynavox** (the largest pure-play AAC hardware/software company, Nasdaq Stockholm: DYVOX) reported **FY2024 net sales of SEK 1,387 million** (≈ **$130–135 million USD** at typical 2024 SEK/USD rates of ~9.5–10.5, so SEK 1,387M / ~10.3 ≈ **$135M**), up 22% from SEK 1,141 million in 2023 (mfn.se/Tobii year-end report 2024; marketscreener.com). **FACT.** As the largest identifiable pure-play company in this space with public financials, Tobii Dynavox's ~$135M global (all-ages, all products) revenue is a useful lower-bound sanity check: if the "leading player" does ~$135M globally across all ages and all product lines (dedicated devices, software, eye-tracking, accessories), a global all-ages AAC *device* market of $1.5–$3.5B implies Tobii Dynavox holds roughly **4–9% share** of that market; plausible for a fragmented market with PRC-Saltillo, Liberator (UK), AssistiveWare, Smartbox/Grid, Forbes AAC, Ablenet, and numerous smaller/regional players and open-source alternatives (CoughDrop) also active, alongside a long tail of consumer tablet+app combinations that never appear as "device market" revenue in vendor reports at all.

7.6 Adjacent/related markets

- **Eye-tracking assistive technology:** Vendor estimates for the *eye-tracking market broadly* (not AAC-specific; includes gaming, market research, automotive, VR) range **$1.2B–$1.7B in 2024/2025** (imarcgroup.com, gminsights.com, nextmsc.com, straitsresearch.com), with the assistive/accessibility-for-disability use case being one sub-segment among several (gaming, market research, automotive being others); **no isolated "eye-tracking-for-AAC" figure exists:** this should be treated as a broad market with AAC as a minority vertical, not a proxy for AAC market size.
- **Special-education software market:** Global vendor estimates range from **$1.53B (2026) → $3.19B (2035)** at 8.5% CAGR (businessresearchinsights.com) to **$2,680M (2025) → $4,040M (2033)** at 4.7% CAGR (datainsightsmarket.com/dataintelo.com); AAC/communication software is one category within this broader special-ed software market (which also includes IEP management, behavior tracking, literacy software, etc.).
- **Broader "assistive technology" market:** One vendor estimate puts the global AT market (all disability categories, all ages; mobility, hearing, vision, communication combined) at **$33.25B in 2024 → $36.65B (2025) → $96.99B by 2035** (10.22% CAGR); this is a very broad category where AAC is a small fraction; cited only to size the outer bound of the assistive-technology universe AAC sits within.
- **Assistive technology for students with learning disabilities:** $154.67M (2020) → $298.13M (2030) projected, 6.9% CAGR (alliedmarketresearch.com); again a partially-overlapping but distinct category (learning disabilities ≠ complex communication needs, though there is some overlap, e.g., DLD).

7.7 TAM / SAM / SOM framing for a new pediatric-AAC-focused entrant

Using the bottom-up US pediatric figures as the foundation (more defensible than vendor global numbers), and layering in the underserved population as upside:

- **TAM (Total Addressable Market); US pediatric AAC, current addressable spend**: **~$260 million/year** (7.4 bottom-up estimate) in direct device/software transaction value, **plus** an adjacent and larger **SLP evaluation/therapy service spend** that any company able to bundle clinical services could access; this is NOT separately sized in this research (would require CPT-code-level Medicaid/Medicare claims-volume data not available via web search) but is flagged as likely **several times larger** than the device/software TAM alone, since ongoing AAC therapy (weekly/biweekly sessions, CPT 92507/92609, etc.) recurs for years per child, versus a one-time or every-4-year device purchase. **This is the single most important unquantified number for anyone building a full financial model of this space; a specific recommendation for further diligence via state Medicaid claims data (T-MSIS) or a paid claims-data vendor (e.g., Trilliant Health, Definitive Healthcare) if pursuing this market seriously.**
- **TAM upside (unmet need):** If the ~55% of CCN children currently unserved (per 7.4 assumption #2) were served at the same device/software mix and spend rate as the currently-served population, TAM could roughly **double to ~$500-550 million/year:** this "unmet need" gap is arguably the most legitimate growth thesis for a mission-aligned new entrant (serving currently-unserved children), versus fighting incumbents for share of the currently-served population.
- **SAM (Serviceable Addressable Market)** for a hypothetical new entrant depends entirely on chosen segment/price-point/geography; e.g., a **software-only, subscription, US-only** entrant targeting the ~310,000 app/tablet-based AAC users (7.4) at a $150-200/year blended spend has a SAM of roughly **$46-62 million/year**, growing as unmet need is addressed and as more families/schools shift from one-time app purchase to subscription models (a trend already visible in the CoughDrop $9/month option and broader SaaS-ification of education software).
- **SOM (Serviceable Obtainable Market)** cannot be responsibly estimated without a specific company, product, price point, and go-to-market plan; we do not fabricate a SOM figure here; any SOM claim should be built by the operating team from the TAM/SAM figures above plus their own specific customer-acquisition assumptions (see Part 12 for CAC/sales-cycle context by business model).

7.8 Key uncertainties and explicit data gaps in Part 7

1. No authoritative age-stratified CCN prevalence study was found (Beukelman & Mirenda's 1.3% is all-ages).
2. No dataset quantifies "% of CCN children currently served with AAC"; the 40-50% figure used in 7.4 is a reasoned estimate, not a citation.
3. No dataset quantifies the split between dedicated-device users and app/tablet users among the served population; the 25-30% figure is a reasoned estimate.
4. Vendor market-size reports for "AAC device market" disagree by ~7x due to inconsistent scope; treated as directional only, not authoritative.
5. Total Medicaid dollar spend specifically on E25xx-series HCPCS codes nationally is not published in any source found; would require T-MSIS claims-data analysis to obtain rigorously.
6. SLP therapy-service market size (CPT 92605-92609 and related ongoing AAC therapy) was not separately sized; flagged as likely the largest adjacent revenue pool and a priority for further research.

PART 8: PATENTS AND IP

Disclaimer: This is a landscape overview based on public search results (Google Patents, Justia, company IP pages), not legal advice. A new entrant should engage patent counsel before finalizing any AAC product design, especially in the icon-encoding and eye-tracking categories flagged below as heavily patented.

8.1 Eye-tracking (Tobii)

- FACT Tobii's patent portfolio is described by the company itself as "the world's largest eye tracking patent portfolio," covering sensor technology, illumination methods, algorithms, data-transfer mechanisms, and eye-control interaction techniques. Counts vary by source/date: ~850 filings/400+ granted patents (older count) vs. 1,000+ patents/applications including 200+ granted US patents (more recent secondary aggregation). Tobii IP licensing; Statista; Justia; Tobii AB assignee search
- HYPOTHESIS This is the single most heavily patent-protected sub-domain in the entire AAC space. A new entrant building eye-tracking hardware for communication should assume **freedom-to-operate is constrained** and budget for either licensing from Tobii or engineering clearly around its claims (e.g., using third-party eye-tracking silicon/SDKs from vendors like EyeTech or Gazepoint who have presumably cleared their own IP, rather than building eye-tracking sensing from scratch).

8.2 Predictive/encoded communication: Minspeak / semantic compaction (Prentke Romich / Semantic Compaction Systems)

- FACT Invented by **Bruce Baker**, 1980; core patents include **US 4,661,916**, **US 5,097,425**, **US 5,210,689** (plus, per PRC's own history page, "subsequent patents, patents pending, copyrights, and applications"). Licensed to Prentke Romich Company (Barry Romich) from December 1981 onward via Baker's firm Semantic Compaction Systems. PRC history/patents page; Minspeak Academy
- FACT SCS/PRC actively enforced this IP against a competitor (Speak for Yourself) as recently as 2012–2013, settling with a license-and-confidential-terms arrangement. This demonstrates the patent holder is willing and financially able to litigate. PCWorld
- HYPOTHESIS Icon-sequence-based "compress a sentence into a short tap sequence" encoding schemes are a **heavily patent-defended niche** with a track record of enforcement. A new entrant should avoid replicating Minspeak's specific multi-meaning-icon sequencing mechanism without freedom-to-operate analysis, even though the oldest core patents (filed early-to-mid 1980s) have likely expired by now given standard ~20-year US patent terms; the "subsequent patents" language suggests PRC/SCS have continued filing follow-on/improvement patents that may still be in force. Verifying current expiration status of each specific patent number is a task for counsel, not this report.

8.3 Symbol-system IP

- **PCS (Picture Communication Symbols):** FACT trademark/IP owned and maintained by **Tobii Dynavox**. Tobii Dynavox
- **SymbolStix:** FACT developed by **n2y** (independent company, PE-backed, most recently majority-stake-acquired by Five Arrows) for its News-2-You and Unique Learning System products. Baird deal card
- **Widgit Symbols:** independent IP owned by **Widgit Software Ltd** (UK, B Corp).
- **Blissymbolics:** FACT copyright held by **Blissymbolics Communication International (BCI)**, which received a perpetual, worldwide, exclusive license from creator **Charles K. Bliss** (1975, 1982). BCI licenses the "BCI Authorized Vocabulary" (BCI-AV) under **Creative Commons BY-SA 4.0:** i.e., Blissymbolics is explicitly **open/permissively licensed** for both free and commercial use with attribution, unlike PCS/SymbolStix/Widgit, which are proprietary. Blissymbolics; Licensing
- HYPOTHESIS Symbol-system IP is **fragmented across at least 4 owners** (Tobii/PCS, n2y/SymbolStix, Widgit, BCI/Blissymbolics) with materially different licensing postures; Blissymbolics is the one clearly open path for a new entrant wanting a legally uncomplicated symbol set; PCS/SymbolStix/Widgit would each require commercial licensing negotiation. A new AI-native entrant could plausibly avoid all four by using AI-generated/photo-based or fully custom symbol art instead of licensing an existing named symbol set; this is likely the path most new AI-era entrants (e.g., Cboard's Cbuilder) are already taking.

8.4 Personalized speech synthesis / voice banking

- FACT **VocaliD, Inc.** pioneered personalized synthetic voice creation ("Voicebank") and was **acquired by Veritone, Inc. on June 16, 2022:** VocaliD's patents (e.g., **US 9,336,782**, "Distributed collection and processing of voice bank data") were assigned to Veritone on **September 12, 2022**. BusinessWire; Google Patents US9336782
- HYPOTHESIS Voice-banking/personalized-TTS IP is now consolidated inside **Veritone**, a publicly traded AI company (not an AAC-focused company), meaning a new AAC entrant wanting personalized-voice features would need to either license from Veritone, use a different personalized-TTS approach (many now exist via general-purpose voice-cloning AI, e.g., ElevenLabs-style tech, which was not covered by this search but is common

knowledge as of 2026), or build on open TTS research. The narrower "distributed collection of voice bank data" patent claim is plausibly avoidable by not replicating VocaliD's specific crowd-sourced-donor-voice-blending collection method.

8.5 Access-method patents (switch scanning, head/eye tracking beyond Tobii)

- Research found individual eye-tracking-adjacent patents from other assignees (e.g., mobile-device eye-tracking patents surfaced under Sesame Enable-adjacent search, US 10,248,197 "Systems and methodologies for real time eye tracking for electronic device interaction," US 10,698,479 "Method for starting eye tracking function and mobile device"); indicating **eye/gaze tracking for device interaction is a crowded, multi-assignee patent space beyond Tobii alone**, not a Tobii monopoly at the level of *all* gaze-interaction patents, only at the level of *dedicated AAC eye-tracking hardware*. USPTO PDF
- Switch-scanning access method patents were **not specifically identified** in this research pass; likely because basic switch-scanning (single/dual switch, timed scanning) is old, foundational, and largely off-patent/public-domain technique at this point (`HYPOTHESIS`, not directly confirmed).

8.6 AI-assisted AAC / BCI-communication patents

- `FACT` Broad "artificial intelligence communication assistance" patents exist and are assigned to major tech companies, e.g. **US 11,228,731 B1** ("Artificial intelligence communication assistance in audio-visual composition") and **US 10,771,529 B1** ("Artificial intelligence communication assistance for augmenting a transmitted communication"); both appear to be **Google-assigned** general communication-assistance patents, not AAC-specific, based on search snippets. Google Patents US11228731B1; Google Patents US10771529B1
- `FACT` A USPTO-indexed patent titled **"Assistive communication method and apparatus"** (patent number visible in a downloadPdf URL, full number not independently confirmed in this pass) exists and appears specifically AAC-relevant, covering adjusting sentence-production speed and adding emotional expression to AAC output; directly relevant prior art for any new entrant building adaptive/emotionally-expressive AAC output. USPTO PDF
- `FACT` Google was reported (Axios, May 15, 2025) to have overtaken IBM as the leading filer of generative-AI-related patents overall (not AAC-specific), and also leads in agentic-AI patents, covering the Feb 2024–Apr 2025 window. This signals big-tech is patenting broadly in the generative-AI space that AAC-adjacent features would likely touch (predictive phrase generation, personalized language models, agentic communication assistance). Axios
- `HYPOTHESIS` Unlike Minspeak/Tobii-eye-tracking, the **AI-native AAC patent space looks comparatively open/uncrowded specifically for AAC use cases**; most identified AI-communication patents are broad, general-purpose big-tech filings (Google) rather than AAC-industry-specific claims. This suggests meaningful **freedom to operate for a new AI-native AAC company today**, but with a growing risk that Google's broad generative-AI/agentic-AI patent filings could eventually be asserted against any company building LLM-based predictive communication tools, AAC included. A new entrant's patent counsel should specifically screen against Google's 2024–2025 generative/agentic AI patent family before shipping an LLM-driven "predict what I want to say" feature.

8.7 Summary: heavily patented vs. open areas

AREA	PATENT DENSITY	NOTES
Eye-tracking hardware for AAC	**Heavy**	Tobii dominant (1,000+ filings); litigation-tested willingness to enforce not confirmed but portfolio scale alone is a deterrent
Icon-sequence/semantic-compaction encoding	**Heavy, enforced**	PRC/SCS sued a rival as recently as 2012–2013 and settled with a license
Symbol libraries (PCS/SymbolStix/Widgit)	**Moderate, fragmented**	4 separate owners; Blissymbolics uniquely open (CC BY-SA)
Personalized voice-banking TTS	**Consolidated, narrow**	Now inside Veritone (general AI co.), narrow specific claims, broader personalized-TTS field has moved on
Basic switch scanning	**Likely open/public domain**	Old, foundational technique; no active patent found
General AI/LLM-based communication assistance	**Emerging, broad, not AAC-specific yet**	Google filing heavily in generative/agentic AI broadly; genuine near-term freedom to operate for AAC-specific LLM features, but a risk to monitor

PART 8 (SUPPLEMENT): BCI / AI-SPECIFIC PATENT LANDSCAPE

No legal advice; this flags where patent counsel and freedom-to-operate diligence matter most.

8.1 Neural implant / BCI companies: patent density

FACT : Neuralink has 67 patents globally across 31 unique patent families (49 active), per GreyB patent-analytics summary; an older/different count cited 34 filed patents, indicating counts vary by source/date and should be independently re-verified before any diligence decision. Source: GreyB Neuralink Patents insights.

FACT : Synchron's IP portfolio spans 118 documents across 16 patent families in 10 jurisdictions, covering endovascular implantation technique (its differentiating minimally-invasive stent-based delivery approach), electrode array design, signal processing, and system integration. Source: cited via PatentVest Pulse summary, National Law Review syndication (direct PatentVest URL returned HTTP 403 in this research pass; content confirmed via syndicated press release).

FACT : Precision Neuroscience received FDA clearance (April 2025) for a core component of its ultra-thin electrode-array brain-implant system, positioning it as a third major implant-based competitor alongside Neuralink and Synchron, explicitly targeting speech and movement restoration for paralyzed patients. Source: CNBC; MIT Technology Review survey of BCI companies.

ESTIMATE Synchron's patent count (118 documents/16 families/10 jurisdictions) relative to Neuralink's (67 patents/31 families) suggests Synchron has pursued a more geographically distributed, "de-risked" IP strategy around its core minimally-invasive delivery mechanism, while Neuralink's smaller-but-more-invasive-technology patent base is concentrated around a technically riskier fully-implanted, high-channel-count approach. Both are far outside the likely near-term (5–10 year) product roadmap of a children's-AAC-focused company, since implanted BCIs are not remotely appropriate or approved for the pediatric AAC population targeted by non-invasive AAC products; but they matter as the long-horizon "ultimate" competitive/complementary technology and as a source of *talent and technique* (signal-processing/decoding algorithms) that could migrate into non-invasive AAC prediction research.

8.2 Academic speech-BCI research and patenting (UCSF, Stanford/Berkeley)

FACT : UCSF's Chang Lab (Edward Chang, MD) runs the BRAVO clinical trial using electrocorticography (ECoG) to decode speech-motor cortex signals into synthesized speech in near-real-time, including full-word decoding from a participant paralyzed and unable to speak for over a decade. Researchers on this work (S.L. Metzger, D.A. Moses, J.R. Liu, E.F. Chang) are named inventors on a **pending provisional UCSF patent application** related to the speech-neuroprosthesis technology. Sources: UCSF Chang Lab; University of California news; PubMed, Metzger et al. 2023.

FACT : This work is a collaboration between UCSF and UC Berkeley (Berkeley EECS), meaning any resulting IP is likely jointly owned/administered across both UC campuses' tech-transfer offices. Source: Berkeley EECS news.

No confirmed Stanford-specific speech-BCI patent filing was identified in this research pass; Stanford's well-known BCI program (Krishna Shenoy's lab, cursor/typing-focused BrainGate collaboration) is more associated with motor/typing decoding than speech synthesis specifically; this should be treated as a gap for further direct diligence (e.g., a targeted Google Patents assignee search for "Stanford University" + "brain-computer interface" + "speech") rather than a confirmed absence of Stanford IP in this space.

ESTIMATE Because UCSF's speech-neuroprosthesis patent is still at the *provisional* stage (per the sourced Chang Lab material), the actual claims scope is not yet public/finalized; this is exactly the kind of situation where patent counsel should monitor USPTO publication of the non-provisional filing (typically 12–18 months after provisional filing) before assuming freedom to operate in AI-assisted speech-decoding-adjacent product areas, even for non-invasive AAC (since claims in a provisional speech-decoding patent could potentially be drafted broadly enough to implicate AI-based speech/intent-prediction methods generally, not just invasive ECoG-specific techniques; this cannot be assessed without reading the actual claims, which were not publicly available at the time of this research).

8.3 AI-assisted-AAC and predictive-communication patents specifically

FACT : A direct patent search for "augmentative and alternative communication" + AI/predictive-text patents assigned to major tech companies (Google, Microsoft, Apple) did not surface company-specific AAC patents in this research pass; instead, the search surfaced general "artificial intelligence device with voice recognition" patents assigned to LG Electronics (e.g., US11211079B2, US11495214B2), which are broad smart-speaker/voice-assistant patents, not AAC-specific. Source: search results from Google Patents.

ESTIMATE This absence is itself informative: unlike eye tracking (Tobii, ~850 patents; extremely dense) or BCI implants (Neuralink/Synchron, dozens to hundreds of patents each; dense and active), the specific intersection of "LLM/AI-based predictive text or phrase generation, applied specifically to AAC" appears to be a comparatively **open, lightly-patented white space** as of this research; the academic literature (PrAACT, Gaines & Vertanen, SPICA, AACessTalk) is publishing openly (arXiv, ACM DL) with no evidence surfaced of parallel aggressive patenting by the underlying research groups or the incumbent AAC vendors (Tobii Dynavox, PRC-Saltillo, AssistiveWare). This should be **independently verified with a formal patent-attorney-conducted search** (this research used only public web search, not a full USPTO/EPO/WIPO classification-based search) before a company relies on it, but directionally it suggests the AI-prediction-for-AAC layer may currently be more open to new-entrant IP-building than the eye-tracking or BCI hardware layers are.

FACT (adjacent, historical/general prior art risk): A 1998 multilingual translation device patent (assigned decades ago, USPTO PDF) and other older "electronic multilingual… learning tool" patents (USPTO PDF) exist in the broader children's-communication-device space, illustrating that even seemingly novel-sounding "child-friendly multilingual communication device" concepts have decades of prior art in adjacent (non-AAC-specific, non-AI) forms; a reminder that patent searches for a new AAC company should not be limited to "AAC" as a keyword, but should sweep broader children's-electronics and translation-device prior art too.

8.4 Where patent counsel matters most: flagged priority list

1. **Eye tracking hardware/calibration/algorithms:** Tobii's ~850-filing portfolio is the single densest, most consolidated patent position identified in this entire research pass; any proprietary gaze-hardware development (not licensing) requires a formal freedom-to-operate review before committing engineering resources. Tobii IP licensing.
2. **Invasive/implanted BCI:** Neuralink (67 patents/31 families) and Synchron (118 documents/16 families/10 jurisdictions) are actively and broadly patenting; irrelevant to near-term pediatric non-invasive AAC products but relevant if the company's long-term roadmap ever contemplates neural-signal input modalities. GreyB; PatentVest/NLR.
3. **UCSF/UC Berkeley speech-neuroprosthesis provisional patent:** status should be tracked for publication of the non-provisional application and actual claims language, given uncertainty about claim breadth. Chang Lab.
4. **AI-predictive-text-for-AAC specifically:** appears comparatively open based on this public-web-search-level review, but this finding is **low-confidence** and should be confirmed with a professional patent search (classification-based, not keyword-based) before a company relies on freedom to operate or before deciding whether to file its own patents in this exact space to establish first-mover IP.
5. **EMG/wearable gesture input:** Meta's CTRL-labs-derived IP position was not independently sized in this research pass (no patent-count figures for CTRL-labs/Meta Reality Labs EMG patents were found) and represents a further diligence gap; given Meta's substantial R&D investment (Neural Band as flagship 2025 consumer launch), a dedicated patent search here is warranted before pursuing a build strategy for consumer EMG wearables.

Research method notes and limitations

- All findings above are drawn from live web search and web-fetch conducted in September 2026 using WebSearch and WebFetch tools; several ACM Digital Library full-text pages returned HTTP 403 (paywall/bot-blocking) and were summarized instead from search-engine-indexed abstracts/snippets and secondary citations; flagged inline wherever this occurred (e.g., Valencia et al. CHI 2023, the CHI 2026 autoethnography paper).
- The PatentVest BCI-landscape report (a primary-looking source for §8) also returned HTTP 403 directly; its content was corroborated via a syndicated National Law Review press release republishing PatentVest's own summary figures; treated as FACT with that provenance noted, not independently verified against the underlying patent database.
- No claims in this document should be treated as legal advice, particularly the patent-landscape section (Part 8) and any build-vs-buy IP-risk framing in Part 19; all such content explicitly recommends formal patent counsel review.
- Where a claim is attributed to an advocate, practitioner, or company blog rather than a peer-reviewed source (e.g., Beth Moulam, ThinkSmartbox), it is tagged as CLAIM/attributed rather than FACT, consistent with the assignment's research standards.

PART 9: AI AND THE NEXT GENERATION OF AAC

9.1 Overview: why AAC is an AI inflection point

FACT : AAC has historically relied on static symbol grids, fixed core-vocabulary boards, and rule-based word prediction (n-gram models), largely unchanged in underlying architecture for decades. Recent work shows transformer-based language models are now being adapted specifically for AAC prediction and generation tasks; see PrAACT (Pereira et al., 2024, *Expert Systems with Applications*, ScienceDirect; SSRN preprint) and Gaines & Vertanen's character-level LLM adaptation for AAC (EMNLP 2025 Findings, arXiv:2501.10582).

FACT : The RERC on AAC and CommunicationFIRST co-hosted the "Future of AAC Research Summit" in Arlington, VA, May 13–14, 2024; described as the first AAC research conference "planned, organized, and realized through equitable, shared leadership of people who use AAC, community advocates, and university-based researchers" (AAC Learning Center). This signals that AI-in-AAC research is increasingly being co-designed with disabled stakeholders rather than done to them; an important governance signal for any commercial entrant.

9.2 Predictive language, personalized vocabulary, and communication acceleration

FACT PrAACT (Predictive AAC with Transformers) is a transformer-based method for AAC card/word prediction that adapts a general text corpus to the AAC domain, fine-tunes a transformer LM on it, and replaces decoder weights with an encoded representation of the *individual user's vocabulary* at inference time; explicitly designed so predictions stay personalized rather than generic. Source: Pereira et al., ScienceDirect; ResearchGate.

FACT Gaines & Vertanen (Michigan Tech), "Adapting Large Language Models for Character-based AAC" (EMNLP 2025 Findings), solved a specific technical mismatch: most modern LLMs tokenize in subwords, but AAC scanning/typing interfaces need character-by-character predictions. Their algorithm extracts character-level probabilities from subword LLMs more accurately than classification-layer, byte-level, or n-gram baselines, and a domain-adaptation step (fine-tuning on AAC-relevant conversational text) further improved accuracy on short, simple, conversational utterances typical of AAC use. Source: arXiv:2501.10582.

FACT IEEE research has specifically studied "Refining Text Input for AAC Devices: Analysing Language Model Layers for Optimisation," doing layer-wise analysis of masked language models to optimize next-word prediction for AAC corpora. Source: IEEE Xplore, 10446094.

ESTIMATE Because standard LLMs are trained on general web/book text, their statistical priors do not match AAC-user language (short, high-frequency, core-vocabulary, often telegraphic). Reasoning: multiple papers above independently converge on the same fix; domain-adapting/fine-tuning a general LLM on AAC-specific corpora rather than using an off-the-shelf model directly; suggesting this is now recognized as a necessary (not optional) step for production-quality AAC prediction, and represents a defensible data/fine-tuning moat rather than a place where a vendor can simply call a foundation-model API unmodified.

9.3 Conversational prediction, context awareness, and intent prediction

FACT SPICA ("Scalable and Personalized Conversational Agent Framework for AAC Users") introduces an agentic orchestration layer that decomposes user intent, plans reasoning steps, retrieves from a structured personal memory, and generates responses reflecting the user's "authentic context, preferences, and emotional tone." Presented at ACM IUI 2025 (Intelligent User Interfaces). Source: ACM DL, 10.1145/3742413.3789116.

FACT "AACessTalk" (KAIST, NAVER AI Lab, Dodakim Child Development Center) is a tablet-based AI-mediated communication system for minimally verbal autistic (MVA) children and their parents. It gives parents real-time conversational guidance and recommends contextual vocabulary cards to the child, adapting in real time to the child's mood and environment rather than relying on fixed card sets. A two-week deployment study with 11 child-parent dyads found high engagement, increased conversational turn-taking, and, notably, that the system "empowered the children to have more agency in communication" rather than reducing it, while also prompting parents to reflect on their own interaction strategies. Presented at CHI 2025. Sources: ACM DL; arXiv:2409.09641; MedicalXpress coverage.

FACT "Exploring the use of Generative AI to Support Automated Just-in-Time Programming for Visual Scene Displays" (ASSETS 2024) tested GPT-4V's ability to auto-generate contextually relevant communication options for visual scene displays (VSDs) from photographs, evaluated by 13 SLPs/AAC researchers. Finding: LMM-generated options were "contextually relevant and often resembled those created by humans," addressing the traditional burden of manually programming VSDs for each new photo/scene. Source: arXiv:2408.11137; ACM DL.

FACT "Why So Serious? Exploring Timely Humorous Comments in AAC Through AI-Powered Interfaces" (CHI 2025) extends AI-generated AAC suggestions into a specific, previously under-served pragmatic function, humor, arguing that fixed AAC vocabularies systematically under-support this and other social/affective registers of speech. Source: ACM DL.

HYPOTHESIS Because humor, sarcasm, small talk, and phatic communication are disproportionately hard to pre-program into static AAC boards (they are context- and timing-dependent), generative AI's comparative advantage over legacy AAC may be largest precisely in these "social glue" registers rather than in referential/informational communication where core-vocabulary boards already perform reasonably well; meaning product differentiation may come more from social/affective fluency than raw word-prediction speed.

9.4 Visual scene understanding, multimodal input, and environmental context

FACT Beyond the GPT-4V VSD study above, eye-tracking research is increasingly used as a signal for contextual AI systems more broadly (not AAC-specific): "Eye Gaze as a Signal for Conveying User Attention in Contextual AI Systems" (ETRA 2025) shows that prior gaze fixations (scanpath history) improve a vision-language model's understanding of image content and predict human-object interaction; directly relevant to AAC systems that would use a wearable/head camera plus gaze to infer "what does the user want to talk about right now." Source: arXiv:2501.13878; ACM DL.

FACT Egocentric (first-person, wearable-camera) computer vision is an active research area with direct AAC relevance for "what is happening around me right now" context injection; surveyed in "Challenges and Trends in Egocentric Vision" (arXiv:2503.15275) and "An Outlook into the Future of Egocentric Vision" (arXiv:2308.07123).

9.5 Personalized synthetic voice, emotion/tone, and identity

FACT Voice banking; recording a large set of an individual's own words/sentences before speech loss to build a personalized synthetic voice; is the established clinical approach (e.g., for ALS). VocaliD's differentiated approach extracts prosodic properties from a target speaker's *residual* vocalizations (for users who never had, or have lost, clear articulation) and blends them with a surrogate donor voice bank, producing a voice that carries the target's vocal identity with the surrogate's clarity; directly relevant to children who may never have developed typical speech. Source: research summarized via arXiv:2605.24337 ("Me, Myself, and My Voice: Exploring Cultural and Linguistic Identity in AAC AI-generated Voices").

FACT That same paper built an ElevenLabs-based tool generating candidate voice options from a cultural survey (language, region, speech style), letting participants request modifications before final synthesis; an explicit attempt to give AAC users agency over their own synthetic voice identity rather than assigning a generic stock voice. It also flags that current AAC devices have "limited" TTS options, with multiple unrelated users often assigned the *same* stock synthetic voice; a documented adoption/social-integration barrier. Source: arXiv:2605.24337.

FACT ElevenLabs' Voice Library policy explicitly disallows children's or child-like voices being added by users (ElevenLabs Help); a real, current constraint any children's-AAC company would hit if planning to license off-the-shelf commercial voice-cloning APIs for pediatric users; this likely requires either a direct enterprise/clinical agreement with a TTS vendor, a specialized pediatric-voice vendor, or in-house voice modeling.

FACT Separate research on "Voice Cloning for Dysarthric Speech Synthesis" addresses the specific data-scarcity problem of building personalized voices from limited, unclear source recordings (as would be typical for a nonverbal or minimally-verbal child); arXiv:2503.01266.

CLAIM/FACT (general AI, not AAC-specific): Emotion-AI / affective computing (facial expression CNNs, vocal prosody analysis, multimodal fusion of video+audio+text) is a mature-enough commercial space (e.g., Hume AI) that could plausibly feed "tone" metadata into an AAC system's phrase generation, but general emotion-AI vendors caution their systems detect "emotion-related behaviors through patterns in observable expressions," not emotions themselves; a limitation worth flagging for any product claiming to infer a nonverbal child's affect and auto-select tone accordingly. Source: Hume AI blog; general survey articles (Coursera, ScienceDirect speech-emotion review). No AAC-specific peer-reviewed emotion-recognition-into-phrase-generation system was found in this research pass; this appears to be a genuine white space rather than a solved/commoditized problem.

9.6 Multilingual communication and translation

FACT MultiGen is an LLM-based, child-friendly multilingual speech generator explicitly targeting low-resource languages/accents (Singaporean Mandarin, Malay, Tamil), converting input text into child-appropriate speech across target languages. Presented at ICMI 2025. Source: arXiv:2508.08715; ACM DL.

FACT ASHA's AAC practice portal notes SLPs should consider AAC systems' ability to switch between messages in different languages, and that "several AAC companies" already offer multilingual functionality; i.e., basic multilingual switching is table-stakes/commodity in commercial AAC today, while *generative*, low-resource-language, child-appropriate multilingual TTS (as in MultiGen) is the frontier/differentiated layer. Source: ASHA Practice Portal.

FACT Related but not AAC-specific: "LINC: Supporting Language Independent Communication and Comprehension" addresses real-time multilingual meeting support, illustrating the general direction of real-time speech translation research that AAC vendors could adapt. Source: arXiv:2504.18988.

9.7 Learning an individual's communication patterns / caregiver modeling

FACT Aided Language Stimulation / AAC modeling (a well-established clinical technique where a communication partner uses the AAC system themselves during natural interaction to teach the child) is being augmented with AI-generated modeling scripts, per "Cooking Up Communication: A Recipe for Using AI to Support AAC with Modeling Scripts" (Autism Spectrum News, practitioner-facing). Source: Autism Spectrum News.

FACT AACessTalk (above) is the most rigorous current example of AI explicitly modeling *both* sides of the dyad; coaching the caregiver's interaction strategy in real time *and* recommending contextual vocabulary to the child; rather than only accelerating the AAC user's output. This dual-sided design is presented as a deliberate alternative to AI systems that only optimize the AAC user's output speed. Source: as cited in 9.3 above.

HYPOTHESIS A commercially important but under-researched opportunity is AI systems that learn a specific child's *personal* communication patterns (preferred phrasing, recurring topics, idiosyncratic symbol/word associations, daily routine vocabulary) over months of use, functioning like a personal language model fine-tuned on one child's communicative history; analogous to how predictive-keyboard personalization works on smartphones but adapted to the AAC modality and to non-verbal/pre-linguistic communicative behavior (not just text history). No mature, publicly documented commercial product doing exactly this longitudinal personalization for young children was identified in this research pass (SPICA's "personal memory" component is the closest current research analog).

9.8 EMG, wearable sensors, gesture and facial/head movement input

Covered in depth under Part 13 (adjacent industries) since the enabling technology comes primarily from gaming/consumer wearables rather than AAC-native research; see §13.4–13.6 below for EMG (Meta Neural Band), gaze (Tobii), and smart-glasses details, all directly transferable to AAC input modalities for children who cannot use touchscreens or switches reliably.

9.9 THE CENTRAL ETHICAL QUESTION: "putting words in the user's mouth"

This is flagged by the assignment as the core concern for the entire report; findings below are treated with extra rigor and direct sourcing.

FACT; foundational paper: Higginbotham, Lesher, Moulton, et al. framing is extended directly in Valencia et al., "'The less I type, the better': How AI Language Models can Enhance or Impede Communication for AAC Users" (CHI 2023). This is the most-cited HCI paper specifically on this tension. Key finding (from search-indexed summary, corroborated across multiple secondary sources since direct full-text fetch was blocked by ACM paywall/403): AI language-model suggestions can reduce the physical/cognitive effort of communication, but participants (AAC users) raised concern that as they shift "from typing their own phrases to prompting and selecting AI-generated phrases," their communication partners may perceive the *system* as having done the communicative work rather than the person; a documented concrete social harm distinct from abstract "authenticity" worries. Sources: ACM DL abstract/summary; cross-referenced in the generative-AI-and-accessibility literature (see next item).

FACT A related finding, cross-cited from CHI/ASSETS generative-AI-accessibility research: "selecting a generated phrase from the system could have social consequences"; participants in at least one study "reflected on how selecting an automated phrase, even pre-stored phrases they had created, made others believe the system did all the work for them." This distinguishes two separable harms: (1) the AI literally generating content the user did not intend ("words in the mouth" in the strict sense), and (2) a *perception* harm where even the user's own pre-authored content, once mediated by an automated selection step, is socially discounted as not "really" theirs. Source: summarized from CHI/ASSETS accessibility generative-AI literature search results (see search results citing arXiv:2408.11137 and related ASSETS/CHI generative-AI-accessibility workshop proceedings, ACM DL 10.1145/3706599.3706734).

FACT Beth Moulam (a disability advocate and AAC user herself, publishing at bethmoulam.com) has written specifically and repeatedly on this topic: - "AAC, AI, authenticity of authorship and agency" asks directly "How can AAC users prove ownership of their words with growing use of AI?"; bethmoulam.com - "Techno-ethics, AI and AAC"; bethmoulam.com

This is a first-person, lived-experience advocacy voice (CLAIM, attributed to Beth Moulam) rather than an academic paper, and should be weighted accordingly; it represents actual AAC-user sentiment, which is a distinct evidentiary category from HCI researcher analysis.

FACT ThinkSmartbox (a commercial AAC vendor, maker of Grid software) published a public position piece, "Using AI with AAC users: Supporting voice and choice," which explicitly frames the ethical stakes: "communication through AAC is deeply connected to identity, agency, and authorship, and when AI contributes to a message, it brings new ethical and clinical considerations including questions around who is 'speaking,' how consent is given, how data is handled, and how bias may shape output." The same source states directly that "some suggest that every time AAC users use prediction or AI, it will be putting words into the AAC user's 'mouth,'" but counters that predictive/AI scaffolding, if made visible and transparent to the communication partner ("visible scaffolding, laying the various processes of communicating open for any communication partner to see"), differs meaningfully from covert generation; i.e., the ethical variable is *transparency of process to the conversation partner*, not merely whether AI assisted at all. Source: ThinkSmartbox.

FACT The 2026 CHI paper "I, Robot? Exploring Ultra-Personalized AI-Powered AAC: an Autoethnographic Account" (accepted to CHI 2026) uses autoethnography; the researcher's own lived account; specifically to interrogate ultra-personalized AI-powered AAC, strongly suggesting the 2026 HCI research agenda is moving toward first-person, AAC-user-led methodology for exactly this authorship question, rather than only third-party observational studies. Source: ACM DL (full text behind ACM paywall; abstract/framing confirmed via search indexing).

FACT "Before the Technological Fix: Scoping AI and AAC for Social Futures" (CHI 2026 Extended Abstracts) explicitly frames AI-in-AAC as a "social futures" question rather than a pure engineering problem; consistent with a broader 2025–2026 HCI-accessibility research shift away from "can AI predict this person's words" toward "should it, under what governance, and who decides." Source: ACM DL, 10.1145/3772363.3798436.

FACT The "Three Praxes Framework" (CHI 2026), a systematic thematic review of 90 curated social-accessibility papers (from 605 screened, 2011–2025), identifies "Communication as World-Building" and "Algorithmic Disability Encounters" as named sub-themes within its "Ecosystem Praxis" category; i.e., a peer-reviewed meta-analysis independently confirms that AAC-and-AI-authorship is now a recognized, actively-mapped subfield of accessibility HCI research, not a fringe concern. Source: ACM DL, 10.1145/3772318.3791125; arXiv:2603.07727.

FACT In the adjacent domain of speech-BCI (which raises an even starker version of the same problem, since the system may synthesize speech from neural signals with no discrete "selection" step at all), a formal bioethics review; "The ethical significance of user-control in AI-driven speech-BCIs: a narrative review"; was published in PMC. This is a rigorous academic ethics review specifically on user-control-vs-AI-generation in speech neurotechnology, directly transferable to any AAC product using predictive/generative AI. Source: PMC11240287.

SYNTHESIS (analyst's own framing, not a single source's claim): Across this literature, the emerging expert/advocate consensus converges on roughly four design principles for AI-assisted AAC that avoid "putting words in the user's mouth": 1. **Suggestion, not substitution:** AI should generate *candidates* for the user to select/edit/reject, never auto-send content without an explicit user action (echoed in the ThinkSmartbox "visible scaffolding" framing and the CHI 2023 Valencia et al. autonomy concerns). 2. **Transparency to the communication partner:** the listener should be able to tell that AI assisted (vs. covert ghostwriting), since several sources locate the harm less in the AI's assistance itself and more in the partner's *social discounting* of AAC output once they suspect automation. 3. **Personalization from the user's own corpus/history**, not generic web-text priors; echoed technically (PrAACT, Gaines & Vertanen domain adaptation) and ethically (Moulam's authorship-and-ownership framing, SPICA's "personal memory" design). 4. **User control over consent, data, and override** at each step; most explicitly named in the PMC speech-BCI ethics review and the ThinkSmartbox piece's "who is speaking, how consent is given, how data is handled" framing.

These four principles are HYPOTHESIS-level as a *synthesized framework* (no single source states them as a unified list this way) but each individual principle is directly traceable to a cited FACT or CLAIM above.

Sources for §9.9 (consolidated): - Valencia et al., "The less I type, the better," CHI 2023 - Beth Moulam; AAC, AI, authorship and agency - Beth Moulam; Techno-ethics, AI and AAC - ThinkSmartbox; Supporting voice and choice - I, Robot? autoethnography, CHI 2026 - Before the Technological Fix, CHI 2026 - Three Praxes Framework, CHI 2026 / arXiv:2603.07727 - User-control in AI-driven speech-BCIs, PMC11240287 - Generative AI and Accessibility Workshop, CHI 2025

9.10 Personalized visual and video generation for AAC and autism supports: a focused look

This subsection is a dedicated, more rigorous look at the specific thesis argued in "THE THESIS" section at the front of this report: whether modern generative AI can and should be used to depict a child's actual, identifiable people, pets, and places in AAC and visual-support tools, rather than generic stock imagery. The bottom line, stated up front: this is genuinely open white space as of September 2026. The enabling image and video technology is already mature enough to build on; no AAC or autism-support product combines it with a specific real person's actual likeness; and the AAC vendor with the most market distribution has deliberately fenced that exact capability off rather than solved it.

1. Personalized visual symbols of a specific real person, generated (not just uploaded) by AI

FACT PRC-Saltillo shipped AI image generation inside its iOS AAC apps (LAMP Words for Life, TouchChat, Unity AAC, Dialogue AAC) in the "2026.1" update (reported release Feb 11, 2026), built on Apple Intelligence. Users can type a descriptive prompt or supply a reference picture, choose a style, and generate up to four candidate button images. Critically, PRC-Saltillo's own documentation states the guardrail explicitly: "Guardrails within Apple Intelligence ensure safe and appropriate image creation. AI features won't generate images of people or copyrighted content." (Source: PRC-Saltillo blog, "Introducing AI Features for iOS Apps," https://prc-saltillo.com/blog/2026-ai-apps) This is a direct, current, named-vendor confirmation that the single largest incumbent AAC company in this space has generative image AI live in production and has chosen, as policy, to exclude the exact capability (real-person likeness generation) this thesis is built on.

FACT Cboard's "Cbuilder" AI board builder (live at cbuilder.io / cboard.io) generates board *content suggestions and layout*, and can create new pictograms as needed, but pulls symbol art from ARASAAC and Global Symbols open libraries, and its text suggestions run on the OpenAI API. It personalizes vocabulary selection and board structure, not photoreal likenesses of specific people. (Sources: https://www.cboard.io/en/cbuilder/, https://github.com/cboard-org/cboard-ai-engine, https://www.cboard.io/en/blog/2026-01-12-cbuilder-is-live-create-custom-aac-boards-faster/)

FACT CardSpeak AI (App Store, live product, https://apps.apple.com/gb/app/cardspeak-ai-aac-pecs/id6747005424) lets a user type a word and get an AI-generated image for a PECS-style card (20 free/month, 40/month on the ~£4.99/mo premium tier), and separately supports uploading a family's own photos into boards. But the AI-generation path produces a generic image matching the word ("dog," "bathroom"), not a stylized or consistent depiction of *this child's specific dog* or *this child's specific bathroom*. The raw-photo-upload path is the old, already-solved capability the brief explicitly excludes.

CLAIM (research, not shipped): A Springer Nature 2026 conference chapter, "AI-Driven Personalized Symbol Generation for AAC Users: A Framework for Inclusive Communication" (https://link.springer.com/chapter/10.1007/978-3-032-31285-3_56), argues generative AI could produce photorealistic-to-minimalist, situationally specific symbols reflecting a user's cultural experience and personal story, but this is a proposed framework/position paper, not a description of an existing deployed product.

CLAIM (research, explicitly inactive): The University of Southampton ran a funded project, "AI for AAC symbol style transformation and auto-generation from other images" (Prof. Mike Wald, Prof. Yuanyuan Yin, Web Science Institute, Stimulus Fund), aimed at generative style-transfer so a *new* symbol matches a user's existing open-license pictograph set (e.g., ARASAAC style). This is about visual-style consistency across a symbol *set*, not identity-consistent generation of a specific real relative. The project page lists status as **"Not active."** (https://www.southampton.ac.uk/research/projects/ai-for-aac-symbol-style-transformation-auto-generation-from-other-images)

CLAIM (research, text-only personalization): A CHI 2026 paper, "I, Robot? Exploring Ultra-Personalized AI-Powered AAC; an Autoethnographic Account" (arXiv:2509.13671, https://arxiv.org/abs/2509.13671), describes a full-time AAC user who fine-tuned a language model on seven months of his own communication logs for personalized *phrase/message* autocomplete, then used it for three months. This is the most rigorous "ultra-personalization" study found in AAC research, and it is entirely textual, not visual, personalization; it also surfaces real risks (the model "resurfaced private details outside their original context," reshaped the author's sense of agency, and "selectively amplified or muted aspects of his identity"), which is directly relevant evidence for how a visual/photo version of ultra-personalization could go wrong.

GAP: No commercial AAC app, and no published research prototype, was found that lets a family generate an AI image or video of a *specific named real person* (e.g., "Grandma Rosa," using her actual face) as a reusable AAC symbol via image-to-image, LoRA-style personalization, or multimodal generation conditioned on a reference photo of that individual. Searches for "AI generated AAC symbols," "personalized AAC images AI," "photo to symbol AAC AI," and "custom AAC symbol generator AI 2025 2026" returned only (a) generic AI symbol/icon generators unrelated to AAC (Pixelcut, Dzine, OpenArt, Glima) or (b) the AAC-specific tools above, all of which are generic-concept generators, not identity-preserving personal-photo generators.

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2. AI-generated Social Stories and personalized routine videos

FACT Multiple commercial AI Social Story generators are live and take a plain-language description as input. GrowTale (https://www.growtale.org/blog/best-social-story-apps-autism-2026) states: "Describe your child's situation in plain language, and the app builds a complete story around it," enforcing Carol Gray-style sentence ratios and first-person perspective automatically. Ella Kids (https://www.ella.kids/post/how-engaging-visuals-in-social-stories-change-the-conversation) similarly builds a story and matching illustration from "just a few inputs," with example imagery like "a young boy, wearing a green shirt, standing in the park." Glint/nerchat (https://www.nerchat.com/social-stories, https://www.nerchat.com/visual-schedules) offers a free AI social-narrative and visual-schedule generator "in seconds." Easy-Peasy.AI also markets a free AI social-story generator (https://easy-peasy.ai/blog/ai-social-stories-generator).

KEY DISTINCTION (FACT): Every one of these tools personalizes by *description* (age, clothing color, setting, favorite activity fed into a text prompt that an image model then renders as a generic-looking child matching that description), not by *identity preservation* from an actual photo of the real child. Ella's own example output describes attributes rather than an identifiable likeness. This is meaningfully different from, and much easier than, the identity-consistent generation the thesis is targeting.

FACT (older, non-AI baseline still in market): Touch Autism's "Social Stories Creator & Library" (http://touchautism.com/app/social-stories-creator-library/, App Store) supports "real photo support," letting parents insert actual photographs of the child's own school, home, or community into a story, but this is manual photo insertion with no AI generation step, the same old capability the brief says is not novel.

CLAIM (product, thin public detail): Ozzystory (https://ozzystory.com/) markets "AI Social Narratives & SEL Tools for Kids" and appears to build "self-narrated social stories and videos" from a short description, but its public site does not disclose whether video uses a real depiction of the child, a generic avatar, or narration over illustrations, nor clear pricing/stage-of-life (live vs. beta). This is flagged as a thin/unverified claim rather than a confirmed capability.

FACT, but not AAC/autism-specific: OpenAI's Sora 2 has a "Cameo" feature (launched fall 2025) letting a person upload a short video/audio recording of themselves once, after which their consistent likeness can be inserted into arbitrary AI-generated video scenes; users control who can use their cameo and can revoke access (sources: https://sorasy.com/en/blog/sora-2-cameo-guide, https://www.eweek.com/openai/news-openai-sora-2-video/, https://superprompt.com/blog/openai-sora-2-complete-guide). This is the closest *general-purpose* technical proof that identity-consistent personalized video is now feasible at consumer scale, but it (1) is a general entertainment product, not built for autism/AAC use cases, (2) fundamentally requires the depicted person's own consent-by-enrollment, which does not solve the third-party problem of depicting a grandmother or sibling who never enrolled, and (3) no source found describes anyone applying Sora-style cameo video specifically to autism social stories or AAC in a shipped or documented pilot; one AI-tools roundup speculated generically that "Sora 2 creates lifelike videos that help autistic individuals learn new skills faster," but this is marketing-adjacent commentary, not a documented case study, clinical pilot, or named product, and should be treated as a low-confidence CLAIM, not a FACT.

GAP: No peer-reviewed study, professional-association guidance (no result from Carol Gray's own organization, ASHA, or an autism research body), or shipped commercial product was found that (a) generates short *video* (not just static illustration) Social Stories, (b) automatically, from a caregiver's typed description, and (c) depicting the real, identifiable child and real family members/locations rather than a generic or attribute-matched avatar. "Text to personalized video social story using AI" is a real and searched-for term with essentially no direct hits beyond generic marketing pages describing hypothetical future capability.

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3. Context-aware / location-aware AAC vocabulary as a shipped commercial feature

CLAIM/GAP: This remains a research topic, not a shipped consumer feature, beyond the SPICA/AACessTalk work already in the main report. Multiple academic systems exist: "TalkAbout," a context-aware AAC prototype that adapts word lists to location and conversation partner (IAENG conference paper, https://www.iaeng.org/publication/IMECS2018/IMECS2018_pp128-133.pdf); a University of Toronto thesis, "Design and Evaluation of a Context-Adaptive AAC" (https://utoronto.scholaris.ca/bitstreams/348c6218-7bc9-49b6-94c5-9ea346805945/download, summarized at http://www.sigaccess.org/newsletter/2019-01/vargas.html); and "A Context-Aware Augmentative and Alternative Communication System for School Children With Intellectual Disabilities" (ResearchGate, https://www.researchgate.net/publication/332943977). All are academic research systems. Searches for "context aware AAC app," "location based AAC vocabulary," and "AAC app changes based on location" surfaced no mainstream commercial app (Proloquo2Go, TouchChat, TD Snap, Avaz, CoughDrop) advertising automatic, sensor-driven, location-triggered vocabulary switching as a live feature. Commercial apps instead support *manually organized* context folders/pages (e.g., a "school" board vs. a "home" board that the user or caregiver switches to by hand), which is a much weaker, non-automatic form of "context awareness." **This confirms the report's existing framing that SPICA/AACessTalk-style automatic context adaptation is still ahead of the commercial market.**

4. Interest-based personalization in AAC/autism tools

FACT Mainstream AAC apps support generic vocabulary personalization. AssistiveWare documents that Proloquo2Go lets caregivers "change words and looks to match the user's talking style, likes and visual preferences" and is built around a core-word vocabulary (Crescendo) that caregivers customize (https://www.assistiveware.com/learn-aac/personalize-vocabulary-and-system, https://www.assistiveware.com/products/proloquo2go). Avaz AAC is marketed as easy to personalize with strong family/caregiver controls (multiple comparison sites, e.g., https://getgoally.com/compare-aac-apps/proloquo2go-vs-avaz-aac/).

GAP: No AAC vendor was found marketing a discrete, named "special interest" theme pack (e.g., a Minecraft-, dinosaur-, or train-themed board skin or vocabulary set) as a product feature. The abundant literature on special interests in autism (e.g., commentary on Minecraft's popularity with autistic learners: https://www.edsurge.com/news/2019-01-28-change-the-game-using-minecraft-to-address-21st-century-learning-for-student-with-autism, https://reframingautism.org.au/minecraft-matters/) is about using existing consumer games/hobbies as engagement tools in therapy or education generally, not about an AAC/communication app auto-theming its interface or symbol set around a child's individual named interest. Today, achieving an interest-themed board requires a parent or SLP to manually source or draw dinosaur- or train-styled icons and import them, again the old manual-customization pattern, not an AI-automated one. This is a second concrete white-space opening adjacent to the core thesis: AI-generated, interest-themed *and* person-specific content are both currently manual, effortful tasks that no product automates end-to-end.

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5. "Describe a situation, get a generated support kit" caregiver tools

FACT Individual pieces of this workflow exist today as separate live products. GrowTale and Ella both take a typed situation description and output a generated Social Story (text + generic/attribute-matched illustration). Glint/nerchat separately offers a free AI visual-schedule generator from a described routine ("Regenerate and customize for each student without starting over," https://www.nerchat.com/visual-schedules). HeyOtto (https://www.heyotto.app/autism-friendly-ai) is a shipped, paid conversational AI platform aimed at parents of autistic/neurodivergent children ages 5-18 that builds a custom visual schedule when a parent describes the child's day, explicitly positioning itself as a "design choices, not clinical interventions" tool and explicitly *not* an AAC app for nonverbal users.

GAP: No single product was found that, from one typed situation description, outputs a *bundled kit* spanning a visual schedule, a Social Story, matching AAC communication cards, and caregiver prep questions together, each tool found does one piece (story, or schedule, or board) rather than an integrated multi-artifact bundle. This "one description in, coordinated multi-format kit out" packaging is itself a gap, independent of the harder identity-personalization question in Sections 1-2.

FACT (methodological caution, cited by the field itself): The Autism Research Institute's own explainer, "Social Stories, AI, and Autism" (https://autism.org/social-stories-ai-and-autism/), cautions that general AI platforms (ChatGPT, Gemini, Copilot, Claude) "can create structured, personalized story text and images when given the right prompt," but warns that "most do not have guidelines for protecting sensitive data," advising against putting real names, real medical histories, or other private details into prompts, and stressing that AI output should be reviewed/revised by a human, not used as a one-step solution. This is a direct, on-point professional-organization caution relevant to any product built on this thesis.

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6. Regulatory and privacy angle: generating images of real people, especially minors and third-party relatives

FACT The FTC finalized an amended COPPA Rule in April 2025 (effective June 23, 2025; compliance deadline April 22, 2026) that, per the Federal Register notice (https://www.federalregister.gov/documents/2025/04/22/2025-05904/childrens-online-privacy-protection-rule) and legal analysis from Akin Gump (https://www.akingump.com/en/insights/ai-law-and-regulation-tracker/new-coppa-obligations-for-ai-technologies-collecting-data-from-children), expanded "personal information" to explicitly include biometric identifiers such as facial templates and voiceprints, restricts indefinite retention of children's data, requires a written data-retention policy, and treats training an AI model on a child's data as requiring separate, specific parental consent (not covered by a general consent).

FACT (directly on point): The amended FTC rulemaking record specifically discusses generative-AI avatars: the Commission noted it would be technically possible for a user to create a "highly realistic avatar that might appear to be generated from a child's image," but concluded it would likely be difficult for operators to determine whether an avatar was in fact generated from an actual child's image absent having collected that image themselves (Federal Register, same citation above; also discussed in Miguel Guhlin's practitioner analysis, https://mguhlin.org/2025/08/19/gen-ai-and-coppa/). This is a real, current regulatory acknowledgment that "AI-generated likeness of a specific child" sits in a gray zone the rule anticipates but does not yet fully resolve, exactly the wrinkle the thesis needs to plan around.

CLAIM/FACT (industry policy): OpenAI's public-facing image policy, per secondary reporting since direct retrieval of openai.com/policies/usage-policies was blocked (403), blocks photorealistic images of public figures who are minors, and generally restricts unauthorized use of a private, identifiable person's likeness; it introduced an opt-out mechanism for public figures who don't want to be depicted (https://www.machine.news/openai-grants-celebrities-a-chatgpt-image-generation-opt-out/; also https://codewithvamp.medium.com/no-more-photo-to-art-transformations-openais-image-rules-just-changed-8aa373c6d89a). Note this policy language is oriented around public figures and adult likeness rights; it does not appear to contain bespoke, explicit guidance for the "private family member of a minor AAC user" scenario this thesis depends on, that is a genuine policy gap, not just a research gap.

`FACT` Apple/Apple Intelligence's guardrail, as surfaced via PRC-Saltillo's own AAC product documentation (Section 1 above), is unambiguous and more restrictive than OpenAI's: it blocks generation of images of *any* people, not just minors or public figures, inside the current AAC AI feature. Any product built on this thesis using Apple Intelligence as the underlying model would need a different foundation model or an exception/partnership, not a prompt workaround.

CLAIM (advocacy/industry synthesis): The Better Business Bureau's National Programs published a "Generative AI & Kids: A Risk Matrix for Brands & Policymakers" (https://bbbprograms.org/getmedia/ef4f972c-7c04-4739-8356-94ae9bca31ec/Generative-AI-Risk-Matrix.pdf), which frames the general child-safety risk landscape for consumer-facing generative AI products aimed at kids; it is a useful risk framework but is not AAC-specific and was not independently re-verified line by line here beyond its listing in search results.

GAP: No dedicated regulatory guidance, professional-association position statement, or case law was found addressing the specific scenario in the brief: an app processing a photo of a *third party* (grandmother, sibling, family friend) who is not the child user and never separately consented, in order to generate a stylized or photorealistic AAC symbol for a minor. COPPA governs the operator's collection of data *about the child*; whether and how it (or any other privacy law, e.g., BIPA-style biometric statutes in Illinois/Texas/Washington, not searched in depth here) treats a *non-child third party's* face processed for a child's benefit is an open legal question this research did not find directly answered anywhere. This ambiguity is itself a notable finding: it is a real, unresolved compliance question a company entering this space would need outside counsel to map, not an already-solved problem.

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7. Technical feasibility: can today's models keep a specific real person's likeness consistent across many images?

`FACT` As of 2026, consistent-character generation is an active, well-documented capability, but it depends on reference-image conditioning, not text description alone. Multiple 2026 practitioner guides describe the state of the art: "consistency comes from feeding the model an image of the subject on every generation," since text alone cannot precisely specify a face (https://oakgen.ai/blog/ai-character-consistency-guide, https://flick.art/blog/img2img-consistent-character, https://artsmart.ai/blog/ai-character-consistency/). Three dominant technical approaches were identified: (1) reference-image conditioning, where the model locks identity from one or more uploaded photos, cited as easiest in tools like Google's Gemini "Nano Banana" and xAI's Grok "Aurora," which "take a reference image directly" (https://blog.mage.space/article/best-ai-image-generators-consistent-characters-2026/392f47f0-6619-4021-9b07-ba3ed8c86ba8); (2) LoRA-style lightweight fine-tuning on 15-30 images of the same person for higher fidelity; and (3) tools like Midjourney v7's `--cref` (character-reference) parameter. OpenAI's "GPT Image 2" is described in these same 2026 sources as "the current state-of-the-art general image model… a serious option for consistent character work" (https://consistentcharacterai.com/posts/best-ai-character-generators-2026).

`FACT` OpenAI's Sora 2 "Cameo" feature (Section 2 above) is a working, shipped example of stable identity-consistent *video* generation from a single short enrollment clip, at consumer scale, as of late 2025/2026.

Feasibility conclusion (synthesized, not a single citation): The underlying model capability the thesis needs, take a handful of real photos of a specific person (grandma, the family dog, the child's own bedroom) and generate a recognizable, stylistically consistent, reusable image or short video of that subject on demand, is now genuinely available off the shelf (Nano Banana, GPT Image 2, Grok Aurora, Sora 2 Cameo, Midjourney `--cref`). This means the barrier to this product thesis is **not primarily a technology-readiness problem in September 2026.** The barrier is (a) no AAC-focused product has integrated this capability yet, and (b) the two AAC/OS incumbents that have shipped adjacent generative-image features (PRC-Saltillo/Apple Intelligence) have deliberately fenced off exactly this use case for safety reasons, and general-purpose vendors' consent/opt-out frameworks (OpenAI) are built around public figures and self-enrollment, not around a parent generating images of a non-consenting relative for a child's benefit. Closing that gap is a product-and-policy integration problem layered on top of already-adequate underlying model capability, which is a meaningfully different (and probably more tractable, if handled carefully) problem than "wait for the AI to get good enough."

Synthesis: is this white space or already solved?

Already solved / commoditized pieces: - Generic AI image generation for AAC symbols from a text description (PRC-Saltillo/Apple Intelligence, CardSpeak AI, Cboard/Cbuilder, Global Symbols SymbolBuilder in development). - AI-generated Social Story *text* and generic/attribute-matched illustrations from a plain-language prompt (GrowTale, Ella, Glint, Easy-Peasy.AI). - AI-generated visual schedules from a described routine (HeyOtto, Glint). - Manual (non-AI) use of a family's own raw photos in AAC boards and Social Stories (Proloquo2Go/TouchChat/CoughDrop custom symbols; Touch Autism, Stories2Learn "real photo" support), this is the old, non-novel capability the brief correctly flags as already common. - The underlying generative-AI technology for identity-consistent image/video generation from reference photos (Nano Banana, GPT Image 2, Sora 2 Cameo, Midjourney `--cref`), which exists in the general consumer AI market, just not wired into any AAC or autism-support product.

Not yet solved, i.e., real white space: - No AAC app or autism visual-support tool generates or stylizes an image/video of a *specific, identifiable real person* (not the primary user, e.g., a grandmother, sibling, or pet) using AI conditioned on that person's actual photo, as opposed to a generic or attribute-described stand-in or a flatly-uploaded static photo. - No product combines identity-consistent AI imagery with a Social-Story or AAC-symbol *workflow* built for clinical/educational credibility (Carol Gray fidelity, SLP/ABA review loops). - No product bundles a single caregiver description into a coordinated multi-artifact kit (schedule + story + cards + prep questions) at all, regardless of the identity-personalization question. - No product offers automatic, sensor-driven context/location-aware vocabulary switching commercially; this remains research-only (SPICA, AACessTalk, TalkAbout, the Toronto and school-children context-aware AAC systems). - No AAC vendor offers a discrete special-interest theming feature; interest-based personalization today is manual. - The specific consent/privacy question of processing a *non-consenting third-party relative's* likeness on behalf of a minor user is not resolved by COPPA, has no clear guidance from OpenAI, Google, Midjourney, or Stability AI, and was flagged by the FTC's own rulemaking discussion of AI avatars as a known-hard, currently-unaddressed edge case. - The two players closest to this space with real distribution, PRC-Saltillo (leading AAC vendor) and Apple (platform underneath it), have chosen a *no real people* guardrail rather than solving the consent/personalization problem, which functionally leaves the identity-personalization capability unclaimed by anyone with AAC-market distribution today.

One-line answer: This is genuinely white space, the enabling AI technology (consistent real-person image/video generation) is mature enough to build on right now, but no AAC or autism-support product, commercial or research, combines it with a specific real person's actual likeness, and the market leader with the most AAC distribution has explicitly fenced that exact capability off rather than shipped it.

PART 10: CONTROVERSIES AND FAILED APPROACHES

This section requires unusual rigor because it concerns methods applied to a population; nonspeaking/minimally speaking people, including children; who by definition cannot always independently contest how their communication is characterized. The scientific and professional consensus here is unusually strong and unusually one-sided compared to typical “some studies say X, others say Y” science communication; this document reflects that asymmetry accurately rather than false-balancing it.

10.1 Facilitated Communication (FC)

What it is: A technique, popularized starting in the late 1970s/1980s (notably by Rosemary Crossley in Australia and Douglas Biklen in the US), in which a “facilitator” physically supports a nonspeaking person’s hand/arm while the person points to letters or pictures to spell out messages.

Established evidence (established = scientific consensus, not disputed): - FACT: Extensive controlled research over multiple decades and multiple countries; using “message-passing” designs in which the facilitator and the communicator are shown different information and asked to communicate about it; has consistently found that when facilitators do not know or are given different information than the communicator, the resulting messages reflect the facilitator’s information, not the communicator’s (ASHA FC Position Statement, 2018; Facilitated Communication, Wikipedia overview of controlled-study literature). - FACT (ASHA position statement, PS2018-00352): ASHA’s official position is that “the scientific validity and reliability of FC have been extensively tested and the conclusion, based on the evidence, is that FC is not a valid technique for individuals with autism or other disabilities… messages are authored by the ‘facilitator’ rather than the person with a disability.” - FACT: The American Psychological Association adopted a resolution (August 14, 1994) stating FC is “a controversial and unproved communicative procedure with no scientifically demonstrated support for its efficacy” (APA Resolution via Quackwatch archival copy). - FACT: AAIDD (American Association on Intellectual and Developmental Disabilities) issued a 2019 Board of Directors position statement stating that, based on current scientific evidence, AAIDD does not support FC or RPM as communication modes, citing “considerable evidence that the messages are authored by the facilitator rather than by the individual with a disability.” - FACT: ASHA’s position states it is consistent with as many as 19 other national/international professional and advocacy organizations opposing FC (facilitatedcommunication.org, Organizations Opposing FC). - FACT: The mechanism most commonly cited by researchers to explain FC’s failure is the **ideomotor effect:** the well-documented psychological phenomenon whereby a person unconsciously produces small muscle movements without conscious awareness of causing them (the same mechanism underlying Ouija board “spirit” movement and dowsing-rod effects). A controlled study (Burgess, Kirsch, Shane, Niederauer, Bacon & Graham, 1998, published in *Psychological Science*) found FC responses were significantly correlated with simple ideomotor responses, supporting the hypothesis that FC functions as a form of automatic writing/unconscious facilitator influence rather than communicator-authored output (Burgess et al. 1998, Sage Journals). - **Classification: PSEUDOSCIENCE.** This is the strongest possible classification in this document’s evidentiary tiers, reflecting near-universal, decades-long, cross-national scientific and professional consensus.

Historical harm context (FACT, well-documented, not merely disputed claim): FC produced a wave of false abuse allegations against parents/caregivers in the 1990s when facilitator-influenced messages were treated as authentic communicator testimony, leading to family separations and legal proceedings later found to be unsupported once controlled testing was applied; this is among the central reasons FC is treated with unusual professional urgency rather than as a merely “unproven” therapy.

10.2 Rapid Prompting Method (RPM)

What it is: Developed by Soma Mukhopadhyay (parent of an autistic child) as a method using rapid verbal, auditory, and visual prompts from a facilitator/instructor while the learner points to letters, pictures, or a stencil/letterboard to spell responses.

Evidence and consensus: - FACT: As of the most recent systematic evaluations available in the sources reviewed, essentially no peer-reviewed, controlled research supports RPM’s validity as an independent communication method; one frequently cited data point: despite RPM’s promoters claiming hundreds of successful users, only a single published study attempted to test RPM’s claims as of ~2017, and that study was found by independent reviewers to have serious methodological flaws (WebSearch synthesis of ASAT Online research synopsis, https://asatonline.org/research-treatment/research-synopses/rapid-prompting/). - FACT: ASHA’s official position statement on RPM (PS2018-00351) explicitly recommends against its use, citing “no scientific evidence of its efficacy” and “prompt dependency” risk, and explicitly frames RPM as sharing FC’s core validity problem; facilitator-dependent prompting that cannot be shown to produce communicator-independent output (ASHA RPM Position Statement). - FACT: AAIDD’s 2019 position statement (cited above) explicitly covers RPM alongside FC, reaching the same non-support conclusion. - **Classification: PSEUDOSCIENCE** (per ASHA/AAIDD), though it should be noted RPM proponents and some individual practitioners dispute this characterization; the document reflects that the weight of controlled scientific evidence and professional-body consensus is decisively against RPM’s validity as an independent-authorship communication method, while acknowledging this is a live, emotionally fraught dispute for the families involved.

10.3 “Spelling to Communicate” (S2C) and letterboarding

What it is: A related-but-distinct approach (promoted notably through the Halo/I-ASC-affiliated training network) in which a “communication and regulation partner” (C&RP) holds a letterboard in front of a nonspeaking/minimally speaking individual, who points to letters to spell messages, with an explicit aim of eventually fading physical support.

The central scientific controversy; authorship: - FACT: The most-discussed empirical study on this question is Jaswal, Wayne & Golino (2020), *"Eye-tracking reveals agency in assisted autistic communication,"* published in *Scientific Reports* (Nature). The study used head-mounted eye-tracking on nine nonspeaking autistic letterboard users, measuring the timing/accuracy relationship between eye gaze and pointing as participants answered novel questions, and the authors concluded the eye-tracking data suggested the autistic participants; not the letterboard holder; were the "agents" producing the typed responses (Jaswal et al. 2020, Nature Scientific Reports; PMC7217901). - FACT: This study has drawn substantial, methodologically specific criticism, including: (1) it did not include a facilitator-blind or message-passing condition; the design specifically shown to unmask FC's authorship problem in the 1990s; meaning the study cannot rule out facilitator influence via subtle, non-verbal cueing even if the participant's own eyes/hand are doing the pointing; (2) critics (e.g., psychologist Stuart Vyse) noted the letterboard was physically held by the facilitator throughout, which the facilitator could position or move to influence responses, rather than being fixed on a table/easel, which would have controlled for this; (3) major professional bodies including ASHA and the American Academy of Pediatrics maintain that, absent controlled message-passing testing (the same standard applied to unmask FC), authorship of S2C-produced messages cannot be considered confirmed (Skeptical Inquirer, "Of Eye Movements and Autism"; critique detail via catherineandkatharine.wordpress.com, an independent critical-analysis blog, treated here as qualitative critique commentary, not peer-reviewed rebuttal, though it engages directly and specifically with the study's methodology). - FACT: S2C/letterboarding is explicitly characterized by ASHA (in its practice-portal and public materials on FC/RPM) and independent critics as a **variant of FC** functionally; i.e., not a scientifically distinct, separately-validated method, but a rebranding that retains FC's core unresolved authorship problem (physical/positional proximity and cueing potential of a facilitator during message production). - CLAIM (I-ASC / S2C-proponent framing): I-ASC (International Association for Spelling as Communication, the primary S2C training/advocacy body) publishes rebuttal material (e.g., "Top 10 Myths about S2C Debunked") arguing the method is distinct from FC/RPM and that authorship concerns are unfounded or overstated (I-ASC); this is included as the clearest available statement of the pro-S2C position, explicitly labeled as an advocacy-organization claim rather than independently validated science. - **Classification: DISPUTED CLAIM verging on weak/pseudoscience by mainstream professional-body standards.** The document places S2C in a distinct tier from RPM/FC not because the underlying scientific concern differs (it does not; the core authorship problem is structurally identical) but because: (a) it has generated at least one published empirical study directly attempting a scientific test (Jaswal et al. 2020), even though that study's design is contested, and (b) there is an unusually vocal, motivated, self-organized advocacy network (including some individual S2C users and their families) actively contesting the mainstream position, and (c) as of this research pass, no professional body's position statement was found that names "S2C" by that specific name as distinctly as they name FC and RPM (ASHA's PS2018-00351 and PS2018-00352 predate S2C's current branding/prominence); this is an evidence gap worth flagging rather than a genuine scientific ambiguity about the underlying authorship question, which mainstream bodies treat as settled by the FC precedent.

10.4 The core scientific principle uniting FC, RPM, and S2C

FACT: All three methods share the same structurally unresolved problem: physical or positional proximity of a facilitator to the communicator's response modality (hand, arm, letterboard position) that has *not been ruled out*, in properly blinded/controlled conditions, as a channel for unconscious facilitator cueing. The gold-standard test that discredited FC in the 1990s; the "message-passing" design, where the facilitator and communicator are given different information and are asked to communicate about it while the facilitator does not know what the communicator was shown; has not, per the sources reviewed, been successfully passed by RPM or S2C under rigorous, adversarially-designed conditions. Advocates of RPM/S2C often argue message-passing tests are themselves methodologically inappropriate for their populations (e.g., citing motor planning differences, testing anxiety, or the assumption that autistic communication should be measured on neurotypical terms); this is a genuine methodological debate raised by proponents, presented here as a CLAIM/counter-argument, not as an accepted resolution, since mainstream professional bodies have not accepted this argument as sufficient grounds to waive controlled testing.

10.5 Brain-computer interfaces (BCI): legitimate research vs. overhyped claims

- **FACT**: BCI communication research for locked-in/severely paralyzed patients (predominantly ALS, and predominantly adult, in the literature reviewed) has produced genuine, peer-reviewed, high-quality clinical results; e.g., a fully implanted BCI enabling communication in a locked-in ALS patient, published in the *New England Journal of Medicine* (NEJM 2016), and continuing active research including a 2025 bioRxiv preprint on decoding intended speech via intracortical BCI in longstanding anarthria/locked-in syndrome.
- **FACT**: Even in this legitimate research track, investigators explicitly acknowledge major practical limitations; e.g., NEJM authors note that despite achieving robotic-control milestones, independent home-based daily communication remains difficult to implement with current BCI technology.
- **FACT**: A notable 2019 controversy exists within even the legitimate BCI literature: a PLOS Biology study on BCI-based communication in the "completely locked-in state" was subject to a retraction dispute in which the original authors disputed the retraction findings; illustrating that even peer-reviewed, non-pseudoscientific BCI research has faced significant post-publication scientific scrutiny and controversy (PLOS Biology).
- Search coverage in this pass did not surface pediatric-specific BCI communication research or documented instances of consumer/commercial "overhyped" pediatric BCI-AAC claims (e.g., marketing claims aimed at parents of nonspeaking children promising near-term "mind-reading" communication devices); this is a notable evidence gap. Given the strong general pattern of hype cycles in consumer neurotechnology marketing, and the demonstrated harm caused by unvalidated communication-authorship claims in the FC/RPM/S2C history, this document flags pediatric BCI-AAC marketing claims as a **HYPOTHESIS-level watch item** for any downstream competitive/market analysis; i.e., a plausible future risk area structurally analogous to the FC/RPM/S2C pattern (unvalidated authorship/agency claims about a vulnerable, cannot-easily-self-report population) rather than a documented current problem in this research pass.

10.6 Summary evidence-tier classification

METHOD	EVIDENCE TIER	BASIS
Standard/mainstream AAC (symbol boards, SGDs, eye-gaze, core vocabulary, aided language modeling)	**Established evidence**	Decades of controlled intervention research, ASHA/ISAAC endorsement, described as evidence-based practice throughout Parts 4–5 sources
Clinical BCI research for locked-in adult patients (ALS etc.)	**Promising research**	Peer-reviewed (NEJM, PLOS Biology, active preprints), acknowledged real-world implementation limits, some post-publication controversy
Facilitated Communication (FC)	**Pseudoscience**	ASHA, APA, AAIDD, ~19 professional/advocacy orgs; decades of controlled message-passing studies; ideomotor-effect mechanism established
Rapid Prompting Method (RPM)	**Pseudoscience**	ASHA and AAIDD position statements; no methodologically sound supporting study identified
Spelling to Communicate (S2C) / letterboarding	**Disputed claim, weak evidence** (functionally continuous with FC per mainstream bodies; contested by an organized advocacy network; one empirical study exists but is seriously methodologically contested)	Jaswal et al. 2020 plus extensive published critique; ASHA/AAP position that authorship is unconfirmed absent controlled testing
Pediatric consumer/commercial BCI-AAC marketing claims	**Insufficient data in this pass to classify; flagged as a hypothesis-level future-risk watch item**	No pediatric-specific sources located; flagged by analogy to the FC/RPM/S2C harm pattern

PART 11: OPPORTUNITY MAP

Scoring convention: All ten dimensions are scored 1–10 where **higher is always better:** including “ethical risk” and “regulatory risk,” which are scored as *favorability* (10 = low risk, 1 = high risk), so the overall score (simple average) is directly comparable across opportunities. Scores are the analyst’s own judgment (HYPOTHESIS-level), calibrated against the evidence in Parts 1–19, not independently benchmarked.

11.1 Master scoring table

#	OPPORTUNITY	IMPACT ON CHILDREN	UNMET NEED	TECH FEASIBILITY	SPEED TO PROTOTYPE	DEFENSIBILITY	REVENUE POTENTIAL	EASE OF DISTRIBUTION	REIMBURSEMENT POTENTIAL	ETHICAL RISK (FAV.)	REGULATORY RISK (FAV.)	**OVERALL**
1	AI Communication Co-Pilot (personalized predictive + generative layer)	9	9	7	6	7	7	6	6	6	7	**7.0**
2	Portable “Communication Profile” interoperability standard	8	9	7	5	4	5	5	5	9	8	**6.5**
3	Pediatric personalized voice-banking platform	9	8	6	5	7	5	5	5	7	7	**6.4**
4	Webcam-only/software eye-gaze access layer	8	7	7	6	5	6	6	5	8	7	**6.5**
5	AI-powered medical-necessity/prior-auth automation	6	9	8	7	5	7	6	8	8	6	**7.0**
6	AI board/VSD auto-generation for teachers & SLPs	7	8	8	8	5	6	7	5	8	8	**7.0**
7	Nonprofit-hybrid / PBC AI-native AAC app	9	7	6	4	5	5	5	6	9	7	**6.3**
8	Unified voice-in/voice-out app for CAS/dysarthria	8	6	5	4	6	5	5	5	7	6	**5.7**
9	District-level AAC outcomes / abandonment-risk analytics	6	7	8	6	6	6	5	4	9	8	**6.5**
10	Dysarthric/atypical-speech ASR licensed for children	7	6	5	4	6	4	4	4	7	6	**5.3**
11	AAC-specific character-level/domain-adapted LLM engine (B2B ingredient)	6	6	8	6	7	6	4	4	8	8	**6.3**
12	Communication-passport teacher-handoff tool	7	8	9	8	3	4	6	3	9	9	**6.6**
13	AI Medicaid/insurance appeals-as-a-service	5	8	8	7	4	7	6	9	8	6	**6.8**
14	Emotion/humor/tone-aware AAC phrase layer	7	6	6	5	5	4	5	4	6	7	**5.5**
15	Low-cost ruggedized wearable AAC (early communicators)	6	5	6	5	4	5	5	5	8	6	**5.5**
16	AAC companion for consumer smart glasses	6	5	5	4	5	4	4	3	7	6	**4.9**
17	Automated SETT/feature-matching digital assessment tool	6	8	8	7	4	6	5	6	8	6	**6.4**
18	Open, AI-generation-compatible next-gen symbol set	6	5	8	7	3	3	6	3	9	9	**5.9**
19	AI caregiver-coaching / aided-language-modeling app	8	8	7	6	6	5	6	4	8	8	**6.6**
20	Situational/selective-mutism AAC-lite product	6	6	8	8	4	5	6	3	8	8	**6.2**
21	US private “specialist AAC hub” service (NHS-model)	7	7	9	5	4	6	3	6	9	7	**6.3**
22	AI intent-disambiguation/documentation tool for emergent communicators	8	7	5	4	5	4	4	5	5	5	**5.2**
23	OBF-based cross-platform vocabulary migration tool	5	6	9	8	3	3	5	3	9	9	**6.0**
24	Employer-sponsored “family AAC benefit”	5	5	8	6	4	6	4	5	8	7	**5.8**
25	On-device/offline small-LM AAC engine (privacy-first)	6	6	7	5	6	5	5	5	9	8	**6.2**
26	Low-cost child-sized micro-gesture/EMG switch	6	5	4	3	5	3	3	5	7	5	**4.6**
27	Multilingual-native AAC vocabulary architecture	7	6	8	6	4	4	5	5	8	8	**6.1**
28	AI-generated custom board content for individual photos (VSD, standalone)	7	7	8	8	4	5	6	5	8	8	**6.6**

11.2 Opportunity detail cards

Each card follows: Problem → User → Existing solution → Why it fails → Proposed innovation → Tech required → Difficulty → Regulatory → IP advantage → Who pays → Price → Market size → Competition → Time to prototype → Capital → Clinical validation → Social impact.

1. AI Communication Co-Pilot. *Problem:* AAC output is slow, generic, and flattens personality. *User:* Symbol/text AAC users, ages 4–14. *Existing solution:* Static n-gram word prediction (unchanged for decades). *Why it fails:* Not personalized to the individual’s own history/voice; no incumbent has shipped a domain-adapted LLM layer. *Innovation:* Personalized, transparent, suggestion-not-substitution predictive/generative layer (per §9.9 four-principle framework), deployable as a plugin via Open Board Format or standalone. *Tech:* Domain-adapted LLM (character-level extraction per Gaines & Vertanen), personal-memory retrieval (SPICA-style). *Difficulty:* Medium. *Regulatory:* Low-moderate (communication-assistance software, not diagnostic; verify with counsel). *IP:* Proprietary fine-tuned models on consented longitudinal usage data; interaction-design patents on transparent-suggestion UI. *Payer:* Family subscription + school site license, later E2511 software reimbursement. *Price:* $10–25/mo or $500–2,000/building/yr. *Market:* Layers onto the ~$260M/yr US pediatric TAM (§7.4) plus adjacent SLP-workflow spend. *Competition:* Cboard's Cbuilder (board-gen only), nascent incumbent AI roadmaps, off-label ChatGPT use by savvy families. *Time to prototype:* 3–4 months (browser overlay on OBF data). *Capital:* Seed ($1–3M). *Clinical validation:* Words-per-minute + caregiver-rated authenticity pilot (50–100 children). *Social impact:* Directly targets the field's most emotionally resonant documented harm; being perceived as less capable than one's actual thinking (§14.1 quotes).

2. Portable "Communication Profile" interoperability standard. *Problem:* Vocabulary/settings/trial history don't travel with the child across SLP, school, hospital, payer, or new device; the single most-repeated friction point across all seven user journeys (§5.7). *User:* All seven stakeholder types. *Existing:* OBF (Open Board Format) covers vocabulary sets only, not access-method settings, trial history, or funding documentation. *Why it fails:* No one owns end-to-end portability; each vendor's data format is a soft lock-in mechanism. *Innovation:* An extended, vendor-neutral profile standard (vocabulary + access settings + effective-strategy notes + funding/eval history) with import/export hooks into major platforms. *Tech:* Schema design, OBF extension, API integrations. *Difficulty:* Medium (technically simple, politically hard; requires incumbent buy-in or critical mass of holdouts). *Regulatory:* FERPA/COPPA/HIPAA-adjacent data handling. *IP:* First-mover standard-setting position (like OBF itself), not patent-based. *Payer:* Schools/districts, health systems (efficiency play). *Price:* B2B licensing or grant-funded nonprofit infrastructure. *Market:* Enabling infrastructure, not directly monetized at scale; more likely a nonprofit/consortium play or a loss-leader for a platform company. *Competition:* None dedicated; OBF is the closest partial precedent. *Time to prototype:* 2–3 months for a schema + reference importer/exporter. *Capital:* Grant/foundation-fundable ($200–500K). *Clinical validation:* Not required (infrastructure). *Social impact:* Very high; eliminates the "reset" cost at every transition documented in every journey.

3. Pediatric personalized voice-banking platform. *Problem:* Children who never had, or are losing, typical speech get a generic stock voice shared by many other device users; documented as a real dignity/adoption barrier (§9.5). *User:* Children with Rett, Batten, SMA, severe CAS, or progressive conditions. *Existing:* VocaliD-style residual-vocalization blending (now inside Veritone, a general AI company, not AAC-focused); ElevenLabs and most commercial voice-cloning vendors explicitly exclude child voices. *Why it fails:* No specialist has filled the vacuum left by VocaliD's absorption into a non-AAC company. *Innovation:* A pediatric-specific voice-banking service combining residual-vocalization blending with cultural/linguistic-identity choice (per arXiv:2605.24337). *Tech:* Voice cloning/blending models, consented pediatric audio data pipeline. *Difficulty:* Medium-high (data scarcity is the core challenge). *Regulatory:* COPPA-grade consent infrastructure for child biometric-adjacent voice data. *IP:* Proprietary pediatric voice-data pipeline and blending technique. *Payer:* Families, ALS/neuromuscular-disease foundations, insurance in some cases. *Price:* $200–500 one-time or bundled into a broader subscription. *Market:* Niche but high-willingness-to-pay; adjacent to the ~4M-person all-ages CCN population. *Competition:* None direct and AAC-pediatric-focused identified. *Time to prototype:* 4–6 months. *Capital:* $1–2M seed. *Clinical validation:* Perceptual/identity-satisfaction studies with children and families. *Social impact:* High; restores a uniquely personal form of identity.

4. Webcam-only/software eye-gaze access layer. *Problem:* Dedicated eye-gaze SGDs cost $5,000–$15,000, gatekept by insurance approval, out of reach for many CP/Rett/ALS families during the gap. *User:* Children who cannot reliably point but retain eye control. *Existing:* Tobii's dedicated IR hardware (heavily patented, ~850+ filings). *Why it fails:* Price and insurance-approval delay leave many children without any interim gaze-access option. *Innovation:* A webcam-only, AI-driven gaze-estimation software layer (per Tobii's own Nexus direction and open WebEyeTrack research) that runs on a family's existing tablet/laptop at $0 incremental hardware cost. *Tech:* On-device few-shot gaze-calibration ML. *Difficulty:* Medium (published open research exists; productization and accuracy-in-the-wild is the work). *Regulatory:* Low if positioned as software accessibility tool. *IP:* Calibration/personalization algorithm improvements; must clear Tobii's hardware-specific patents (software-only approach is the FTO-safer path per §19.5). *Payer:* Families (low price point), schools as a bridge/trial tool. *Price:* $50–150 one-time or low-cost subscription. *Market:* Meaningful slice of the ~117,600 dedicated-SGD-using children (§7.4) plus the larger unserved population. *Competition:* Tobii Nexus itself (but bundled into Tobii's ecosystem, not standalone/cheap). *Time to prototype:* 3–5 months. *Capital:* $500K–1.5M. *Clinical validation:* Accuracy/dwell-time comparison against dedicated hardware. *Social impact:* High; directly expands access for the most access-constrained population (CP, Rett).

5. AI-powered medical-necessity/prior-authorization automation. *Problem:* The single highest-leverage bottleneck in the entire funding pipeline (§6.1, §5.6); LOMN drafting and prior-auth submission is manual, slow (6–12 weeks baseline, 1–6 months with appeals), and every major vendor maintains in-house "funding specialist" staff just to manage it. *User:* SLPs, hospital AAC clinics, families. *Existing:* Manufacturer-embedded and third-party funding-navigation firms (AAC Funding Help, etc.); labor-intensive, not software-scaled. *Why it fails:* No software platform automates documentation generation or tracks state-by-state Medicaid variance systematically. *Innovation:* AI-assisted LOMN drafting from evaluation data, automated payer-specific documentation-requirement checklists, and appeals-drafting using the "93% approved with added documentation" pattern (§4.2.1). *Tech:* LLM-based document generation, payer-rules database. *Difficulty:* Medium. *Regulatory:* HIPAA compliance; not a medical device itself. *IP:* Proprietary payer-rules database (50-state Medicaid variance is genuinely hard to compile; a real moat). *Payer:* Hospital/clinic B2B SaaS, or per-case fee. *Price:* $50–200/case or $200–500/clinician/month. *Market:* Every SGD sale in the US touches this bottleneck; a large, unsized-but-real service market. *Competition:* Manufacturer in-house teams (not sold as software), boutique funding-consulting firms. *Time to prototype:* 3 months (document-generation MVP). *Capital:* $500K–1M. *Clinical validation:* Not required; track approval-rate/time-to-approval improvement instead. *Social impact:* High; shrinks the "no communication support during the gap" period for every family who uses it.

6. AI board/VSD auto-generation for teachers & SLPs. *Problem:* Teachers report 0–90 min/day paid planning time but spend unpaid hours (up to 30+/week in some cases) manually programming personalized boards (§5.4); devices with expired vocabulary "just turn up" without proper setup. *User:* Teachers, SLPs, parents. *Existing:* Manual board-building; Cboard's Cbuilder (AI-generated boards from a prompt, live Jan 2026) is the closest existing competitor. *Why it fails:* Incumbent commercial apps have not shipped this; Cbuilder is open-source/board-only, not integrated with visual-scene-photo input. *Innovation:* GPT-4V-class multimodal generation of contextually relevant boards from a child's own photos/environment (per the ASSETS 2024 study, SLP-validated as resembling human-made output). *Tech:* Multimodal LMM API + AAC-specific prompt/curation layer. *Difficulty:* Low-medium (published proof-of-concept exists). *Regulatory:* Low. *IP:* AAC-specific prompt engineering and clinician-validated output-quality pipeline (the model itself is commodity). *Payer:* Schools, clinics, families. *Price:* $5–15/mo add-on or bundled. *Market:* Every AAC-using child needs new boards as contexts change; a recurring, high-frequency need. *Competition:* Cboard/Cbuilder, in-app static libraries. *Time to prototype:* 2–3 months. *Capital:* $300–800K. *Clinical validation:* SLP-rated output-quality studies (replicate ASSETS 2024 methodology). *Social impact:* High; directly relieves a documented, severe uncompensated-labor burden on teachers.

7. Nonprofit-hybrid / PBC AI-native AAC app. *Problem:* Subscription/freemium models risk gating core communicative function; families need an app they can trust will never do this. *User:* Broad AAC-using pediatric population, especially lower-income families. *Existing:* CoughDrop (pay-what-you-can cross-subsidy, real working precedent, §12.13) but not AI-native; AssistiveWare (bootstrapped, no outside VC, but not a formal PBC). *Why existing solutions are incomplete:* No AI-native entrant has combined CoughDrop's access-aligned economics with 2024–2026-era generative AI capability. *Innovation:* A PBC-chartered app combining cross-subsidy pricing with the AI Co-Pilot (#1) and board-generation (#6) features, contractually committing to never gate core communication behind payment. *Tech:* Full AAC app stack + AI layers above. *Difficulty:* High (full-stack build). *Regulatory:* Standard AAC-software posture; PBC incorporation is a legal/governance choice, not a regulatory one. *IP:* Brand/trust position + proprietary AI layers built on top. *Payer:* Mixed; paying families/schools cross-subsidize free tier. *Price:* $9–15/mo comparable to CoughDrop, free tier for qualifying families. *Market:* Full ~$260M/yr TAM (§7.4) plus unmet-need upside (~$500M/yr, §7.7). *Competition:* CoughDrop directly, all major incumbents indirectly. *Time to prototype:* 9–12 months for a credible MVP (full app, not just a feature). *Capital:* $3–8M seed/Series A. *Clinical validation:* Standard AAC efficacy + abandonment-rate tracking. *Social impact:* Very high if executed; directly targets the "revenue vs. access" tension the whole report is oriented around.

8. Unified voice-in/voice-out app for CAS/dysarthria. *Problem:* Children with apraxia/dysarthria who have some intelligible speech are forced into a binary choice between "pure AAC" and "pure speech therapy," when ASHA guidance explicitly says AAC should run *concurrently* with speech therapy (§4.1, CAS section). *User:* CAS, dysarthria, mild-moderate CP with speech. *Existing:* Symbol AAC apps (no ASR) or Voiceitt-style ASR apps (no AAC fallback); never combined. *Why it fails:* No identified product does real-time ASR "clean-up" *and* seamless symbol/text fallback in one interface. *Innovation:* Single app that ASR-cleans intelligible attempts and falls back to AAC symbols/text for unintelligible ones, tracked longitudinally for the SLP. *Tech:* Personalized dysarthric ASR (Voiceitt-style) + AAC engine. *Difficulty:* Medium-high (ASR personalization is data-scarce, §19.2). *Regulatory:* Low-moderate. *IP:* Proprietary personalized-ASR data pipeline for children specifically. *Payer:* Families, clinics. *Price:* $15–25/mo. *Market:* Smaller than full-CCN population but well-defined (CAS ~1–2/1,000, dysarthric CP subset). *Competition:* Voiceitt (adult-weighted), Google Project Relate (research, not product). *Time to prototype:* 5–6 months. *Capital:* $1–2M. *Clinical validation:* Intelligibility-improvement and AAC-therapy-outcome studies. *Social impact:* High; directly serves ASHA's own concurrent-use guidance, an underbuilt product category.

9. District-level AAC outcomes / abandonment-risk analytics. *Problem:* No aggregated early-warning system exists for special-ed directors to spot which of their AAC-using students are at risk of abandonment (30–50% base rate, §4.2.1) before it happens. *User:* School district special-education directors, AT teams. *Existing:* CoughDrop/TD Snap log individual usage but don't roll up district-wide risk signals. *Why it fails:* Existing tools are child-level/therapist-level, not administrator-level. *Innovation:* A dashboard flagging declining usage, inconsistent home/school data, or training gaps across an entire district's AAC population. *Tech:* Data aggregation (with consent/FERPA compliance) across existing app usage logs, risk-scoring model. *Difficulty:* Medium. *Regulatory:* FERPA/student-data-privacy is the central burden. *IP:* Risk-scoring model trained on real longitudinal usage-outcome data; a genuine data moat if built at scale. *Payer:* School districts (site license). *Price:* $2,000–10,000/district/yr depending on size. *Market:* ~13,000+ US school districts, though only a fraction have large AAC populations. *Competition:* None dedicated identified. *Time to prototype:* 4–5 months (requires data-sharing agreements with an existing app vendor; a real dependency). *Capital:* $1–2M. *Clinical validation:* Retrospective validation against known abandonment outcomes. *Social impact:* High; turns a chronic, invisible failure mode into a manageable, visible one.

10. Dysarthric/atypical-speech ASR licensed for children. *Problem:* Google's Project Euphonia dataset and Voiceitt's commercial model are not pediatric-specific or broadly licensable to third parties (§19.2). *User:* Any company (including #8 above) wanting to embed atypical-speech ASR for children. *Existing:* Voiceitt (commercial, adult-weighted), Google Euphonia (research, not licensable). *Why it fails:* No pediatric-specific, licensable ASR component exists as an ingredient product. *Innovation:* A consented pediatric-atypical-speech dataset and fine-tuned ASR model, licensed as an API to AAC/speech-therapy app builders. *Tech:* ASR fine-tuning pipeline, pediatric data-collection infrastructure. *Difficulty:* High (data scarcity + consent complexity for minors' biometric-adjacent voice data is the core barrier). *Regulatory:* COPPA-grade. *IP:* The dataset itself is the moat. *Payer:* B2B (other AAC/speech-tech companies). *Price:* Usage-based API pricing. *Market:* Small standalone but valuable as an ingredient (Voiceitt's modest $34M raised over 13 years suggests this is a niche, not venture-scale alone, per §13.6 ESTIMATE). *Competition:* Voiceitt, Google (non-commercial). *Time to prototype:* 9–12 months (data collection is the bottleneck). *Capital:* $2–4M. *Clinical validation:* Word-error-rate benchmarking against typical-speech ASR. *Social impact:* Medium-high, mainly via enabling other products (#8).

11. AAC-specific character-level/domain-adapted LLM engine (B2B ingredient). *Problem:* Off-the-shelf LLMs mismatch AAC's short, telegraphic, high-frequency-vocabulary language patterns (§9.2). *User:* Other AAC software companies (B2B), including open-source projects. *Existing:* Published research (PrAACT, Gaines & Vertanen) not yet productized by anyone identified. *Why it fails:* Academic-to-commercial gap; no one has packaged this as a licensable API. *Innovation:* A hosted or on-device "AAC-tuned prediction API" any app (CoughDrop, a school-built tool, a new entrant) could integrate. *Tech:* Fine-tuned/adapted open LLM, character-level extraction algorithm. *Difficulty:* Medium (research is published; engineering/hosting is the work). *Regulatory:* Low (infrastructure component). *IP:* The adaptation technique + any proprietary training data. *Payer:* B2B API usage fees. *Price:* Usage-based (per-prediction or per-seat). *Market:* Every AAC software vendor is a potential customer; a genuine "picks and shovels" play.

Competition: None productized yet; risk that a well-funded incumbent builds this in-house instead of buying. *Time to prototype:* 3–4 months. *Capital:* $500K–1.5M. *Clinical validation:* Prediction-accuracy/keystroke-savings benchmarking. *Social impact:* Indirect but broad; raises the baseline for every app that integrates it.

12. Communication-passport teacher-handoff tool. *Problem:* Knowledge about a specific child's effective vocabulary/strategies is lost at every grade/provider transition (§5.4, §5.7). *User:* Teachers, SLPs, parents. *Existing:* Informal notes, IEP documents (not AAC-specific or structured for quick handoff). *Why it fails:* No structured, low-effort, AAC-specific handoff format exists. *Innovation:* A simple structured template + light software tool auto-populated from existing app usage data, designed for a 15-minute handoff conversation. *Tech:* Lightweight data export/summarization, possibly LLM-generated summary from usage logs. *Difficulty:* Low (this is the easiest-to-build opportunity on the list). *Regulatory:* FERPA-adjacent. *IP:* Minimal; more of a service/format-standard play than a defensible technology. *Payer:* Schools/districts, low price point. *Price:* $500–2,000/school/yr or free/open as a trust-building tool for a larger platform. *Market:* Every AAC-using student transition, annually. *Competition:* None dedicated. *Time to prototype:* 6–8 weeks. *Capital:* Minimal (<$200K) or bootstrappable as a feature of #1/#7. *Clinical validation:* Not required. *Social impact:* Medium-high relative to its very low cost/difficulty; a strong "quick win" companion feature.

13. AI Medicaid/insurance appeals-as-a-service. *Problem:* Appeals succeed 93% of the time with added documentation, implying most initial denials are winnable but families/clinics lack the capacity to pursue them fully (§4.2.1, §5.7). *User:* Families, hospital/clinic funding-navigation staff. *Existing:* Manual, ad hoc appeals processes; manufacturer funding teams handle only their own devices. *Why it fails:* No vendor-agnostic, systematized appeals service exists at scale. *Innovation:* AI-drafted appeal letters incorporating the specific denial-reason pattern and payer's own coverage-policy language, human-reviewed before submission. *Tech:* LLM document drafting + payer-policy database (shared infrastructure with #5). *Difficulty:* Medium. *Regulatory:* HIPAA. *IP:* Payer-policy database + denial-pattern library. *Payer:* Per-case fee or clinic subscription. *Price:* $100–300/appeal or bundled with #5. *Market:* A meaningful fraction of all SGD purchase attempts. *Competition:* Boutique funding-consulting firms (manual, not software-scaled). *Time to prototype:* 3 months. *Capital:* Shared with #5 (~$500K–1M combined). *Clinical validation:* Not required; track approval-rate improvement. *Social impact:* High; closes the exact gap ("initial denial is common, appeals work but require capacity") documented independently across sources.

14. Emotion/humor/tone-aware AAC phrase layer. *Problem:* Static boards systematically under-support humor, sarcasm, and social "glue" registers; the CHI 2025 finding that this is where generative AI's advantage over legacy AAC is largest (§9.3). *User:* AAC users seeking fuller social/peer participation. *Existing:* None identified as a dedicated feature in commercial apps. *Why it fails:* Incumbent vocabulary sets are built around referential/informational communication (requests, needs), not social/affective registers. *Innovation:* A phrase-suggestion layer specifically tuned for timely, contextual humor/small-talk, building on the CHI 2025 "Why So Serious?" research. *Tech:* LLM fine-tuned on conversational/social registers + timing-awareness. *Difficulty:* Medium. *Regulatory:* Low. *IP:* Novel training-data curation for social-register AAC language (thin but real). *Payer:* Add-on to #1 or #7. *Price:* Bundled, not likely to be standalone. *Market:* Feature-level, not a standalone company. *Competition:* None dedicated. *Time to prototype:* 2–3 months as a feature. *Capital:* Minimal if built as a feature of a larger platform. *Clinical validation:* Peer-interaction/social-participation outcome measures. *Social impact:* Medium-high; directly targets the "cannot express personality" dignity concern (§14.3).

15. Low-cost ruggedized wearable AAC for early communicators. *Problem:* Device breakage/battery failure is a documented parent complaint (§4.2.1); GoTalk Select shows demand for a wearable form factor. *User:* Early/emergent communicators, classroom settings. *Existing:* GoTalk Select (mid-tech, limited vocabulary). *Why it fails:* Existing wearables are fixed-vocabulary, non-dynamic. *Innovation:* A low-power e-ink or ruggedized small-display wearable with dynamic (not fixed) vocabulary, sold direct to schools below dedicated-SGD price points. *Tech:* Low-power display hardware, embedded software. *Difficulty:* Medium-high (hardware is always harder than software). *Regulatory:* Standard consumer-electronics safety (not FDA DME unless positioned for reimbursement). *IP:* Hardware design + power-management engineering. *Payer:* Schools, families. *Price:* $300–800. *Market:* A slice of the app/tablet-based AAC segment (~310,000 children, §7.4) seeking more durability than a shared classroom tablet offers. *Competition:* GoTalk Select, general tablet+case bundles. *Time to prototype:* 9–12 months (hardware). *Capital:* $2–5M (hardware capital intensity). *Clinical validation:* Durability/usability field testing. *Social impact:* Medium; addresses a real but secondary pain point.

16. AAC companion for consumer smart glasses. *Problem:* Higher-functioning AAC users may want camera-based scene cues and low-stigma form factor rather than a visibly "special" device. *User:* Verbal-but-limited or situationally non-speaking users comfortable wearing glasses. *Existing:* None identified. *Why it fails:* Category doesn't exist yet; smart glasses themselves are new (Meta Ray-Ban Display, Sept. 2025). *Innovation:* A companion app riding Meta's (or similar) camera + AI assistant + EMG-band platform for scene-cued vocabulary and captioned output. *Tech:* Platform SDK integration (dependent on third-party developer access; unconfirmed for Meta's Neural Band, §13.4). *Difficulty:* High (platform dependency risk). *Regulatory:* Low. *IP:* Thin; mostly application-layer. *Payer:* Families (glasses cost $299–799 plus app). *Price:* $10–20/mo app layer. *Market:* Small near-term (glasses adoption is early); larger long-term if smart glasses become mainstream. *Competition:* None yet. *Time to prototype:* 6+ months, gated by platform SDK availability. *Capital:* $1–2M, high platform risk. *Clinical validation:* Usability studies. *Social impact:* Medium; most relevant to a narrower, higher-functioning slice of the population; least mature "why now" of the opportunities on this list.

17. Automated SETT/feature-matching digital assessment tool. *Problem:* SLP caseload (46% cite as barrier) and documentation burden constrain assessment quality and speed (§5.3). *User:* SLPs, AAC specialists. *Existing:* Paper/manual SETT-framework worksheets. *Why it fails:* No digital tool structures and semi-automates the process while still producing payer-grade documentation. *Innovation:* A guided digital SETT/feature-matching workflow that outputs both a device recommendation and funding-ready documentation in one pass (natural integration point with #5). *Tech:* Structured-workflow software + LLM-assisted documentation drafting. *Difficulty:* Medium. *Regulatory:* Low (clinical decision-support, not diagnostic). *IP:* Workflow design + integration with #5's payer-rules database. *Payer:* Clinics, hospital AAC programs. *Price:* $50–150/clinician/month. *Market:* Every practicing AAC-specialist SLP (a defined, addressable professional population). *Competition:* None dedicated identified. *Time to prototype:* 4 months.

Capital: $500K–1M. *Clinical validation:* Time-to-recommendation and documentation-completeness studies. *Social impact:* Medium-high; directly reduces the caseload/training-gap bottleneck.

18. Open, AI-generation-compatible next-gen symbol set. *Problem:* Symbol IP is fragmented across four owners (Tobii/PCS, n2y/SymbolStix, Widgit, BCI/Blissymbolics) with real licensing friction (§8.3). *User:* Any new AAC software entrant. *Existing:* ARASAAC (open, CC BY-NC-SA, ~13,000 symbols) is the closest existing open alternative. *Why it's incomplete:* ARASAAC wasn't designed for AI-generation compatibility (consistent style transfer, prompt-controllable variation). *Innovation:* A fully open (CC BY-SA or similar), AI-generation-native symbol style/dataset that new entrants can build on without licensing friction, positioned to become the "ARASAAC of the AI era." *Tech:* Diffusion/generative image models fine-tuned for a consistent, clinically-validated symbol style. *Difficulty:* Medium (technically buildable; adoption is the harder problem). *Regulatory:* None. *IP:* Deliberately open; the "moat" is community/standard-setting position, not exclusivity. *Payer:* Grant/foundation-funded, or a platform company's loss-leader investment. *Price:* Free. *Market:* Infrastructure, not directly monetized. *Competition:* ARASAAC, Mulberry, Sclera. *Time to prototype:* 4–6 months. *Capital:* $300–800K (grant-fundable). *Clinical validation:* SLP-rated symbol clarity/recognizability studies. *Social impact:* Medium-high, mainly by lowering the barrier for other companies on this list (especially #6).

19. AI caregiver-coaching / aided-language-modeling app. *Problem:* Parents are expected to become AAC communication partners themselves with little to no training parity with SLPs (§5.2, Berenguer et al. 2022). *User:* Parents/caregivers. *Existing:* AACessTalk (academic research prototype, KAIST/NAVER, not commercialized). *Why it fails:* No commercial product has taken AACessTalk's dual-sided (child + caregiver) coaching model to market. *Innovation:* A consumer app coaching caregivers in real time on aided-language-stimulation technique while recommending contextual vocabulary to the child; explicitly modeling both sides of the interaction, not just accelerating the child's output. *Tech:* Real-time conversational AI, dual-user interface design. *Difficulty:* Medium-high (genuinely novel interaction design, though the research template exists). *Regulatory:* Low. *IP:* Interaction-design/dual-sided-coaching model (first commercial mover on a published academic template). *Payer:* Families, schools (for parent-training programs). *Price:* $15–25/mo. *Market:* Every family of a new AAC user (the training-gap population is close to universal per Berenguer et al.). *Competition:* None commercial identified; academic prototype only. *Time to prototype:* 6–8 months (dual-sided UX is real engineering work). *Capital:* $1.5–3M. *Clinical validation:* Replicate/extend AACessTalk's engagement and turn-taking outcome measures. *Social impact:* High; addresses the training gap directly, at the point (the home) where the most AAC use actually happens.

20. Situational/selective-mutism AAC-lite product. *Problem:* Children who speak fluently at home but cannot speak in specific settings are underserved by AAC products designed around consistent non-speakers (§4.1). *User:* Children with selective mutism, situational anxiety-driven speech loss. *Existing:* General AAC apps (visually/behaviorally over-built for this population) or nothing at all. *Why it fails:* No lightweight, low-stigma, fast-onboarding tool exists calibrated to a child who may only need it in one specific setting (school) and may fade out of using it entirely as treatment progresses. *Innovation:* A minimal, phone-based script/phrase-bank tool explicitly designed as transitional (not a lifelong AAC system), aligned with ASHA's flexible/temporary framing (§4.1). *Tech:* Simple TTS/script-bank app, no complex symbol system needed. *Difficulty:* Low. *Regulatory:* Low. *IP:* Thin; mainly clinical-design and positioning. *Payer:* Families, school counselors. *Price: $5–10/mo or one-time low fee.* Market: *Selective mutism prevalence is a defined but smaller population than autism/CP.* Competition: *None dedicated identified; a genuine underserved niche.* Time to prototype: *6–8 weeks.* Capital: *<$300K.* Clinical validation: *Treatment-progression/fade-out outcome tracking with anxiety-treatment providers.* Social impact:* Medium; small population, but currently near-zero dedicated product support.

21. US private "specialist AAC hub" service (NHS-model). *Problem:* US AAC expertise is spread thin across thousands of individual insurers/districts rather than concentrated, unlike England's 17-region NHS specialist-hub model (§6.8). *User:* Families, schools, clinics lacking in-house AAC expertise. *Existing:* Individual hospital AAC clinics (e.g., Gillette Children's); good but not networked or payer-agnostic. *Why it's incomplete:* No private, cross-payer network replicates the NHS's centralized-expertise/triage advantage in the US's fragmented system. *Innovation:* A telehealth-enabled specialist-AAC-assessment and navigation network selling B2B into health systems, districts, and insurers as a "AAC expertise as a service" layer. *Tech:* Telehealth platform + clinical staffing model (not primarily a technology play). *Difficulty:* High (a services business, not a software product; different execution muscle). *Regulatory:* Standard telehealth/clinical-practice regulation, state-by-state licensure complexity. *IP:* Thin; the moat is clinical-network quality and payer relationships. *Payer:* Health systems, districts, insurers (B2B contracts). *Price:* Contract-based, likely $50K–500K/year per institutional client. *Market:* Every US region lacking dedicated AAC specialist capacity (most of the country, per the training-gap findings). *Competition:* Individual hospital programs, none networked at scale. *Time to prototype:* 6–9 months (requires clinical staffing, not just software). *Capital:* $2–5M (services businesses are capital-hungry for staffing before revenue). *Clinical validation:* Outcome/time-to-device comparisons against non-hub-served regions. *Social impact:* High if it reduces friction system-wide, but the hardest opportunity on this list to execute given its services (not software) nature.

22. AI intent-disambiguation/documentation tool for emergent communicators. *Problem:* Determining genuine communicative intent for early/emergent or multiply-disabled communicators is clinically hard (§4.2.1); and is the exact same unresolved problem underlying the FC/RPM/S2C controversy. *User:* Clinicians, parents of pre-symbolic/emergent communicators. *Existing:* The "presume competence" clinical framework (contextual fit, non-verbal confirmation, response-to-breakdown) applied informally, inconsistently, and undocumented. *Why it fails:* No structured, transparent, non-facilitator-dependent tool helps caregivers apply this framework consistently or document it for IEP/funding purposes. *Innovation:* A structured observation-logging tool (NOT a facilitated-communication-style output device) that helps caregivers/clinicians systematically apply and document the three converging-evidence criteria, explicitly excluding any physical/gestural facilitation to avoid any FC/RPM/S2C-adjacent design risk. *Tech:* Structured logging/observation software, possibly video-annotation assisted by AI (flagging candidate communicative moments for human review, never auto-interpreting intent). *Difficulty:* Medium; the clinical-design discipline required to stay unambiguously clear of the FC/RPM/S2C pattern is the hard part, not the software. *Regulatory:* Low if scrupulously positioned as an observation/documentation aid, not an interpretive/authorship tool. *IP:* Thin. *Payer:* Clinics, schools. *Price:* Low, likely bundled into #17. *Market:* Every pre-symbolic/emergent-communicator evaluation. *Competition:* None dedicated. *Time to prototype:* 3 months. *Capital:* <$500K. *Clinical validation:* Essential and non-negotiable; must be validated against, not merely inspired by, the "presume competence" literature, with explicit involvement of the professional bodies that authored the FC/RPM position statements. *Social impact:* Potentially high, but this is the single highest ethical-risk-if-done-wrong opportunity on the entire list; flagged accordingly with a lower ethical-risk-favorability score in the table above.

23. OBF-based cross-platform vocabulary migration tool. *Problem:* Families/clinics lose a child's personalized vocabulary when switching between CoughDrop, TouchChat, Proloquo2Go, TD Snap, etc. *User:* Families, clinics changing systems. *Existing:* Open Board Format exists as a partial standard; not all major vendors fully support import/export. *Why it's incomplete:* No neutral third-party migration/backup tool exists. *Innovation:* A vendor-agnostic backup/migration utility. *Tech:* OBF parsing/conversion. *Difficulty:* Low-medium. *Regulatory:* Data-privacy handling. *IP:* Minimal; a utility/trust play, similar to #12. *Payer:* Families/clinics, low price or free (marketing/trust tool for a larger platform). *Price:* Free or <$5/mo. *Market:* Every system-switching event. *Competition:* None dedicated. *Time to prototype:* 6–8 weeks. *Capital:* <$200K. *Clinical validation:* Not required. *Social impact:* Medium; a small but genuine friction-reducer, best built as a feature rather than a company.

24. Employer-sponsored "family AAC benefit." *Problem:* No identified company sells an AAC-access benefit directly to self-insured employers, unlike fertility/mental-health point solutions in adjacent health-tech (§12.14). *User:* Employees with a child with CCN. *Existing:* None identified; a genuine whitespace. *Why it's unexploited:* AAC is a smaller, less broadly-relevant-seeming population than fertility/mental health from an employer-benefits-marketing perspective, even though the need is acute for affected families. *Innovation:* A benefits product bundling AAC evaluation-navigation, funding-gap bridge financing, and app/device access, sold to HR/benefits teams. *Tech:* Benefits-administration platform + partnerships with #5/#13-style navigation tools. *Difficulty:* Medium (business-model innovation more than technology). *Regulatory:* ERISA/benefits-law considerations. *IP:* Thin; the innovation is channel/distribution, not technology. *Payer:* Employers (per-employee-per-month fee). *Price:* $1–3 PEPM (per-employee-per-month, comparable to niche point-solution benefits). *Market:* Untested; a genuine hypothesis requiring employer-demand validation. *Competition:* None direct. *Time to prototype:* Requires a pilot employer partnership rather than a software build. *Capital:* $1–2M. *Clinical validation:* Not required. *Social impact:* Medium; introduces a genuinely new non-family payer, which is valuable regardless of scale.

25. On-device/offline small-LM AAC engine (privacy-first). *Problem:* Cloud-dependent AI features risk sending a vulnerable child's communication data off-device and fail without connectivity (school WiFi dead zones, cars, outdoors); both real, documented constraints (§13.8). *User:* Any AAC app needing AI features. *Existing:* Most current AI-AAC research prototypes (SPICA, AACessTalk) are not confirmed to run on-device. *Why it's incomplete:* On-device small-LM AAC-specific tooling doesn't yet exist as a packaged offering. *Innovation:* An offline-capable, on-device small-language-model engine purpose-built for AAC prediction/generation, riding the >90%-by-2030 inference-cost collapse (Gartner, §13.8). *Tech:* On-device LLM quantization/optimization for AAC-specific tasks. *Difficulty:* Medium-high (on-device ML engineering is a specialized skill). *Regulatory:* Favorable; on-device processing simplifies COPPA/privacy compliance relative to cloud alternatives. *IP:* Optimization/quantization technique for the AAC-specific task. *Payer:* B2B (licensed into #1, #7, or incumbents). *Price:* Licensing fee or bundled. *Market:* Every AI-AAC feature eventually needs this as table stakes, not a premium feature (§13.8). *Competition:* General on-device-AI vendors (Apple Intelligence, Google) not AAC-specific. *Time to prototype:* 4–6 months. *Capital:* $1–2M. *Clinical validation:* Latency/accuracy benchmarking vs. cloud alternatives. *Social impact:* Medium-high, mainly via enabling trustworthy AI in #1/#7/#19 for privacy-sensitive families/schools.

26. Low-cost child-sized micro-gesture/EMG switch. *Problem:* Children with extremely limited reliable movement have no mature, low-cost EMG/micro-gesture switch option; Meta's Neural Band is closed, academic HD-sEMG isn't wearable-ready (§13.4, §19.6). *User:* Children with severe motor impairment (advanced CP, SMA, high-level spinal injury). *Existing:* Mechanical switches only (commoditized but require some reliable gross movement). *Why it fails:* No child-sized, low-channel-count, affordable EMG alternative exists for children who cannot reliably trigger mechanical switches. *Innovation:* An open-hardware, low-channel EMG or capacitive micro-gesture switch specifically sized/calibrated for children. *Tech:* Low-channel-count EMG sensing, child-appropriate form factor. *Difficulty:* High (hardware, signal-processing, and a small/hard-to-recruit pediatric test population). *Regulatory:* Medical-device-adjacent (skin-contact sensor); likely requires more regulatory diligence than pure software plays. *IP:* Hardware/signal-processing design. *Payer:* Families, Medicaid (as a DME accessory, potentially under E2512). *Price:* $200–500. *Market:* A small, severely-underserved population; high impact per user, modest total volume. *Competition:* None mature and child-specific identified. *Time to prototype:* 12+ months (hardware + signal-processing R&D). *Capital:* $2–4M, hardware-heavy. *Clinical validation:* Essential; a body-worn sensor for children needs real safety/efficacy validation. *Social impact:* High for a narrow population, but the least capital-efficient opportunity on this list.

27. Multilingual-native AAC vocabulary architecture. *Problem:* Multilingual families report irrelevant, translation-bolted-on vocabulary as a real barrier (§4.2.1); a documented, clinically-endorsed but commercially underserved gap. *User:* Multilingual/bicultural families. *Existing:* "Several AAC companies" offer basic language-switching (table stakes); none identified build vocabulary natively multilingual/multicultural from the ground up. *Why it fails:* Default core-vocabulary lists are English-derived and directly translated rather than independently derived per language/culture. *Innovation:* A vocabulary architecture built from linguistically-independent, culturally-specific core-word research per target language (building on MultiGen's low-resource-language generative approach, §9.6). *Tech:* Multilingual generative TTS/vocabulary generation, linguistic research per language. *Difficulty:* Medium-high (requires real linguistic research investment per language, not just translation). *Regulatory:* Low. *IP:* Proprietary per-language core-vocabulary research + generative pipeline. *Payer:* Families, schools in multilingual districts. *Price:* Bundled feature or add-on. *Market:* A meaningful and growing slice of the US AAC population given immigration demographics (not separately sized in this research). *Competition:* None building this natively identified. *Time to prototype:* 4–6 months per initial language (Spanish first, given US demographics). *Capital:* $1–2M. *Clinical validation:* Bilingual-SLP-validated vocabulary-appropriateness studies. *Social impact:* High for an underserved, currently poorly-served population.

28. AI-generated custom board content for individual photos (standalone consumer version of #6). *Problem:* Same as #6, but positioned as a direct-to-family consumer tool rather than a teacher/SLP B2B tool. *User:* Parents. *Existing:* Same as #6. *Why it fails:* Same as #6, plus consumer awareness/discovery is a distinct go-to-market challenge from B2B. *Innovation:* A simple mobile app: photograph anything, get an instant AAC board.

Tech: Same as #6. *Difficulty:* Low-medium. *Regulatory:* Low. *IP:* Same as #6. *Payer:* Families, direct. *Price:* $5–10/mo or one-time. *Market:* Overlaps with #6's addressable base but via a different channel (consumer app stores vs. school/clinic sales). *Competition:* Cboard/Cbuilder. *Time to prototype:* 2–3 months. *Capital:* $300–600K. *Clinical validation:* Same as #6. *Social impact:* High-frequency, low-friction value delivery directly to families; but subject to the same "clinician-gatekept market punishes app-store-only strategies" risk flagged by the Verbally failure (§18.3), so likely best paired with #6's B2B channel rather than pursued as a pure consumer play.

PART 12: BUSINESS MODELS

For each model: who uses it, who buys/pays, indicative price, sales cycle, gross-margin potential, CAC challenges, regulatory burden, clinical-evidence bar, scalability, ethical considerations, and; per the assignment's explicit instruction; **whether the model's incentives align with maximizing child access/outcomes, or create incentives to restrict access**.

12.1 Direct-to-consumer (DTC) device sale

- **Uses:** Child. **Buys/pays:** Family, out-of-pocket or via insurance reimbursement claim filed by the family/manufacturer.
- **Price:** $5,000–$8,500 (dedicated SGD, per 6.6) or $200–$1,000 (tablet + app).
- **Sales cycle:** Weeks (app) to months (insurance-mediated dedicated device, given prior-auth/appeals per 6.4).
- **Gross margin:** High on software (near-100% marginal cost after development); moderate-to-high on hardware (locked-tablet dedicated devices likely carry 50-70%+ gross margins given the price premium over commodity tablet hardware, though exact company-level COGS were not found and this is a reasoned estimate based on the tablet-vs-dedicated-device price gap in 6.6).
- **CAC:** Low for organic/SEO-driven app discovery; high for hardware requiring clinician-mediated sales and funding-specialist support (embedded cost, per 6.4).
- **Regulatory burden:** Software apps used purely for AAC communication have historically been treated by FDA largely as low-risk/exempt (general wellness/communication aid, not diagnostic or therapeutic in the FDA regulatory sense); **not independently verified against current FDA device classification rules in this pass; flagged for regulatory/legal review**, not asserted as fact.
- **Clinical evidence required:** Growing expectation (from SLP purchasers and payers) of published efficacy/usability evidence, though the bar for a *consumer* app purchase is lower than for a *reimbursed* device.
- **Scalability:** High for software; moderate for hardware (manufacturing + funding-support overhead).
- **Access alignment: Aligned** when priced to be broadly affordable (e.g., $250 one-time app); DTC software is one of the *most* access-positive models because it bypasses the insurance-approval bottleneck entirely for families who can afford the one-time fee, though it excludes families who cannot.

12.2 AAC app (one-time purchase)

- Essentially 12.1's software case. **Ethical flag:** A one-time-purchase model has no ongoing revenue incentive to *restrict* access once purchased; arguably one of the most child-outcome-aligned commercial models, since the company has already been paid and now wants the child to succeed and generate word-of-mouth/reviews. **Access alignment: Strongly aligned.**

12.3 Freemium AAC

- **Uses:** Child. **Buys:** Family/clinician (upgrade decision).
- **Price:** Free tier + paid tier ($0 → $50-150/year typical freemium software economics, not AAC-specific-verified).
- **Sales cycle:** Instant (self-serve download) for free tier; short for upgrade.
- **Gross margin:** Very high on paid conversions; the free tier is a pure CAC investment.
- **CAC:** Low; the free tier *is* the acquisition funnel.
- **Regulatory burden:** Same as 12.1/12.2.
- **Ethical consideration; explicitly flagged per assignment:** This is the model most likely to create a **tension between access and revenue**: a poorly-designed freemium AAC app could gate core communication functionality (e.g., core vocabulary size, number of buttons, voice quality) behind a paywall, which is ethically fraught when the "product" is a child's ability to communicate at all. **Access alignment: Conditionally aligned:** aligned if the free tier provides genuinely functional core communication (as CoughDrop's open-source, pay-what-you-can model attempts, per 6.6) and monetizes premium/convenience features (advanced customization, cloud sync, multiple devices) rather than gating basic expressive capability; **misaligned** if core communication ability itself is paywalled.

12.4 Subscription software (SaaS)

- **Uses:** Child (with caregiver/clinician as configurer). **Buys:** Family, clinic, or school.
- **Price:** CoughDrop's $9/month is the clearest real data point (6.6); comparable education-SaaS subscriptions generally run $5-30/month per seat.
- **Sales cycle:** Short for individual/family subscriptions (self-serve); long (6-18 months) for institutional (school/district) subscriptions requiring procurement approval.
- **Gross margin:** Very high (80-90%+ typical of SaaS) once product is built.
- **CAC:** Low for individual; high for institutional (requires sales team, RFP responses, pilot programs).
- **Regulatory burden:** Low-moderate.

- **Scalability:** Very high; the most scalable model in this list.
- **Ethical consideration:** A subscription model creates an ongoing revenue relationship that *requires* continued value delivery to retain the customer; arguably healthier incentive alignment than one-time purchase (which has zero ongoing incentive to keep improving the product) but introduces churn risk if a low-income family can't sustain monthly payments and **loses access to their communication device/app** if they lapse; a much more severe consequence than losing a typical SaaS subscription. **Access alignment: Conditionally aligned:** strongly dependent on hardship/waiver policies for non-payment (does the company brick the AAC device of a nonspeaking child over a missed $9 payment?). This is a genuine ethical design question flagged for any subscription-model AAC company.

12.5 Hardware + subscription (device-as-a-service adjacent)

- **Uses:** Child. **Buys:** Family/Medicaid/insurance (device) + ongoing subscription (software/cloud features).
- **Price:** Device $5,000-8,500 one-time (often insurance-funded) + $5-20/month software subscription (family-funded, since most payers don't reimburse recurring software fees the same way as one-time DME).
- **Sales cycle:** Long (matches dedicated-device insurance cycle, 6.1-6.4).
- **Gross margin:** Blended; hardware margin per 12.1, plus very high recurring software margin.
- **Regulatory burden:** Highest of the models discussed; full DME/HCPCS coding, LCD compliance, WOPD, SLP-evaluation requirements (per Part 6).
- **Ethical consideration:** Real risk that a insurance-funded *hardware* purchase becomes a Trojan horse for a recurring *software* fee the payer never approved and the family must cover indefinitely to keep full functionality; this is the "razor and blades" model applied to a medical necessity device, which is ethically distinct from applying it to a printer. **Access alignment: Requires careful design:** flagged as the model with the highest potential for a "restrict access to force revenue" failure mode if core communication functionality (not just cloud extras) is gated behind the ongoing subscription after the device itself was purchased/reimbursed as a one-time medical necessity.

12.6 School licensing / district licensing

- **Uses:** Many children (classroom-wide or district-wide). **Buys/pays:** District, using IDEA federal + state + local special-ed funds (per 6.5).
- **Price:** Enterprise/site-license pricing, likely negotiated per-seat or per-building (no specific figures found; **flagged as data gap:** school AT procurement pricing is rarely public).
- **Sales cycle:** Very long (6-18+ months); must go through IEP-team-level clinical validation, district AT committee, procurement/RFP, and budget cycle alignment (district fiscal years).
- **Gross margin:** Can be high at scale (single sales motion serves many students) but requires significant sales/customer-success investment given complexity of the K-12 procurement process.
- **CAC:** High per district (long cycle, many stakeholders; SLP, special-ed director, CFO/procurement, sometimes school board) but low marginal CAC per *student* once a district contract is won.
- **Regulatory burden:** Moderate; must meet accessibility (Section 508/WCAG), student-data-privacy (FERPA/COPPA/state student-privacy laws), and often state-specific AT-approval-list requirements.
- **Access alignment: Strongly aligned:** because the district (not the individual family) is the payer, there is no per-family ability-to-pay barrier once a district contract exists, and the incentive is to serve as many identified students as effectively as possible to justify contract renewal. The main access risk is *district-level* rationing (limited AT budgets mean not every child who needs a device gets one), not company-level incentive misalignment.

12.7 Clinic licensing / therapist platform

- **Uses:** Children in outpatient/clinic-based speech therapy. **Buys:** Clinic/practice (as a tool for their SLPs) or individual therapists.
- **Price:** Likely a per-clinician or per-clinic seat license (no AAC-specific figures found in this research; comparable EHR/clinical-software SaaS in speech therapy tends toward $50-200/clinician/month based on general clinical-software market patterns; **not independently verified for AAC-specific platforms, flagged as an inference from adjacent healthcare-SaaS pricing norms, not a cited fact**).
- **Sales cycle:** Moderate (weeks to a few months); faster than school districts, slower than consumer.
- **Gross margin:** High (SaaS economics).
- **Access alignment: Aligned:** a platform that makes SLPs more effective/efficient indirectly benefits every child on that clinician's caseload; revenue scales with clinician adoption, not per-child gating.

12.8 Insurance-reimbursed medical device / Medicaid-funded product

- This is the traditional PRC-Saltillo/Tobii Dynavox model described in Part 6.
- **Sales cycle:** Longest of all models (months, given SLP evaluation → physician WOPD → prior authorization → appeals-if-denied, per 6.2-6.4).
- **Gross margin:** Likely high once the reimbursement-code/DME-supplier infrastructure exists (the price premium over commodity hardware, per 6.6, suggests healthy margins), but customer acquisition and "funding specialist" overhead (6.4) is a real, ongoing cost embedded in the model; effectively a tax on every sale that funds the insurance-navigation cottage industry.

- **Regulatory burden:** Highest of any model in this list; full DME supplier accreditation, HCPCS coding compliance, state-by-state Medicaid enrollment as a provider, FDA considerations if the product is marketed with therapeutic claims.
- **Clinical evidence required:** Highest bar; payers increasingly expect published efficacy data, and CMS/state Medicaid coverage policy explicitly requires SLP-documented medical necessity.
- **Barrier to entry (this IS the moat for incumbents):** The multi-year process of getting a device individually recognized under existing HCPCS codes, building DME-supplier relationships, training a national network of clinician-evaluators, and building funding-specialist infrastructure is a substantial and durable barrier; new entrants attempting this model should expect a multi-year, capital-intensive road before achieving revenue at scale.
- **Access alignment: Structurally aligned but practically friction-heavy:** a fully-reimbursed model theoretically gives every medically-qualifying child access regardless of family income, which is the best *equity* outcome in principle, but the friction (6.1-6.4) means real-world access is gated by family/clinician sophistication in navigating the approval bureaucracy; a "hidden tax" on less-resourced families who lack an advocate.

12.9 Device rental / leasing

- **Uses/buys:** Families or clinics needing a device for evaluation/trial periods, or short-term use (e.g., while awaiting insurance approval of a permanent device, or for a child whose needs may change rapidly).
- **Price:** Not found specifically for AAC; general medical-DME rental norms suggest a fraction of purchase price per month.
- **Access alignment: Aligned:** rental/trial models reduce the risk of a family/payer committing $8,000 to a device that turns out to be a poor fit, and can bridge the gap during the (often months-long) insurance approval process (6.4); genuinely pro-access if priced accessibly, though creates ongoing revenue dependent on continued rental (mild version of the 12.5 concern) rather than aligned incentive to transition the family to permanent, fully-owned equipment.

12.10 Device-as-a-service (DaaS) / AI communication assistant / communication analytics

- These are more emergent/less-established models with limited public pricing/market data found; treated as HYPOTHESIS-level business model sketches rather than documented markets.
- **AI communication assistant** (e.g., predictive phrase generation, real-time contextual vocabulary suggestion powered by LLMs): potentially subscription-priced similar to 12.4; **key ethical consideration specific to this model**: an AI system that generates or predicts what a nonspeaking child "wants to say" carries unique risks around authenticity of voice/agency (a documented concern in the AAC field around "who is really speaking" when predictive/generative AI is involved); this is squarely the kind of responsible-AI-for-communication issue relevant to organizations focused on ethical AI-assisted communication tools for children with developmental disabilities. **Access alignment: Potentially highly aligned** (could dramatically lower the cost and skill barrier to effective AAC use) **but requires the most careful ethical design** of any model in this list, given the risk of the technology substituting for, rather than amplifying, the child's own communicative intent.
- **Communication analytics** (aggregating usage data to help clinicians/parents identify communication-development trends): raises **child-data-privacy** considerations (COPPA, FERPA if school-deployed, state student-data-privacy laws) as the central regulatory burden; access-alignment is neutral-to-positive if data is used to improve the child's own therapy, but flagged as an area requiring explicit parental-consent and data-minimization design.

12.11 Caregiver tools / teacher tools / assessment software / training & certification

- **Buys:** Individual parents/teachers (low price point, high volume) or institutions (training/certification programs, e.g., PRC-Saltillo's or AssistiveWare's own clinician-training/certification offerings, which exist as real ancillary revenue lines for incumbents, though specific pricing was not independently found in this pass).
- **Access alignment: Aligned:** training/certification revenue is orthogonal to device/software gating; it monetizes clinician expertise-building rather than child access.

12.12 AAC implementation consulting / API-platform / OEM technology licensing / patented access-technology licensing

- **Buys:** Other companies, school systems, or device manufacturers (B2B2C).
- **Price:** Highly variable, deal-specific; no public benchmark data found.
- **Sales cycle:** Long (enterprise B2B).
- **Gross margin:** Can be very high for pure IP/technology licensing (e.g., licensing an eye-gaze algorithm or switch-access technology to hardware OEMs) since marginal cost of licensing is near zero.
- **Access alignment: Indirectly aligned if it lowers the cost of downstream products** (e.g., licensing core access-technology cheaply to many hardware makers increases competition and choice for families) but **potentially misaligned if used to create exclusive lock-in** (e.g., patenting a core access method and refusing to license it broadly, forcing families into a single expensive product); the ethical valence of this model depends entirely on licensing terms (exclusive vs. non-exclusive, price).

12.13 Research partnerships / nonprofit+commercial hybrid / public-benefit corporation / foundation-funded access model

- **Examples/precedent (FACT):** CoughDrop operates an explicitly mission-driven, open-source, "pay what you can" cross-subsidy model (6.6); a real, functioning example of a hybrid approach where paying customers/donors subsidize free access for low-income families. AssistiveWare is a privately-held, apparently unfunded/bootstrapped company (per Crunchbase/Tracxn data, 6.6) that has chosen not to raise outside venture capital, which is itself a structural choice that may reduce pressure toward growth-at-all-costs pricing.
- **Public Benefit Corporation (PBC) structure (FACT, general corporate-law mechanism, not AAC-specific):** A PBC is a for-profit legal entity that embeds a social mission into its charter, is required to balance shareholder return against stated public benefit, and must report on this balance; recognized in Delaware, California, New York and other states (spzlegal.com, ssir.org). No AAC-specific company was confirmed in this research to be formally incorporated as a PBC, but the structure is directly relevant to the assignment's mission (per the auto-memory note referencing "responsible AI-assisted communication tools for kids w/ developmental disabilities") as a legal wrapper that could formally commit a company to prioritizing child-access outcomes alongside investor returns, and could be a genuine differentiator/trust-signal in fundraising and in payer/school-district sales conversations (districts and Medicaid programs may view a PBC's binding public-benefit commitment favorably in procurement, though this is a HYPOTHESIS about buyer psychology, not a documented purchasing-criteria fact).
- **Foundation-funded access model:** Philanthropic/grant capital directly subsidizes free or low-cost access for a defined underserved population (echoing the UK NHS specialist-hub concentration-of-expertise approach in 6.8); access-alignment is high by construction, but scalability is capped by the size of available grant funding rather than by market economics, meaning this model alone rarely scales to serve the full ~950,000-child CCN population (7.3) without a complementary revenue-generating arm; hence the appeal of the **hybrid** structures.
- **Access alignment (overall, this cluster of models): Strongly aligned by design:** these are the models explicitly built to resolve the tension the assignment asks about (revenue vs. restricting access), and the research found real, operating precedent (CoughDrop) that this is not merely theoretical. **This cluster of models; nonprofit+commercial hybrid, PBC, or foundation-subsidized cross-subsidy pricing; is the most evidence-backed answer to "which model best aligns better outcomes for children WITH revenue."**

12.14 Employer-sponsored benefits (as a business-model channel, distinct from 6.7's description of the payer mechanic)

- Not identified as a distinct, actively-marketed go-to-market channel by any AAC company in this research (i.e., no evidence found of a company selling "AAC benefits" directly to employers as a distinct product, the way e.g. fertility or mental-health benefits are sold to employers in adjacent health-tech markets); flagged as a **potential underexplored/whitespace model**: a company could in principle sell a "dependent AAC benefit" to self-insured employers the way point-solution health benefits are sold elsewhere in the employee-benefits ecosystem, but this is a HYPOTHESIS about market whitespace, not a documented existing model.

12.15 Cross-cutting synthesis: which models create incentives to restrict access vs. expand it

MODEL	RESTRICTS ACCESS RISK	EXPANDS ACCESS ALIGNMENT
DTC one-time app purchase	Low	**High**
Freemium	**Medium-High if core function gated**	High if only convenience features gated
Subscription SaaS	Medium (churn = loss of access)	High if hardship policies exist
Hardware + subscription	**Medium-High** (razor/blade risk on a medical necessity item)	–
School/district licensing	Low (district-level rationing, not company-incentive)	High
Clinic/therapist platform	Low	High
Insurance-reimbursed medical device	Low (company incentive) / High (systemic friction)	High in principle, friction-limited in practice
Device rental/leasing	Low-Medium	High for trial/bridge use
AI communication assistant	Depends entirely on design (authenticity-of-voice risk)	Potentially very high if done ethically
IP/technology licensing	**High if exclusive**, Low if open/non-exclusive	High if broadly licensed
Nonprofit+commercial hybrid / PBC / foundation cross-subsidy	**Lowest**	**Highest:** the closest existing pattern to "revenue without restricting access"

Bottom line for the assignment's explicit ask: The research identifies the **nonprofit+commercial hybrid / cross-subsidy / PBC cluster (12.13):** with CoughDrop as a real, operating proof-of-concept; as the model class with the strongest documented alignment between revenue generation and expanded (not restricted) child access. The **highest-risk** models for access-restricting incentives are (a) **freemium models that gate core communicative function** rather than convenience features, and (b) **hardware-plus-subscription models that could turn an insurance-funded medical necessity device into an ongoing pay-to-retain-functionality relationship**. Both risks are design choices, not inherent to the revenue model itself; meaning a company can choose a subscription or freemium model and still land on the "access-expanding" side of this table by committing (contractually, or via PBC-style charter commitments) to never gating core communicative capability behind payment, and to hardship/non-payment policies that preserve access.

End of Part D research (Parts 6, 7, 12). All figures are tagged FACT/ESTIMATE/CLAIM/HYPOTHESIS inline; explicit data gaps are called out in sections 6.3, 6.4, 7.8, and throughout Part 12 where public pricing/market data was unavailable. Research stream covering Part 9 (AI and the Next Generation of AAC), Part 13 (Adjacent Industries), Part 19 (Build-vs-Buy Opportunities), and a Part 8 supplement (BCI/AI-specific patent landscape).

PART 13: ADJACENT INDUSTRIES

13.1 Gaming controllers and adaptive input hardware

FACT The Xbox Adaptive Controller (Microsoft, launched 2018) functions as a hub rather than a standalone controller: 18 × 3.5mm jacks (each mapped to a standard Xbox button), plus USB-A and USB-C ports, allowing any third-party switch, joystick, or button to be wired in. Microsoft explicitly designed it in collaboration with disabled gamers and accessibility nonprofits to be “plug-and-play, extensible, and affordable.” Sources: Microsoft Garage; Xbox product page; Fast Company.

ESTIMATE (transfer to AAC): The XAC’s core insight; build an accessible *hub* standard that lets a large existing ecosystem of third-party switches/joysticks plug in, rather than building bespoke proprietary input hardware; is directly reusable for an AAC hardware company: a switch-interface hub standard for AAC devices could similarly leverage the existing installed base of AT switches (see §13.7) rather than requiring users to buy new proprietary hardware. This lowers customer switching costs and could be an intentional go-to-market wedge.

13.2 Consumer/gaming eye tracking

FACT Tobii’s consumer gaming line (Tobii Eye Tracker 5) is a mass-market, USB-attached eye/head tracker compatible with 170+ PC games, sold as a peripheral (typically ~$220–280 retail based on public retail listings). Source: Tobii Gaming; Amazon listing.

FACT Tobii Nexus uses AI-powered software to convert ordinary webcam images into real-time eye-tracking data “with minimal computing requirements”; i.e., Tobii itself is moving toward software-only, camera-agnostic gaze estimation rather than requiring dedicated IR-illuminated hardware. Source: Tobii Nexus.

FACT Tobii already directly supplies the medical/AAC market: in January 2019, PRC-Saltillo (a major U.S. speech-generating-device maker) announced Tobii as the eye-tracking module supplier for its Accent line of SGDs. Source: Tobii blog.

ESTIMATE Consumer gaming demand (a much larger market than clinical AAC) has been the primary driver pulling eye-tracking hardware cost down from the thousands of dollars (dedicated medical-grade gaze SGDs) toward ~$200–300 consumer peripherals, and now toward $0 incremental hardware cost via webcam-only software (Tobii Nexus, and open-source projects like WebEyeTrack, arXiv:2508.19544, and the older OpenGazer). This is a clear “previously too expensive, now commoditizing” technology transfer relevant to Part 19.

13.3 AR/VR and smart glasses

FACT Meta Ray-Ban (non-display) AI glasses start at $299; Meta Ray-Ban Display (with the Neural Band, see §13.4) launched at $799 in September 2025 and are sold at retail (Best Buy, LensCrafters, Sunglass Hut, Ray-Ban stores), expanding to Canada/France/Italy/UK in early 2026. Sources: Meta accessibility page; Meta Ray-Ban Display launch, about.fb.com.

FACT Meta’s accessibility framing for these glasses is explicit: “AI glasses support users with reduced vision, hearing or mobility by enabling hands-free operation,” including live captioning (Ray-Ban Display), spoken scene description via Meta AI, and a “Call a Volunteer” feature (Be My Eyes integration) connecting to sighted human volunteers via the glasses’ camera. Sources: Meta accessibility page; Be My Eyes smart-glasses page.

FACT A comparative note from AFB’s AccessWorld review: a Meta glasses accessibility feature paywall has been criticized as “giving Apple a clear opening” in the low-vision/accessibility assistive-glasses space; i.e., this is a competitively contested and evolving market, not settled. Source: Next Reality News.

ESTIMATE Consumer smart glasses (Meta Ray-Ban family) at $299–799 are now priced in the same range as, or cheaper than, many dedicated AAC accessories, and already bundle camera-based scene understanding, an AI assistant, and (in the Display model) a hands/EMG input channel; making them a plausible *platform* for a lightweight AAC companion app/skill rather than requiring a bespoke hardware device, particularly for higher-functioning users who can wear normal glasses.

13.4 EMG and wearable neural-adjacent input

FACT Meta’s Neural Band is a consumer EMG wristband (from the 2019 CTRL-labs acquisition) that decodes subtle finger/wrist muscle-activation signals into device commands, bundled with Ray-Ban Display glasses at $799 (not sold standalone), launched September 17, 2025 (Meta Connect), retail availability from September 30, 2025. Sources: Meta EMG wearable page; about.fb.com launch post; VR/AR Wiki.

ESTIMATE This is the first mass-market consumer EMG product shipped at scale (hundreds of thousands+ of units implied by mainstream retail distribution), which is a major cost/availability inflection point: EMG wearables were previously a specialty/research-grade or clinical-rehab category (e.g., the Myo Armband, discontinued, or bespoke academic rigs described in the HD-sEMG assistive-robotics literature, npj Robotics, 2025). A commodity, mass-produced EMG wristband platform (or its component suppliers/chipsets) becoming available for third-party integration would meaningfully lower the cost of building EMG-based “micro-gesture” AAC switch/selection input for children with limited large-motor control; though as of this research, Meta has not indicated the Neural Band is available as an open third-party SDK/hardware component outside its own glasses ecosystem (unverified; flagged as a gap for further diligence before assuming licensability).

FACT (research-grade EMG, not yet consumer commodity): Academic HD-sEMG systems (high-density surface EMG arrays) achieve strong gesture-recognition accuracy for assistive robotic control but "have large footprints and require precise positioning that can be cumbersome for wearable applications"; i.e., the *high-accuracy* end of EMG gesture recognition is not yet consumer-wearable-ready; the Meta Neural Band represents a different (lower channel-count, wrist-only) design point optimized for a narrow gesture vocabulary rather than high-fidelity signal decoding. Source: Frontiers, medium-density EMG armband; PMC12075175.

13.5 Automotive driver-monitoring cameras

FACT The global automotive driver monitoring system (DMS) market was estimated at $2.72B in 2024, projected to reach $6.14B by 2034 (CAGR 8.6%). Source: Global Market Insights.

FACT Cost reduction in automotive DMS is being driven by (a) lower-processing-power/lower-spec camera designs, (b) higher-resolution single sensors replacing multi-camera rigs, and (c) integrating DMS processing onto the same silicon as other ADAS functions rather than a dedicated processor. Software-only pipelines can now extract fixation-related gaze features from conventional RGB video (no dedicated IR eye-tracking hardware required). Sources: Indie Semiconductor blog; Mobileye blog; MDPI sensors paper on low-cost DMS eye-tracking.

ESTIMATE Automotive-grade driver-monitoring camera+algorithm stacks (built for regulatory mandates like EU General Safety Regulation) are being produced at multi-million-unit annual scale, which should make the underlying RGB-camera gaze/drowsiness/attention-estimation silicon and software extremely cheap on a per-unit basis relative to dedicated medical/AAC eye-tracking hardware; a clear candidate for a "buy the chip/module, don't build gaze estimation from scratch" strategy (see Part 19).

13.6 Speech recognition for atypical/dysarthric speech

FACT Google's Project Euphonia (research initiative) is expanding disordered-speech ASR training data collection to additional languages (Spanish, Japanese, French, Hindi) as of the 2025 Frontiers publication; as of Feb 2025 its dataset included 1.5M+ utterances from ~3,000 speakers with atypical speech, collected via a proprietary web tool from consented participants. Sources: Frontiers, 2025; Google Research blog; Project Euphonia site.

FACT Voiceitt (founded 2012, Stamford CT, ~25 employees) offers a deep-learning speech-recognition engine with personalized acoustic modeling for people with motor/speech disabilities, integrating with smart-home devices and video conferencing. Total disclosed funding is reported as ~$33.7M (PitchBook) with a Series A closing Dec 2022 (investors including Cisco Investments, Third Culture Capital); no acquisition found as of this research (remains an independent private company). Sources: PitchBook profile; Voiceitt site; MobiHealthNews funding coverage.

ESTIMATE Both Google (Euphonia, non-commercial research feeding into products like Live Transcribe/Project Relate) and Voiceitt (commercial, ~$34M raised) validate that atypical/dysarthric ASR is now an active, funded, technically tractable category rather than a research curiosity; but the relatively modest total funding for the best-known standalone commercial player (Voiceitt) suggests this remains a narrow niche market on a standalone basis, more likely to be valuable as a *component* embedded in a broader AAC/accessibility platform than as a standalone venture-scale business.

13.7 Switch access and low-cost/open-source assistive hardware

FACT LibreBridge Mini is described as an open-source, low-cost, configurable accessibility switch interface with 6 reconfigurable ports and web-based configuration. Source: librebridge.com.

FACT Broader open-source-hardware assistive-tech literature documents Arduino, Raspberry Pi, NVIDIA Jetson, OpenCV, YOLO/MobileNet, and DIY EEG/EMG signal-conditioning boards being used to build low-cost assistive technologies outside the traditional (expensive, proprietary) medical-device supply chain. This is a general trend note (source discusses OSHW/OSS in AT broadly, indexed via search results referencing IEEE Access/DOAJ literature).

ESTIMATE Basic mechanical switch-access hardware (buttons, joysticks) is a fully commoditized category with many established vendors (e.g., Inclusive Technology) and open-source alternatives; this is a "buy/don't build" component for a new AAC company (see Part 19), with differentiation available mainly in software (switch-scanning algorithms, adaptive timing/dwell logic) rather than the physical switch itself.

13.8 On-device / edge AI cost trends (cross-cutting enabler)

FACT Cloud LLM inference pricing as of ~2026 ranges roughly $0.75–$5.00 per million input tokens and $4.50–$30 per million output tokens for flagship models, while on-device inference costs approach zero marginal cost per query after initial model download; Apple Intelligence runs a ~3B-parameter on-device model for tasks like summarization on-device. Gartner is cited predicting that by 2030, inference cost for a 1-trillion-parameter-class model will be 90%+ lower than in 2025, driven by silicon efficiency and inference-specialized hardware. Sources: Gartner press release; Edge-first inference survey, arXiv:2505.16508; On-device LM review, arXiv:2409.00088.

ESTIMATE This cost trajectory directly matters for a children's-AAC product because (a) on-device inference avoids sending a vulnerable child's speech/communication data to the cloud (privacy/COPPA-relevant), (b) it removes per-query cost as a barrier to unlimited daily use (important for a device a child may use hundreds of times a day), and (c) offline operation is often clinically required for AAC devices (must work without WiFi, e.g., at school, in a car, outdoors); meaning on-device small-LM capability is likely to become a baseline product requirement, not a premium feature, within the multi-year horizon of a new AAC company's roadmap.

13.9 Robotics, prosthetics, and neural-interface research transfer

FACT A 2025 review, "Neural Interfaces for Robotics and Prosthetics: Current Trends," frames neural-interface-driven prosthetics, brain-controlled wheelchairs, and BCI-driven robotic arms as a converging field with communication BCIs (i.e., the same underlying decoding techniques serve both movement restoration and speech restoration). Source: MDPI/JSAN, doi:10.3390/jsan14060105.

FACT Computer vision has been combined with brain-machine interfaces (eye tracking + BMI) to control robotic upper-limb prosthetics, and deep-learning platforms like "StairNet" apply real-time perception (originally for prosthetic leg mobility) that is architecturally similar to scene-understanding approaches useful for AAC visual-scene-display generation. Source: search-indexed summary citing arXiv:2505.02516 and related prosthetics-CV literature.

HYPOTHESIS The core computer-vision and signal-decoding stacks being built for prosthetics/robotics (real-time, low-latency, embedded, safety-critical perception) are architecturally closer to what a children's AAC device needs (real-time, low-latency, must work in a moving/dynamic environment, cannot fail silently) than typical consumer-AI/chatbot infrastructure is; suggesting an AAC hardware company may find more relevant engineering talent/partnerships in the assistive-robotics and edge-robotics-perception world than in generic "AI startup" talent pools.

PART 14: WHAT PARENTS AND AAC USERS ACTUALLY WANT

IMPORTANT METHODOLOGICAL NOTE: Direct access to Reddit (r/AAC, r/autism, r/CerebralPalsy, r/SLP) was **not available** in this research environment (both direct web-fetch and browser-based access to reddit.com were blocked by platform policy in this session). This is disclosed transparently rather than fabricating Reddit content. To compensate, this section draws on the closest available substitutes for genuine, unfiltered qualitative voice-of-user data: - **App store reviews** (Proloquo2Go, via Apple App Store, individually attributed with reviewer handle/date where available) - **Published qualitative research that itself aggregates parent/clinician focus-group and interview quotes** (Yau et al. 2024; Berenguer et al. 2022); these are peer-reviewed as *synthesis methodology*, but the individual quotes within them are still single-informant qualitative data, not independently-verified population facts - **AAC self-advocate public writing:** most notably endever *(via CommunicationFIRST guest content) and Emma Zurcher-Long (via her blog* Emma's Hope Book *and related secondary coverage); genuine AAC-user-authored content, though accessed via secondary summarization/search rather than full primary-source fetch in every case - Advocacy organization position content (CommunicationFIRST, Autistic Self Advocacy Network/ASAN) - Professional community publications** that explicitly discuss AAC-user-reported emotional experience (ASHA Leader, USSAAC Speakup)

All of the above are explicitly labeled **qualitative/customer-discovery data, not population-representative scientific evidence**, consistent with the instructions for this report.

14.1 Direct voices of AAC users themselves (prioritized per instructions)

- CLAIM (endever*, nonspeaking autistic self-advocate, via CommunicationFIRST guest blog): describes healthcare systems making it "really difficult to utilize services" because they are structured around spoken communication by default; argues AAC users should not be restricted to a single communication technology/modality and describes AAC devices sometimes functioning as "a physical barrier restraining the user from freely employing their own unique communication skills" when providers/institutions rigidly insist on one modality (CommunicationFIRST).
- CLAIM (synthesized self-advocate framing, multiple sources): the *speed* mismatch between AAC and spoken conversation is reported by AAC users as being linked to being perceived as "more impaired" and consequently "more likely to be ignored or disrespected" in real-time social interaction; this is described as a dignity/respect issue, not merely a convenience issue.
- CLAIM (unnamed AAC user, quoted via ASHA Leader feature "From Frustration to Understanding"): "My speech is not functional without AAC in the sense that I'm not able to have my needs met (for example, ask for help, explain what is wrong or what I need). I am also unable to show my higher level thinking."; directly evidences the "non-verbal ≠ no language" framing central to this report; also documents frustration that professionals/family were satisfied with limited "functional" speech that did not reflect the user's actual thinking capacity (ASHA Leader).
- CLAIM (Emma Zurcher-Long, autistic writer/AAC user, via her blog *Emma's Hope Book*, secondary summary): "my mind talks heavy thoughts, but my mouth talks silliness," and a wish that people would "listen to my writing voice, but they listen to my talking voice instead"; a direct first-person articulation of the gap between AAC-mediated communication (perceived by Emma as more accurately representing her thoughts) and her spoken output.

14.2 Documented findings restated as user-facing "wants" (bridging Part 4 evidence into product-relevant framing)

From the peer-reviewed syntheses (Yau et al. 2024; Berenguer et al. 2022), parents/caregivers explicitly want: individualized (not generic) training and coaching; devices selected *with* them and other frontline stakeholders (teachers), not delivered as a fait accompli; faster sentence-formation/communication rate; better voice quality and customization; multilingual/non-English vocabulary support; coordinated (not siloed) professional support across therapy providers; continued access without financial catastrophe; and social inclusion support for their AAC-using child, not just device functionality.

14.3 Problem/opportunity table

PROBLEM MENTIONED	USER TYPE	FREQUENCY (QUALITATIVE)	SEVERITY	EXISTING SOLUTIONS	OPPORTUNITY
Slow communication rate / cannot keep up with real-time conversation	AAC users themselves; parents	High; repeatedly independently documented across self-advocate writing, ASHA Leader features, and Berenguer et al. 2022 synthesis	High; linked to social exclusion and being perceived as less capable than actual cognitive ability	Word prediction, phrase banks, motor-plan-based systems (e.g., LAMP Words for Life)	Faster, context-aware prediction/generation (with strong authorship/privacy safeguards) that preserves the user's authentic voice rather than guessing generically
High cost of devices/apps ($125–$300+ for leading apps; $8,000–$15,000+ for dedicated SGD hardware per parent-report)	Parents	High; recurring theme in both academic synthesis and app-store reviews	High; direct access barrier, can determine whether a child gets any AAC at all pre-funding-approval	Insurance/Medicaid funding pathways, manufacturer funding-assistance programs (Tobii Dynavox, Lingraphica, PRC-Saltillo)	Lower-cost/tiered offerings; funding-navigation tooling to reduce the administrative burden that currently falls on parents and clinics

PROBLEM MENTIONED	USER TYPE	FREQUENCY (QUALITATIVE)	SEVERITY	EXISTING SOLUTIONS	OPPORTUNITY
Device/training complexity ("steep learning curve," "not for first-time users")	Parents, AAC users, new SLPs	Medium-high; documented in Yau et al. 2024 (44-90% ranking knowledge/training a top barrier depending on stakeholder) and app-store reviews	High for new users/families, especially without professional support	Manufacturer training materials, third-party coaching (fee-based)	Better onboarding UX; layered complexity (simple-start, progressively unlockable) rather than all-features-at-once
Devices excluded from selection process (schools/teachers)	Teachers, educators	Documented; 80% of educators in Yau et al. 2024 ranked device fit a top-3 barrier, explicitly citing exclusion from selection	High; undermines classroom implementation entirely	None systematic; ad hoc IEP-team involvement	Structured multi-stakeholder feature-matching tools that formally include teachers pre-purchase
Stigma / public misunderstanding of device users' capability	Parents (directly experienced); AAC users (directly experienced, per self-advocate writing); clinicians (perceive as parental over-perception)	High, but contested in attribution (see Yau et al. 2024 attribution-gap finding)	High; affects social participation and self-esteem	Awareness campaigns (ISAAC, advocacy orgs); none device-level	Product/UX choices that reduce device "othering" (e.g., less clinical-looking hardware/UI); but must be balanced against not tokenizing aesthetics over function
Cannot express personality/higher-level thinking through default vocabulary sets	AAC users themselves (strongest direct evidence from Emma Zurcher-Long and ASHA Leader quotes)	Medium (fewer sources, but very high-severity direct quotes)	High; described by users as a core dignity issue, not a cosmetic one	Extensive manual customization (time-burdensome per Berenguer et al. 2022)	Tools for faster, lower-burden personal-voice customization; AI-assisted vocabulary suggestions reviewed/approved by the user, not auto-generated without consent
Vocabulary not multilingual/culturally relevant	Multilingual families	Medium (clear documented pattern, smaller absolute source count in this pass)	Medium-high for affected families; potentially severe (total exclusion) if no home-language support exists at all	Some manufacturer multilingual vocab sets; mostly manual family/SLP customization	Native multilingual vocabulary architecture from initial design, not bolt-on translation
Difficulty transferring skills/settings between systems (school vs. home vs. new device)	Parents, teachers, SLPs	Medium-high (documented "carryover" barrier, Part 4.2.1)	High; repeated "reset" cost at every transition	None systematic identified	Portable communication-profile/data-portability standard
Caregiver dependence / cannot use AAC independently in all contexts (e.g., car, noisy environments)	Parents	Medium (direct quotes in Berenguer et al. 2022)	Medium-high; restricts ordinary daily-life communication opportunities	Low-tech backup boards; none high-tech specific	Context-adaptive/portable low-power modes; better non-visual or lower-attention access methods
Device breakage / battery / physical robustness	Parents	Medium (documented in Berenguer et al. 2022 synthesis; commonly mentioned in app-review/product-support anecdotes though not independently quantified in this pass)	Medium; inconvenience up to communication-outage severity	Manufacturer warranties/repair programs	Ruggedized hardware design; redundant/backup access modes during repair windows
Insurance/funding delay	Parents, hospital/clinic staff	High (well-documented, quantified: 6–12 week baseline, 1–6 month appeals)	High; can leave a child without any communication support during the gap	Manufacturer funding-navigation teams; persistence-based appeals (93% eventual approval with added documentation)	Streamlined, standardized medical-necessity documentation tooling; interim/bridge-device loan programs

14.4 Explicit limitation statement for Part 14

Because direct Reddit/forum access was unavailable in this session, the raw-anecdote density that the assignment envisioned (e.g., verbatim r/AAC or r/CerebralPalsy threads) is **thinner than the assignment's ideal**, and is substituted with published-qualitative-research quotes and app-store reviews, which are the closest available proxies but are not identical in character to unmoderated forum discussion (they are more likely to be filtered through either academic methodology or app-store review-solicitation prompts, both of which can shape what gets said). Any downstream use of this Part 14 table should treat the "Frequency" column as a rough qualitative impression built from a narrower source base than originally scoped, not a rigorously sampled measurement, and should ideally be supplemented later with direct Reddit/forum data collection through a tool or process with reddit.com access.

Master source list (all parts)

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- Emma's Hope Book (Emma Zurcher-Long blog, secondary summary source); https://emmashopebook.com/

- ASHA Leader, “From Frustration to Understanding: An AAC Story of Presuming Potential”; https://leader.pubs.asha.org/do/10.1044/leader.FTR2.30032025.AAC-presumed-potential.46/full/
- Apple App Store, Proloquo2Go reviews; https://apps.apple.com/us/app/proloquo2go-aac/id308368164?see-all=reviews *Research stream D; Parts 6, 7, and 12 of the investor-grade AAC research report*

Tagging convention used throughout: `FACT` (cited), `ESTIMATE` (bottom-up calculation shown), `CLAIM` (attributed to a named speaker/source, may be self-interested), `HYPOTHESIS` (reasoned but unverified). Where market-research vendor numbers are cited, they are explicitly triangulated against independent inputs rather than trusted at face value.

PART 15: 15–20 PEOPLE TO STUDY

1. **Charles K. Bliss** (1897–1985); Creator of Blissymbolics. Holocaust survivor whose original ambition was a universal, logically composed international symbol language; his system was later repurposed (against some of his own wishes) as a clinical AAC tool. ISAAC: The Symbols of Bliss
2. **Shirley McNaughton:** Led the Ontario Crippled Children's Centre (now Holland Bloorview) team that first clinically adapted Blissymbolics for non-speaking children with cerebral palsy (1971), founding the practical field of symbol-based AAC. Blissymbolics.org; Shirley McNaughton CV
3. **William C. Stokoe:** Gallaudet English professor whose 1960 monograph founded sign-language linguistics, proving ASL is a true language with its own phonology/morphology; created "Stokoe notation." Wikipedia: William Stokoe
4. **Dorothy Casterline and Carl Cronenberg:** Co-authors with Stokoe of *A Dictionary of American Sign Language on Linguistic Principles*, the first sign-language dictionary built on linguistic (not merely lexicographic) principles.
5. **Gregg Vanderheiden:** Founded what became the Trace Research & Development Center (early 1970s) after building a communication board for a non-speaking boy with CP; coined/popularized the term "augmentative communication" (1979) and shaped both AAC and computer-accessibility standards for 45+ years. Vanderheiden 2002 retrospective
6. **Bruce Baker:** Conceived Minspeak (semantic compaction/motor-planning icon sequences) as a doctoral student in linguistics; partnered with Prentke Romich starting ~1981 to commercialize it. Minspeak History
7. **Barry Romich:** Co-founder/leader of Prentke Romich Company (PRC); partnered with Baker to bring Minspeak to market in commercial SGDs starting 1982–1983. PRC-Saltillo; Our History
8. **Andy Bondy, Ph.D. and Lori Frost, MS, CCC-SLP:** Co-developed PECS (1985) at the Delaware Autism Program and founded Pyramid Educational Consultants to disseminate it worldwide. ASAT overview of PECS
9. **Dennis H. Klatt:** MIT speech scientist whose KlattTalk/MITalk research (1960s–1980s) became the basis for DECtalk, the synthetic-speech engine most famously used by Stephen Hawking. Poignantly, Klatt lost his own voice to cancer treatment. Wikipedia: Dennis H. Klatt
10. **Walter Woltosz:** Founder/CEO of Words Plus; built the "Equalizer" software (1986) that gave Stephen Hawking his voice, originally developed to help his own mother-in-law who had ALS. Computer History Museum on DECtalk/Hawking
11. **Stephen Hawking:** Not an inventor, but the single most consequential public AAC user in history; his decades-long, highly visible use of a switch-scanning SGD with synthesized speech shaped public understanding of what AAC is and can achieve.
12. **Roxanna (Roxie) Mayer-Johnson:** Speech-language pathologist who created the Picture Communication Symbols (PCS) in the 1970s and co-founded Mayer-Johnson with husband Terry Johnson; PCS became (and largely remains) the default visual vocabulary of mainstream AAC software. Wikipedia: Picture communication symbols
13. **Gayle Porter:** Australian speech pathologist (Cerebral Palsy Education Centre, Victoria) who developed PODD (Pragmatic Organisation Dynamic Display) over roughly 15 years, reorganizing AAC vocabulary around conversational pragmatics rather than static topic boards. CPEC; PODD
14. **Toby Churchill:** British entrepreneur, paralyzed and non-speaking after a 1968 illness, who founded Toby Churchill Ltd. (1973) and created the Lightwriter, a foundational UK SGD line; a "founder as user" case study. Wikipedia: Toby Churchill
15. **David Niemeijer, PhD:** Founder/CEO of AssistiveWare (2000); creator of Proloquo and then Proloquo2Go (2009), the app widely credited with moving AAC onto mainstream consumer tablets and dramatically lowering cost/stigma. AssistiveWare; David Niemeijer
16. **David R. Beukelman (1943–2022):** University of Nebraska–Lincoln researcher, co-author (with Pat Mirenda) of *Augmentative and Alternative Communication: Supporting Children and Adults with Complex Communication Needs*, the field's dominant graduate textbook; widely described as one of the principal founders of the AAC research field. Tandfonline tribute to Beukelman
17. **Pat Mirenda:** Co-author of the same foundational AAC textbook; major contributor to AAC-and-autism research (e.g., co-editor of *Autism Spectrum Disorders and AAC*).
18. **Janice Light:** Penn State researcher, added as a co-author for the textbook's 5th edition; leading researcher on AAC for children/youth with developmental disabilities and on the construct of "communicative competence" in AAC.
19. **John Eulenberg:** Director of the Artificial Language Lab at Michigan State University; hosted and helped organize the May 1983 East Lansing meeting where ISAAC was founded and the term "AAC" was formally adopted. ISAAC; Wikipedia
20. **Edward Chang, MD:** UCSF neurosurgeon/researcher leading the Chang Lab's speech-neuroprosthesis work (BRAVO trial), producing the 2021 and 2023 breakthroughs in decoding words and full sentences directly from speech-motor cortex activity in paralyzed, non-speaking patients. Chang Lab; Speech Neuroprosthesis

PART 16: ORGANIZATIONS

Professional / membership organizations

- **ISAAC; International Society for Augmentative and Alternative Communication.** Founded May 1983, East Lansing, Michigan; the field's global professional body, with national chapters (USSAAC, ISAAC Canada, and 17 countries/regions total per Wikipedia). Publishes the *AAC* journal and runs biennial international conferences. isaac-online.org; Wikipedia
- **USSAAC; United States Society for Augmentative and Alternative Communication.** US chapter of ISAAC; runs "Leaders & Legends" oral-history interviews (e.g., with Gregg Vanderheiden) that are a valuable primary source for AAC history. ussaac.org
- **ASHA; American Speech-Language-Hearing Association.** The main US professional/credentialing body for speech-language pathologists; maintains the AAC Practice Portal (clinical guidance) and issues field-shaping position statements; including the contested 2018 statement discouraging Facilitated Communication and RPM/Spelling to Communicate. ASHA AAC Practice Portal
- **RESNA; Rehabilitation Engineering and Assistive Technology Society of North America.** Interdisciplinary professional organization covering assistive technology broadly (including AAC); certifies Assistive Technology Professionals (ATP) and hosts an annual conference used heavily by device manufacturers and clinicians. (Referenced but with limited standalone detail surfaced in this research pass; recommend direct follow-up at resna.org for a deeper organizational history if needed for later drafts.)
- **Pyramid Educational Consultants:** The training/consulting organization founded by Andy Bondy and Lori Frost to disseminate PECS worldwide via certified training. pecs.com
- **Blissymbolics Communication International (BCI):** The organization maintaining and governing the Blissymbolics standard/vocabulary today. blissymbolics.org

Research centers / university programs

- **Trace Research & Development Center:** Originated at the University of Wisconsin–Madison in the early 1970s around Gregg Vanderheiden's work; now housed at the University of Maryland's iSchool; foundational center for both AAC and general digital accessibility/universal design standards, celebrating 50+ years of continuous R&D. Trace Center 50-year history release
- **Chang Lab, UC San Francisco:** Edward Chang's neurosurgery/neuroscience lab; runs the BRAVO clinical trial for ECoG-based speech neuroprostheses; source of the 2021 and 2023 landmark speech-decoding results. changlab.ucsf.edu
- **BrainGate Consortium:** Multi-institution research collaboration (Brown University, Massachusetts General Hospital/Harvard, Stanford, UC Davis, Case Western/VA, and others) developing intracortical BCIs, including BrainGate2, the platform behind the 2025 UC Davis real-time speech result. Referenced via NIH/NPR coverage
- **RERC on AAC (Rehabilitation Engineering Research Center on AAC), Penn State:** Federally funded (NIDILRR) rehabilitation engineering research center specifically focused on AAC technology; published the tribute to David Beukelman cited above. rerc-aac.psu.edu
- **Michigan State University Artificial Language Lab:** John Eulenberg's lab; historically important as the host of the 1983 ISAAC founding meeting and early AAC/computer-language research.
- **Cerebral Palsy Education Centre (CPEC), Victoria, Australia:** Home institution where Gayle Porter developed and refined PODD. cpec.org.au/podd
- **Ontario Crippled Children's Centre (now Holland Bloorview Kids Rehabilitation Hospital), Toronto**; Site of Shirley McNaughton's foundational 1971 clinical Blissymbolics program.

Journals

- **Augmentative and Alternative Communication (the "AAC" journal):** Founded 1985, published by Taylor & Francis on behalf of ISAAC; the field's flagship peer-reviewed quarterly journal; current editor-in-chief Ralf Schlosser (Northeastern University); reported 2018 impact factor of 2.706. Wikipedia: AAC journal; Tandfonline journal home

Companies (device/software makers: organizational rather than biographical entries)

- **Prentke Romich Company (PRC) → PRC-Saltillo (merged 2019):** Oldest major dedicated-SGD manufacturer lineage (50+ years); products include Minspeak/Unity, LAMP Words for Life, Accent and PRiO hardware, TouchChat, NovaChat. prc-saltillo.com/why-prc-saltillo/history
- **Sentient Systems Technology → DynaVox → DynaVox Systems (1998 Sunrise Medical merger) → Tobii Dynavox (2014 acquisition)**; Second major legacy SGD lineage; pioneered eye-gaze SGDs and Medicare SGD coverage advocacy. dynavoxgroup.com/pages/our-history
- **Tobii Technology / Tobii AB:** Swedish eye-tracking company (founded 2001); acquired DynaVox in 2014 to form Tobii Dynavox, now the dominant player in eye-gaze-enabled SGDs (I-Series, TD Snap software). corporate.tobii.com/about-us/history-of-tobii
- **Toby Churchill Ltd.:** UK SGD maker (founded 1973), maker of the Lightwriter line; historically linked to the "Liberator" branded devices in the UK AAC market. Wikipedia: Toby Churchill

- **AssistiveWare:** Founded 2000 by David Niemeijer; maker of Proloquo2Go and successor Proloquo products; credited with catalyzing the consumer-tablet AAC market from 2009 onward. assistiveware.com/about
- **Mayer-Johnson, LLC → Tobii Dynavox:** Original publisher of PCS symbols (1980s founding by Roxanna and Terry Johnson); PCS rights now owned by Tobii Dynavox. Wikipedia: Picture communication symbols
- **Attainment Company:** Maker of the GoTalk mid-tech device line since 1993. attainmentcompany.com
- **Smartbox:** UK maker of the Grid software/hardware AAC line.
- **CoughDrop:** Open-source-friendly, cross-platform symbol-based AAC app/company with a data-tracking/analytics emphasis.
- **Avaz:** AAC app company, notable for strong presence in the Indian/South Asian AAC market alongside global use.
- **Lingraphica:** SGD maker specializing in aphasia (stroke-related language loss) rather than developmental disability populations.
- **Words Plus:** Walter Woltosz's company; historically significant as the maker of the Stephen Hawking "Equalizer"/EZ Keys software lineage.
- **Voiceitt:** Founded 2012 (Israel); ASR-for-atypical-speech company, distinct from symbol-substitution AAC; it aims to make a user's own impaired speech machine-understandable. futurumgroup.com coverage
- **SignAll:** Company building camera-based sign-language-to-text/speech translation technology (video-based, since ~2016). signall.us
- **Neuralink:** Elon Musk-founded BCI company; first human cursor-control implant in 2024 (Noland Arbaugh), announced dedicated speech-implant trial for ~October 2025.
- **Acapela Group, CereProc, VocaliD, ModelTalker:** Voice-banking/personalized synthetic-voice vendors serving the ALS/progressive-illness AAC population; Acapela's voice-banking solution won a CES 2023 Innovation Award. Dynavox Group press release on Acapela CES award
- **Google (Project Relate / Project Euphonia):** Google Research initiative(s) applying ML to improve speech recognition for people with atypical/dysarthric speech, conceptually parallel to Voiceitt but from a large-platform R&D angle.

Sources consolidated (representative, not exhaustive: full URLs also appear inline above)

- ISAAC: https://isaac-online.org/english/home/ and https://en.wikipedia.org/wiki/International_Society_for_Augmentative_and_Alternative_Communication
- ASHA AAC Practice Portal: https://www.asha.org/practice-portal/professional-issues/augmentative-and-alternative-communication/
- ASHA RPM/FC position: https://www.asha.org/policy/ps2018-00351/ and https://www.asha.org/about/press-room/fc-and-rpm/
- Trace R&D Center: https://trace.umd.edu/news/new-history-of-the-trace-center-released-technology-and-disability-50-years-of-trace-rd-center-contributions-and-lessons-learned/
- PRC-Saltillo history: https://prc-saltillo.com/why-prc-saltillo/history ; Minspeak history: https://minspeak.com/minspeak-history/
- DynaVox/Tobii history: https://dynavoxgroup.com/pages/our-history ; https://corporate.tobii.com/about-us/history-of-tobii
- AssistiveWare/Proloquo2Go: https://www.assistiveware.com/person/david-niemeijer ; https://medium.com/@AssistiveWare/the-democratization-of-communication-cfa81eb2dd17
- PECS: https://asatonline.org/for-parents/learn-more-about-specific-treatments/picture-exchange-communication-system-pecs/ ; https://en.wikipedia.org/wiki/Picture_Exchange_Communication_System
- Blissymbolics: https://isaac-online.org/the-symbols-of-bliss/ ; https://www.blissymbolics.org/index.php/about-blissymbolics
- William Stokoe / ASL linguistics: https://en.wikipedia.org/wiki/William_Stokoe
- Martha's Vineyard Sign Language: https://en.wikipedia.org/wiki/Martha's_Vineyard_Sign_Language
- Helen Keller/Anne Sullivan manual alphabet: https://www.afb.org/about-afb/history/online-museums/anne-sullivan-miracle-worker/formative-years/manual-alphabet
- DECtalk/Klatt/Hawking: https://computerhistory.org/blog/how-dectalk-gave-voice-to-a-genius-engineering-stephen-hawkings-wheelchair/ ; https://en.wikipedia.org/wiki/Dennis_H._Klatt
- Words Plus/Woltosz/Equalizer: https://beyondwords.io/blog/stephen-hawkings-voice/
- POSSUM: https://www.nature.com/articles/sc196315 ; Toby Churchill: https://en.wikipedia.org/wiki/Toby_Churchill
- E-TRAN history: https://store.lowtechsolutions.org/what-is-an-e-tran/
- Picture Communication Symbols/Mayer-Johnson: https://en.wikipedia.org/wiki/Picture_communication_symbols
- GoTalk/Attainment Company: https://www.attainmentcompany.com/technology/gotalks
- PODD/Gayle Porter: https://www.cpec.org.au/podd
- TouchChat/Saltillo: https://touchchatapp.com/articles/new-and-improved-app-websites-from-prc-saltillo?mode=view
- AAC journal: https://en.wikipedia.org/wiki/Augmentative_and_Alternative_Communication_(journal)
- Apple accessibility timeline: https://www.macstories.net/stories/a-timeline-of-ios-accessibility-it-started-with-36-seconds/
- Sign language recognition/computer vision: https://pmc.ncbi.nlm.nih.gov/articles/PMC10535774/ ; https://www.signall.us

- Silent speech/EMG/EEG interfaces: https://openbci.com/community/synthetic-telepathy-with-subvocal-recognition-neurotechsc/ ; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC12526642/
- UCSF speech neuroprosthesis: https://changlab.ucsf.edu/speech-neuroprosthesis ; https://www.nature.com/articles/s41586-023-06377-x ; https://www.ucsf.edu/news/2021/07/420946/neuroprosthesis-restores-words-man-paralysis
- Neuralink/BCI 2024-2025: https://www.npr.org/sections/shots-health-news/2025/06/30/nx-s1-5339708/brain-computer-interface-implants-disabilities-neuralink ; https://applyingai.com/2025/09/neuralinks-2025-speech-implant-trial-a-business-focused-deep-dive/
- Voiceitt/Google Project Relate/dysarthric speech ASR: https://futurumgroup.com/insights/voiceitt-launches-accessible-and-inclusive-voice-enabled-experience-app/ ; https://www.tandfonline.com/doi/full/10.1080/10400435.2024.2328082
- Voice banking (ALS Association, Acapela, VocaliD, CereProc): https://www.als.org/support/programs/voice-banking-0 ; https://dynavoxgroup.com/blogs/press-releases/acapela-group-s-voice-banking-solution-named-as-ces-2023-innovation-awards-winner
- Terminology dispute (nonverbal/nonspeaking): https://www.autismparentingmagazine.com/nonverbal-vs-nonspeaking/ ; https://stimpunks.org/glossary/nonspeaking/ ; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11197385/

Research date: September 5, 2026. All facts are cited with source URLs and dated where the underlying source is dated. Claims tagged per research standard: `FACT` (cited), `ESTIMATE` (reasoning shown), `CLAIM` (attributed to a company/person, unverified), `HYPOTHESIS` (analyst inference).

PART 17: STARTUP AND INVESTMENT LANDSCAPE

17.1 Startups (founded ~last 10–15 years, i.e., since ~2011)

Voiceitt

- Covered in Part 3 above. FACT Total funding $21M–$33.7M depending on source; latest confirmed round Series A, closed Dec 2, 2022. Technology: personalized ASR for dysarthric/non-standard speech. Business model: appears B2B/B2C hybrid (not fully confirmed). Status: appears active/independent as of 2026.

Cboard

- Covered in Part 3 above. Founded ~2015 (per ALS-diagnosis origin story), Argentina/Israel. Funding model: Open Collective crowdfunding, not VC. Status: active, recently shipped Cbuilder AI feature (Jan 2026).

Cognixion

- Covered in Part 3 above. Founded 2014 (as Smartstones, rebranded). $29M total raised. Investors: Prime Movers Lab, Amazon Alexa Fund, Samsung NEXT, Intel Capital, CABHI, Memorial Hermann Foundation, Northwell Holdings, Verizon Forward for Good (per BusinessWire 2020 release). Technology: non-invasive EEG + AR + AI for speech/communication. Status: active; partnered on Apple Vision Pro integration.

Synchron

- FACT Non-surgical, endovascular brain-computer interface ("Stentrode"). **Series D of $200 million closed November 6, 2025**, led by **Double Point Ventures**, with **ARCH Ventures, Khosla Ventures, Bezos Expeditions, NTI, METIS** as existing investors and new investors **Australian National Reconstruction Fund, T.Rx Capital, Qatar Investment Authority, K5 Global, Protocol Labs, IQT**. **Total funding to date: $345 million.** Use of funds explicitly includes expanding a "cognitive AI division" in New York to train models on brain data, plus an engineering hub in San Diego. Target market: paralysis (ALS, spinal cord injury, stroke); mobility, communication, and independence. BusinessWire; MedTech Dive

Precision Neuroscience

- FACT Neuralink competitor building a **thin-film, wireless cortical BCI**. A core system component received **FDA clearance in April 2025:** reported as the first full regulatory clearance for a wireless BCI. Initial target application: restoring speech and movement for patients with severe paralysis. CNBC

Paradromics

- FACT FDA approved a clinical study (November 2025) to evaluate Paradromics' BCI for speech restoration; evaluating safety and ability to provide text/synthesized-speech communication for people with paralysis. STAT News

Neuralink (communication-relevant activity)

- Neuralink is broadly known (general knowledge, not independently re-confirmed via a dedicated search in this pass) to be pursuing speech-decoding as one of its BCI application targets, competing directly with Synchron, Precision Neuroscience, and Paradromics in the paralysis-communication BCI race. Treat any specific Neuralink funding/trial figures as needing separate verification from another research stream, since this stream did not run a dedicated Neuralink search.

Sesame Enable (failed: see Part 18)

- Founded 2007, Israel, by **Giora Livne** (quadriplegic naval officer) and **Oded Ben Dov:** head-motion-based touch-free smartphone/tablet control (assistive access technology, adjacent to AAC access methods). **Shut down late 2019** due to inability to build a sustainable business model; technology released for free use before shutdown. Sesame Enable

17.2 Investors, accelerators, foundations active in assistive/communication tech

- FACT **Adaptation Ventures:** described by TechCrunch (May 20, 2025) as "the first angel fund dedicated to disabled founders," focused on disability/accessibility tech broadly. TechCrunch
- FACT **ATX Impact Ventures:** assistive-technology-focused fund co-sponsored by **Kois** and **Disability Impact Partners**, targeting low- and middle-income country markets. ATX Impact Ventures
- FACT **AT2030 Programme / Accessible & Assistive Tech Growth Fund (AT Growth Fund):** described as aiming to be a leading scaling vehicle for growth-ready assistive-tech ventures in low/middle-income countries. AT2030

- FACT **Remarkable:** "disabilitytech" accelerator/venture arm of the **Cerebral Palsy Alliance**, backs startups from pre-seed through Series A, including US companies, via training/capital/networks. Perkins School for the Blind roundup
- FACT **2Gether-International (2GI):** disability-led nonprofit startup accelerator operating since 2019, run by and for entrepreneurs with disabilities.
- FACT **Assistive Technologies for Disability Trust (AT4D)** (Kenya) partnered with the **Judith Neilson Foundation** to launch a **$500,000 "Momentous Pilot Fund"** (reported March 2026) supporting digital solutions for mobility, communication, inclusive education, and digital accessibility in Africa. AllAfrica
- **Corporate strategic investors identified funding communication-accessibility startups directly: Amazon Alexa Fund** (Cognixion), **Intel Capital** (Cognixion), **Samsung NEXT** (Cognixion); indicating big-tech corporate venture arms are a real, if selective, funding source in this space, generally attaching to AI/hardware-forward startups rather than pure clinical-AAC-app plays.
- **ESTIMATE (context, not a direct source for this specific number):** Broader market-context reporting states the overall assistive/accessible technology market is projected to grow from roughly $30 billion today to over $60 billion by the early 2030s at 6–9% annual growth (per the Perkins/AT-fund roundup source); this is a market-wide figure (all assistive tech, not AAC-specific) and should not be conflated with the ~$2–2.3B AAC-specific figures in Part 3.

PART 18: FAILURE ANALYSIS

Each case below is a real, sourced company/product/technology that failed, was discontinued, was forcibly divested, or failed to achieve durable adoption, followed by a concrete lesson.

1. DynaVox Inc.: bankruptcy (2013–2014)

- FACT DynaVox Inc. (the pre-Tobii dedicated-SGD hardware maker) filed for bankruptcy; its operating affiliates were sold via a competitive bankruptcy auction for **$18 million** to Tobii Technology AB, approved by a Delaware court May 22, 2014. Law360
- **Why:** The timing (2013–2014) coincides directly with the iPad/app-store disruption of the dedicated-hardware category; cheaper, more capable consumer tablets with $70–$300 AAC apps undercut $8,000–$15,000 dedicated devices just as DynaVox was carrying the cost structure of a hardware-first company.
- **Lesson for a new entrant:** A dedicated-hardware business model is extremely exposed to consumer-electronics platform shifts. Any hardware-based communication company needs either (a) IP/access-method advantages (e.g., proprietary eye-tracking) that a general tablet genuinely cannot replicate, or (b) a software/subscription revenue line that survives even if the hardware itself gets commoditized.

2. Toby Churchill Ltd → Abilia/Lightwriter ownership churn

- FACT Toby Churchill Ltd, maker of the pioneering **Lightwriter** text-based communication aid (founded 1973), is today marketed under the **Abilia** brand; indicating a change of corporate ownership/branding over time (specific transaction details and dates were **not confirmed** in this research pass; flagged as a data gap, not a confirmed failure narrative). Wikipedia; Lightwriter
- **Lesson:** Even category-pioneering, decades-old dedicated-device brands are not immune to ownership consolidation as the market shifts to software/tablet-based solutions; long product histories do not guarantee independence.

3. Verbally / Verbally Premium (Intuary): app discontinued

- FACT Verbally and Verbally Premium, text-based AAC apps made by **Intuary**, were **removed from the Apple App Store on January 31, 2022**. OMazing Kids AAC Consulting
- **Why (HYPOTHESIS, not directly confirmed by a company statement in search results):** App-store AAC economics are brutal; competing against $300 one-time-purchase incumbents (Proloquo4Text, TouchChat) with entrenched clinician recommendation networks makes new entrant customer acquisition extremely difficult; a text-based AAC app also faces a smaller addressable literate-user segment than symbol-based apps.
- **Lesson:** AAC is a **clinician-gatekept, recommendation-driven market**, not a self-serve consumer app market. A new app-based entrant must invest in SLP/clinician relationships and clinical credibility from day one, not just app-store optimization; general app-store growth tactics do not transfer to this vertical.

4. Sesame Enable: shut down 2019

- FACT Founded 2007 (Israel) by Giora Livne (quadriplegic) and Oded Ben Dov; built touch-free, head-motion smartphone/tablet control. **Shut down late 2019** because "building a sustainable business model proved difficult"; released the technology free before closing. Sesame Enable
- **Why:** Classic **access-technology monetization problem:** the target population (severe motor impairment) is small, often not the direct purchaser (insurance/state agencies are), and free/built-in alternatives (Apple's own head-tracking/Switch Control features) improved over the company's lifetime, eroding the differentiation of a standalone paid product.
- **Lesson:** Any startup building an access-method layer (head tracking, eye gaze, voice control) on top of mainstream consumer devices must plan for the mainstream platform vendor (Apple/Google/Microsoft) eventually shipping a "good enough" free version of the same capability natively; a real and recurring existential risk (HYPOTHESIS generalized from this case plus the Google Project Relate / Apple Live Speech pattern noted in Part 3).

5. Tobii's forced divestiture of Smartbox (2018–2020): a regulator-driven "failure" of a consolidation strategy

- FACT UK CMA blocked/unwound Tobii's 2018 acquisition of Smartbox, finding it risked "less choice, lack of innovation, and higher prices" for AAC users; Smartbox was re-divested for £13.4M in October 2020. GOV.UK
- **Why this is a failure worth studying:** it is a rare explicit regulatory finding that **over-consolidation actively harms this specific patient population:** a cautionary tale for any new entrant's own eventual M&A/exit strategy (an acquirer with a dominant hardware+eye-tracking position may face antitrust friction acquiring adjacent players).
- **Lesson:** For a startup contemplating being acquired by (or acquiring) a dominant incumbent in this space, antitrust scrutiny is a real, documented risk specific to the AAC market; not a hypothetical.

6. Speak for Yourself patent lawsuit (2012–2013): chilling effect on smaller competitors

- FACT SCS/PRC sued the two-person, SLP-founded Speak for Yourself app over alleged infringement of Minspeak-style semantic-compaction patents; the case triggered public backlash (families feared losing app access) and settled with a license/confidential terms in October 2012. Disability Scoop
- **Why relevant as a "failure" lesson even though Speak for Yourself survived:** the episode shows a small, clinically-credible new entrant can be legally cornered by an incumbent's IP even while building a genuinely differentiated product, and had to divert scarce resources into litigation defense rather than product development during a critical early growth period.
- **Lesson:** A new entrant should conduct **freedom-to-operate analysis on icon-encoding/semantic-compaction-style features specifically** before shipping (see Part 8.2), and budget legal-defense reserves given the incumbent's demonstrated willingness to litigate.

7. iPad/tablet disruption of the dedicated-SGD hardware category generally

- **FACT (synthesized from multiple sources in Part 3 research):** Industry commentary consistently frames 2010-era iPad adoption as fundamentally disrupting the $8,000–$15,000 dedicated-device category by offering $70–$300 apps on a $300–$900 consumer tablet; one source notes a fully-equipped iPad AAC setup (device + case + keyguard) runs roughly $710–$900 total. AssistiveWare; "democratization of communication"; Paradromics AAC device comparison
- **Why:** classic low-end market disruption; a "good enough," dramatically cheaper substitute captured a large share of the addressable market, forcing legacy hardware vendors (DynaVox, and by extension the wider dedicated-SGD category) to either consolidate (Tobii's roll-up strategy) or reposition around features tablets genuinely cannot replicate (eye-tracking hardware, DME-covered durability/warranty, dedicated switch interfaces).
- **Lesson:** A new communication-hardware entrant must assume any pure "better tablet app holder" positioning is vulnerable to the next platform shift; durable differentiation has to come from something a general-purpose device cannot trivially replicate (proprietary sensing hardware, clinically-validated encoding methods, or funded/warrantied service infrastructure), not screen size or app design alone.

8. AAC device/app abandonment as a chronic, system-wide failure pattern (not one company, but a documented systemic failure)

- FACT Multiple peer-reviewed/clinical sources converge on **AAC abandonment rates of roughly 30–50%** over time, with one estimate suggesting only ~40% of AAC users continue to use their system effectively long-term. SpeechPathology.org 2026 back-to-school guidance; PubMed; Predictors of assistive technology abandonment
- **Why:** Documented drivers across the literature include insufficient communication-partner (family/caregiver/teacher) training, poor fit between device complexity and user's actual motor/cognitive/literacy profile, and lack of ongoing clinical support after initial device provisioning; i.e., the *sale* of a device or app is not the same as durable *adoption*.
- **Lesson:** A new entrant's product and business model must treat **onboarding, caregiver training, and longitudinal engagement** as core product surface area, not an afterthought; a company that only optimizes for the initial sale/prescription event, without building sustained caregiver/therapist engagement loops, is optimizing for a metric (device placement) that has a 30–50% documented failure rate at the outcome that actually matters (sustained functional communication).

9. Speech-generating-device patent-litigation risk as a structural deterrent to new entrants (systemic, illustrated by case #6)

- Already covered in #6 above as its own case; listed again here only to flag it explicitly as a *structural* market feature (not a one-off event); patent assertion by incumbents against small AAC-app entrants has precedent and should be modeled as a recurring risk category, not a historical curiosity.

10. VocaliD's independent existence ending via acquisition into a non-AAC-focused company

- FACT VocaliD (personalized voice banking, relevant to giving AAC/ALS/voice-loss users a natural-sounding personalized voice) was acquired by **Veritone** (a general enterprise AI company) in June 2022; its patents were reassigned to Veritone in September 2022. BusinessWire
- **Why relevant as a failure-adjacent lesson (not a failure of VocaliD's technology, which was by most accounts good; but a failure of the *standalone company* model):** a mission-specific personalized-voice-banking company was ultimately more valuable as a feature/capability inside a general-purpose AI company's platform than as an independent business serving the (numerically small) voice-loss/AAC population alone.
- **Lesson:** Purely mission-specific "one clinical feature" companies in this space (personalized-voice-banking being the clearest example found) may face a structurally limited standalone total addressable market, making **acquisition into a broader AI/voice platform** a more likely outcome than an independent scale-up; a realistic exit-path expectation for a narrowly-scoped new entrant, and a reason to consider whether the product should be a platform (many use cases) or a feature (one use case) from the start.

11. Lingraphica funding-claim discrepancy as a caution about market-report reliability (methodological failure, not a company failure)

- Not a company failure, but a documented **research-integrity failure worth flagging explicitly**: a market-report-style source claimed Lingraphica raised a "$50 million Series B" for AI R&D, which could not be corroborated by Crunchbase/Tracxn/PitchBook-style primary sources, one of which explicitly shows no confirmed funding round as of mid-2025.
- **Lesson for the investor-grade report as a whole:** AI-generated market-report content is now common in search results for this sector and can fabricate specific, plausible-sounding funding figures. Any investor-facing claim about a specific company's funding round should be cross-checked against at least one primary source (SEC filing, company press release, Crunchbase/PitchBook direct profile) before being presented as fact; this report has flagged the one instance found during this research pass, but the pattern likely recurs elsewhere in AAC market coverage and other research streams should apply the same skepticism.

12. Non-invasive BCI-for-communication: an open clinical question, not yet a proven category (forward-looking risk flag, not a past failure)

- The current wave of BCI-for-communication funding (Synchron $345M total, Precision Neuroscience FDA clearance, Paradromics FDA trial approval) is **still pre-commercial** for all players identified in this research. None has a confirmed reimbursed, commercially available communication product as of this research date.
- **Lesson:** A new entrant should distinguish carefully between "well-funded and regulatorily-progressing" (true of Synchron/Precision/Paradromics) and "market-proven" (not yet true of any invasive/semi-invasive BCI-for-communication company); the sector's history (DynaVox, Sesame Enable, Verbally) shows that funding and regulatory progress do not guarantee durable commercial adoption in this specific vertical; the *next* wave of BCI failures, if they occur, will likely be diagnosed with the same root causes already seen in this report (reimbursement pathway, caregiver/clinical training burden, competition from improving non-invasive/software alternatives) rather than a novel failure mode.

Research gaps / items explicitly not found or not verifiable in this pass

- Widgit Software's ownership/shareholder structure and revenue.
- Precise founding year and independent verification of AssistiveWare's founding date (used a figure not independently re-confirmed in this pass).
- A clean, single-source reconciliation of Voiceitt's total funding ($21M vs. $33.7M discrepancy between sources).
- Confirmed details of a Toby Churchill Ltd → Abilia ownership transaction (dates, price, acquirer identity).
- Independent verification of Neuralink's specific speech/communication-focused funding or trial figures (not covered by a dedicated search in this research pass; recommend another stream verify if Neuralink is to be covered in depth elsewhere in the report).
- Confirmed current independent status/details of Enkidu Research's TangoTab AAC device (search returned an unrelated "TangoTab" restaurant-app company under the same name; a name collision, not a confirmed AAC-company profile). **Scope of this document:** Part 4 (Children Specifically), Part 5 (User Journeys), Part 10 (Controversies and Failed Approaches), Part 14 (What Parents and AAC Users Actually Want).

Tagging convention used throughout: FACT (cited, verifiable claim), ESTIMATE (reasoning-based approximation, source given for inputs), CLAIM (attributed to a named speaker/stakeholder, not independently verified), HYPOTHESIS (plausible but unproven mechanism/explanation). Qualitative/anecdotal sources (Reddit, forums, app reviews, blogs, YouTube) are explicitly labeled as such and are treated as **customer-discovery data, not scientific evidence**.

A note on terminology (applies throughout)

FACT : A diagnosis does not by itself determine communication ability. Children described as "autistic," "apraxic," "CP," etc. span an enormous range; from children with zero reliable spoken output to children with fluent-but-unpredictable speech that fails under stress, fatigue, or unfamiliar listeners. This document follows current disability-community and clinical guidance:

- **"Non-verbal":** a legacy term, still common in older medical literature and insurance paperwork, technically implying the absence of *language*, not just speech. Increasingly criticized as inaccurate and stigmatizing because many people labeled "non-verbal" have intact receptive/expressive language they cannot reliably output through speech (FACT, per multiple sources below).
- **"Non-speaking" / "minimally speaking" / "unreliably speaking":** increasingly preferred terms centering the actual observable phenomenon (absence or unreliability of spoken output) without implying an absence of language or thought. CLAIM (self-advocate framing, e.g. endever* via CommunicationFIRST): "nonspeaking" is preferred by many autistic self-advocates because it does not conflate lack of speech with lack of language or intellect.
- **"AAC user":** identity-neutral, used regardless of whether AAC is a primary, supplemental, or situational communication mode.
- Speech reliability is not binary or static: a child may speak fluently at home and become non-speaking under stress, in unfamiliar settings, or when fatigued or dysregulated (situational/context-dependent speech loss); documented in autism, selective mutism, and anxiety literature (FACT, ASHA Selective Mutism Practice Portal, https://www.asha.org/practice-portal/clinical-topics/selective-mutism/).

- ASHA has not to date issued a formal position statement adjudicating “non-verbal” vs. “non-speaking” terminology; the shift is largely community/advocacy-driven, though ASHA’s own clinical materials increasingly use “minimally verbal” and “complex communication needs” (ESTIMATE based on review of ASHA Practice Portal pages cited below; no single ASHA terminology position statement was located).

Sources: Nonverbal autism (Wikipedia, general orientation only); Giving Voice to Non-Speakers: Language, Respect and the Power of Naming – Autism Spectrum News; ASHA Selective Mutism Practice Portal; CommunicationFIRST guest blog by endever*

PART 19: BUILD-VS-BUY OPPORTUNITIES

For each component: **commodity vendors named**, and a **build-vs-buy** call with reasoning.

19.1 Text-to-speech (TTS)

BUY/LICENSE; commodity, with a caveat for pediatric voices.

FACT : Amazon Polly pricing: Standard ~$4.80/1M characters, Neural ~$19.20/1M, Generative ~$30/1M, Long-form ~$100/1M. Google Cloud TTS: ~$4/1M characters for standard voices, with a free tier (1M chars/month for WaveNet). Microsoft Azure: 129 neural voices across 54 locales, pay-per-character, 500K free chars/month. ElevenLabs: subscription tiers $5–$99+/month, roughly $0.05–$0.10 per 1K characters at the premium end, ~10K free chars/month. OpenAI TTS: $15/1M chars (tts-1), $30/1M (tts-1-hd). Source: aggregated comparison, Deepgram 2026 comparison; TTSEasy comparison.

FACT : ElevenLabs explicitly disallows children's/child-like voices in its public Voice Library (ElevenLabs Help); meaning a pediatric AAC company cannot simply self-serve child voices through ElevenLabs' standard consumer product and would need a direct enterprise agreement, a different vendor, or in-house/partnered voice modeling (e.g., academic VocaliD-style residual-vocalization techniques for children with atypical or absent speech).

Reasoning: Base TTS quality/latency/cost is now a genuinely commoditized, multi-vendor market (Google/Amazon/Microsoft/ElevenLabs/OpenAI all viable, sub-cent-per-message economics at AAC usage volumes). The defensible IP is *not* generic TTS; it's (a) personalized/child-appropriate voice banking pipelines, (b) prosody/emotion control tuned for AAC-typical short utterances, and (c) integration/latency engineering (must be near-instant for conversational use, unlike batch content-generation use cases most TTS vendors optimize for).

19.2 Speech-to-text / ASR for atypical speech

BUY the general ASR layer; BUILD/PARTNER for the dysarthric/atypical personalization layer.

FACT : Google's Project Euphonia dataset (1.5M+ utterances, ~3,000 speakers with atypical speech, expanding to Spanish/Japanese/French/Hindi) is a research asset feeding Google's own products (e.g., Project Relate, per search indexing), not a general-purpose licensable API for third parties as of this research. Voiceitt offers a commercial, independently licensable personalized-ASR engine for disordered speech (~$34M raised total, Series A Dec 2022). Sources: as cited in §13.6.

Reasoning: For typical/neurotypical speech input (e.g., a caregiver dictating, or a partially-verbal child's occasional clear words), commodity ASR (Google/Azure/AWS/OpenAI Whisper) is the obvious buy. But accurately recognizing the disordered, atypical, or emerging speech of many AAC-eligible children specifically requires either (a) a licensing/partnership deal with a specialist vendor (Voiceitt) or Google's research program, or (b) building a proprietary fine-tuned model on a company's own collected pediatric-atypical-speech dataset; which, if collected with consent at scale, could become a genuine data moat, since disordered/pediatric speech data is scarce and hard to collect (a recognized "data scarcity" problem per arXiv:2503.01266).

19.3 Symbol libraries

BUY/USE-OPEN as default; BUILD only for a differentiated proprietary symbol style if pursuing a premium/clinical positioning.

FACT : Open, freely licensable symbol sets include ARASAAC (~13,000 symbols, CC BY-NC-SA, free with attribution, downloadable in 10+ language packs), Mulberry (~3,000 symbols, CC BY-SA, now unmaintained), and Sclera (~11,000 high-contrast symbols, CC BY-NC). Source: OpenAAC symbol libraries page; Spectronics symbol set comparison.

FACT : Proprietary/commercial symbol sets; SymbolStix (used in 8 of the top 13+ iOS symbol-based AAC apps, the most widely used commercial set) and PCS/Picture Communication Symbols (used in 6 of the top 13+ apps); require licensing from their respective owners (Tobii Dynavox for SymbolStix; N2Y/Boardmaker for PCS), and Widgit is more prevalent in the UK market than the US. Source: Spectronics comparison; OMazing Kids AAC symbol usage summary.

Reasoning: Symbol libraries are a fully commoditized layer at the "has enough symbols to build a working vocabulary" level (ARASAAC alone is sufficient for MVP/most clinical use and is free). Buying/licensing a commercial set (SymbolStix/PCS) mainly buys *market credibility and clinician familiarity* (many SLPs are already trained on these specific symbol sets and existing student AAC boards use them), which matters for adoption/interoperability with schools even though it isn't a technical moat. A new entrant should default to open sets (ARASAAC/Mulberry/Sclera) to avoid licensing costs and lock-in, but budget for a SymbolStix or PCS license if targeting school/clinical procurement where switching costs for existing symbol-literate students are real. Symbol *generation* (AI-generated custom symbols/pictures per §9.4's VSD research) is a more differentiated build opportunity than static libraries.

19.4 AAC software engine / core app architecture

BUY/FORK open source as a baseline; BUILD the personalization/prediction layer.

FACT: CoughDrop is an open-source, web-based AAC app built on modern web standards (Web Speech API, IndexedDB, HTML5 offline caching) that uses the Open Board Format (OBF) for vocabulary-set portability. Source: GitHub; bcarter/coughdrop; IntuitionLabs profile.

FACT: Commercial competitors include TD Snap (Tobii Dynavox), TouchChat, and Proloquo2Go (AssistiveWare), the latter built around a "core-word Crescendo vocabulary" progression system. Source: Spectrum Unlocked comparison.

Reasoning: The Open Board Format (OBF) standard and CoughDrop's open-source codebase mean the *baseline* AAC app shell (grid UI, symbol display, TTS playback, offline caching, board navigation) is not defensible IP; it can be forked, licensed, or rebuilt cheaply, and OBF interoperability is actually valuable to support (schools/clinicians expect to move vocabulary sets between systems). The real build target is the layer on top: AI-personalized prediction (§9.2), contextual card recommendation (§9.3), and caregiver-modeling features (§9.7); none of which existing open-source AAC engines currently ship natively.

19.5 Eye tracking

BUY hardware/module; BUILD/TUNE the gaze-to-communication-intent layer.

FACT: Tobii holds what it calls the "world's largest eye tracking patent portfolio" (~850 filings, 400+ granted), covering hardware design, calibration, wearable and screen-based integration, illumination methods, and algorithms; and already supplies PRC-Saltillo's AAC eye-gaze devices. Source: Tobii IP licensing page; Tobii/PRC-Saltillo.

FACT: Lower-cost/software-only alternatives exist and are improving: Tobii Nexus (webcam-based, AI-driven), open-source WebEyeTrack (browser-based, few-shot on-device personalization, arXiv:2508.19544), and automotive-grade RGB-camera gaze pipelines (§13.5) that don't require dedicated IR hardware.

Reasoning: Given Tobii's dominant, deep, ~850-filing patent position specifically in eye-tracking hardware/calibration/algorithms, and its existing direct supply relationship with a leading AAC competitor (PRC-Saltillo), this is one of the clearest "buy or partner, do not build" calls in the whole landscape for any device requiring dedicated-hardware-grade gaze accuracy (patent counsel should specifically review freedom-to-operate before building any proprietary IR gaze-tracking hardware). However, the *webcam-only, software-based* gaze-estimation space (Tobii Nexus, WebEyeTrack, and similar academic/open approaches) is less patent-dense and more buildable, particularly for a lower-precision "attention/engagement" signal rather than pixel-accurate dwell-selection gaze typing.

19.6 Wearables: EMG and gesture input

BUY/PARTNER where possible; BUILD is currently hard because the leading platform (Meta) is closed.

FACT: Meta's Neural Band (from the 2019 CTRL-labs acquisition) is the first mass-market consumer EMG wristband, bundled only with Ray-Ban Display glasses at $799, not sold or (per available information) SDK-licensed standalone as of this research. Sources: as cited in §13.4.

Reasoning: Unlike TTS or symbol libraries, there is no mature, licensable, third-party commodity API for consumer-grade EMG gesture recognition today; Meta's leading consumer implementation is vertically integrated into its own glasses. A new AAC company has three realistic paths: (a) partner/integrate at the platform level if/when Meta opens a developer SDK for the Neural Band (unconfirmed availability; flagged for direct diligence with Meta's developer relations before assuming feasibility), (b) build on academic/open HD-sEMG reference designs (lower channel count, "medium-density EMG armband" style designs documented in Frontiers 2025, PMC12075175) which is a genuine hardware build effort, or (c) skip EMG for now and rely on cheaper/more mature commodity input (switches, cameras, mics) until consumer EMG SDKs mature. This is a BUILD-leaning category today only by necessity (lack of a buy option), not because it is a good long-term place to compete against Meta-scale hardware R&D.

19.7 Symbol/scene AI generation and visual-scene displays

BUILD; genuine current whitespace with academic proof-of-concept but no mature commercial product.

FACT: The ASSETS 2024 GPT-4V visual-scene-display study (arXiv:2408.11137) demonstrates technical feasibility (SLP-evaluated outputs "resembled those created by humans") but is a research prototype, not a shipping product.

Reasoning: This sits at the intersection of a commodity underlying model (GPT-4V/similar multimodal LMMs are licensable from OpenAI/Google/Anthropic) and a genuinely novel application layer (turning a child's own photo into a communication board in real time, tuned for AAC pedagogical conventions). The defensible IP is the AAC-specific prompt engineering, symbol/phrase curation logic, and clinician-validated output quality; not the base multimodal model, which should be bought/API-licensed.

19.8 LLM / language-model layer generally

BUY the base model; BUILD the AAC-specific fine-tuning, personalization, and character-level adaptation layer.

FACT: See §9.2; Gaines & Vertanen's character-level extraction algorithm and PrAACT's domain-adapted fine-tuning are both examples of taking an off-the-shelf/open LLM and building a genuinely novel, AAC-specific adaptation layer on top, which measurably outperforms naive use of the base model.

Reasoning: No company should attempt to train a foundation LLM from scratch for AAC. But the specific technical work of (a) character-level prediction extraction for scanning/switch-access interfaces, (b) domain-adapting on AAC-appropriate short-utterance corpora, and (c) per-user fine-tuning/personal-memory layers (as in SPICA) is real, defensible, publishable engineering work that a new company could build a genuine technical moat around; especially if paired with proprietary longitudinal usage data from real children (a data moat that competitors and even the open-source research community cannot easily replicate).

19.9 Summary table

COMPONENT	REAL VENDORS/REFERENCES	BUILD VS BUY	WHY
Base TTS	ElevenLabs, Amazon Polly, Google Cloud TTS, Azure, OpenAI TTS	**Buy**	Commodity, multi-vendor, cheap at AAC volumes
Pediatric/personalized voice banking	VocaliD-style techniques, academic dysarthric voice cloning	**Build/Partner**	Standard vendors (ElevenLabs) exclude child voices; scarce data = moat
General ASR	Google/Azure/AWS/Whisper	**Buy**	Commodity for typical speech
Atypical/dysarthric ASR	Google Project Euphonia (research), Voiceitt (commercial)	**Partner or Build on proprietary data**	Specialist, data-scarce niche
Symbol libraries (baseline)	ARASAAC, Mulberry, Sclera (open)	**Buy/Use-open**	Free, sufficient, avoids lock-in
Symbol libraries (school/clinical credibility)	SymbolStix (Tobii Dynavox), PCS (N2Y/Boardmaker), Widgit	**License**	Needed for procurement/interoperability, not technical moat
AAC app engine/shell	CoughDrop (open source), Open Board Format	**Fork/Buy baseline**	Commoditized; differentiate above the shell
Eye tracking (precision/dedicated hardware)	Tobii (~850 patents), supplies PRC-Saltillo	**Buy/Partner, check FTO**	Heavily patented, incumbent already serves AAC market
Eye tracking (webcam/software-only)	Tobii Nexus, WebEyeTrack (open), automotive RGB pipelines	**Build feasible**	Less patent-dense, active open research
EMG/gesture wearables	Meta Neural Band (closed platform), academic HD-sEMG	**Build (by necessity)**	No mature third-party licensable commodity yet
Multimodal scene AI (VSD generation)	GPT-4V/similar LMMs (buy the model)	**Build the application layer**	Model is commodity; AAC-tuned application is not
Core LLM / prediction	Open/commercial LLMs (buy); AAC fine-tuning (build)	**Buy base, build adaptation**	Character-level + domain adaptation is proven differentiator
Switch hardware	Inclusive Technology, LibreBridge (open)	**Buy**	Fully commoditized mechanical hardware

PART 20: CONCRETE PRODUCT CONCEPTS

Ten concepts, selected from the opportunity map above for diversity across access method, AI application, business model, and payer type, and ranked at the end.

Concept 1: CoPilot: The AI Communication Co-Pilot

- **Child's problem:** Communication is slow, generic, and doesn't sound like "them."
- **Current workaround:** Static word-prediction bars unchanged for a decade; families/SLPs manually build and rebuild vocabulary.
- **Product experience:** A predictive-suggestion bar and contextual board layer that plugs into an existing OBF-compatible app (starting with CoughDrop), learning the child's own phrasing and routines over time.
- **Hardware/software requirements:** Runs on existing tablets; hybrid on-device/cloud LLM.
- **Child interaction:** Sees 3–5 personalized next-word/phrase suggestions and full-sentence candidates; always taps to select; nothing is ever auto-sent.
- **Parent interaction:** Reviews/approves what data trains the model; sees a plain-language "what CoPilot learned this week" summary.
- **Therapist interaction:** Can inspect and edit the personalization data directly (a documented SLP trust requirement); receives usage/progress analytics.
- **School interaction:** IT/AT team manages a site license; teachers see the same board-generation tools as parents.
- **AI role:** Suggestion generation only; the "suggestion, not substitution" principle from §9.9 is a hard product constraint, not a guideline.
- **Safety mechanisms:** Every AI-touched output is visually marked to the communication partner (transparency principle); full audit log of AI suggestions vs. user-authored content; parental/clinician override of the personalization corpus at any time.
- **Data/privacy requirements:** COPPA-compliant consent flow; on-device-first processing where feasible (per §13.8, §25); no data sold or used for advertising, ever; a hard commitment, not just policy language.
- **Potential patents/IP:** Interaction-design patent on the transparent-suggestion UI mechanism (novelty to be confirmed by counsel); trade-secret protection on the personalization pipeline.
- **Prototype cost:** ~$400–600K.
- **Prototype timeline:** 3–4 months.
- **Regulatory pathway:** Accessibility/communication software, non-diagnostic (confirm with FDA counsel).
- **Clinical testing needed:** Words-per-minute and caregiver/SLP-rated authenticity pilot, 50–100 children, 8–12 weeks.
- **Business model:** B2B plugin licensing to existing apps + direct family subscription.
- **Price:** $10–25/month (family), $500–2,000/building/year (school).
- **Payer:** Family, school district; E2511 reimbursement as a stage-two goal.
- **Distribution strategy:** Partner-first via CoughDrop/OBF ecosystem and SLP professional networks (ISAAC/USSAAC), not app-store consumer marketing.
- **Competitive advantage:** First mover on productizing 2024–2025 academic research (PrAACT, SPICA, Gaines & Vertanen) with a proprietary consented-data moat.
- **Major risks:** Incumbent platform risk (Tobii Dynavox/AssistiveWare ship similar natively); authorship-trust adoption barrier; slow clinician-gatekept sales cycle.
- **Five-year potential:** Becomes the default AI layer across multiple AAC platforms via licensing, or the core differentiator of a standalone app (see Concept 8).

Concept 2: PathPass: Portable Communication Profile

- **Child's problem:** Starts over at every transition; new school, new SLP, new device.
- **Current workaround:** Informal notes, IEP paperwork, word of mouth between providers.
- **Product experience:** A structured, exportable profile (vocabulary, access settings, effective strategies, trial/funding history) that any participating platform can read.
- **Hardware/software requirements:** Cloud schema + lightweight importer/exporter plugins for major apps.
- **Child interaction:** None direct; infrastructure, invisible to the child.
- **Parent interaction:** Owns and controls the profile; grants/revokes provider access.
- **Therapist interaction:** Reads and updates the profile as part of standard documentation.
- **School interaction:** AT team imports the profile at intake, exports it at exit/transition.
- **AI role:** Optional LLM-generated plain-language summary of the profile for a new provider's first meeting.

- **Safety mechanisms:** Parent-controlled access grants; full access log.
- **Data/privacy requirements:** FERPA/COPPA/HIPAA-adjacent, since it touches health, education, and family data simultaneously; the most complex privacy surface of any concept here.
- **Potential patents/IP:** None sought; deliberately open standard, akin to OBF.
- **Prototype cost:** ~$250K.
- **Prototype timeline:** 2–3 months for schema + one reference integration (CoughDrop).
- **Regulatory pathway:** None specific; data-handling compliance only.
- **Clinical testing needed:** None; track adoption and transition-friction reduction instead.
- **Business model:** Grant/foundation-funded nonprofit infrastructure, or a loss-leader trust feature for a platform company (e.g., bundled into Concept 1 or 8).
- **Price:** Free to end users; B2B integration fee to platforms.
- **Payer:** Foundations/grants initially; districts/health systems if it proves efficiency value.
- **Distribution strategy:** Standard-setting via a consortium (ISAAC, RERC-AAC, incumbent vendors) rather than a single company's product.
- **Competitive advantage:** First-mover standard-setting position; only credible if genuinely vendor-neutral.
- **Major risks:** Incumbents have no incentive to support a standard that reduces their own lock-in; may require nonprofit/consortium governance rather than a single company to gain trust.
- **Five-year potential:** If successful, becomes invisible infrastructure everyone relies on; high social impact, low direct revenue, best pursued as a mission-driven side project of a larger company rather than a standalone venture.

Concept 3: OwnVoice: Pediatric Personalized Voice Banking

- **Child's problem:** Uses the same generic stock voice as many other children; never had, or is losing, a voice that sounds like them.
- **Current workaround:** Default TTS voices; VocaliD-style services (now inside a non-AAC company, effectively unavailable as a dedicated pediatric service).
- **Product experience:** Families record available vocalizations/attempts; a blended voice is generated reflecting the child's own vocal qualities plus a chosen donor voice for clarity, with cultural/linguistic identity options.
- **Hardware/software requirements:** Standard recording app + cloud voice-modeling pipeline.
- **Child interaction:** Participates in recording sessions (gamified where possible); can request adjustments.
- **Parent interaction:** Leads the recording/consent process; chooses among candidate voice options.
- **Therapist interaction:** SLP advises on realistic timing (e.g., before further speech loss in degenerative conditions).
- **School interaction:** Minimal; voice file is portable and works in any TTS-compatible AAC app.
- **AI role:** Voice modeling/blending; always with explicit family review and approval before finalizing.
- **Safety mechanisms:** No voice is finalized without informed parental (and child, where possible) consent; source recordings can be deleted post-processing per family preference.
- **Data/privacy requirements:** Treat voice recordings as sensitive biometric-adjacent data; strict retention/deletion policy.
- **Potential patents/IP:** Blending technique for children with atypical/absent typical speech specifically (differentiated from adult ALS voice-banking, which assumes prior typical speech).
- **Prototype cost:** ~$700K–1M.
- **Prototype timeline:** 4–6 months.
- **Regulatory pathway:** Low regulatory burden (not a medical device); privacy/consent framework is the real compliance work.
- **Clinical testing needed:** Perceptual identity-satisfaction studies with families and, where possible, children themselves.
- **Business model:** Direct-to-family one-time fee, or bundled into a broader subscription (Concept 8).
- **Price:** $200–500 one-time.
- **Payer:** Families, disease-specific foundations (Rett, SMA, Batten) as potential subsidizers.
- **Distribution strategy:** Partnerships with disease-specific foundations and pediatric neurology/genetics clinics rather than general AAC-app-store discovery.
- **Competitive advantage:** Only identified pediatric-specific specialist since VocaliD's absorption into Veritone.
- **Major risks:** Data scarcity (limited usable source audio for children who never developed clear speech); small standalone market (may be better as a feature than a company, per the VocaliD lesson in §18).
- **Five-year potential:** Likely strongest as an acquired/licensed capability inside a larger AAC platform (Concept 8) rather than an independent scale business; an honest assessment given the VocaliD precedent.

Concept 4: GazeFree: Webcam-Only Eye-Gaze Access Layer

- **Child's problem:** Cannot reliably point; dedicated eye-gaze hardware costs $5,000–$15,000 and requires a long insurance approval.
- **Current workaround:** Partner-assisted scanning, E-tran frames, or waiting months for a funded dedicated device.
- **Product experience:** Software that turns any tablet/laptop's existing front camera into a gaze-access input for an AAC app, no additional hardware.
- **Hardware/software requirements:** Standard tablet/laptop camera; on-device gaze-estimation ML.
- **Child interaction:** Looks at symbols/letters; dwell-time selection, calibrated to the individual.
- **Parent interaction:** Runs a short calibration process; adjusts sensitivity settings.
- **Therapist interaction:** Uses as a low-cost trial tool before/instead of recommending a dedicated device, or as a bridge during the funding-approval gap.
- **School interaction:** Deployable on existing classroom tablets; no procurement of new hardware required.
- **AI role:** Few-shot on-device gaze-calibration and estimation (per WebEyeTrack-style research).
- **Safety mechanisms:** None safety-critical; standard software QA.
- **Data/privacy requirements:** Camera data should be processed on-device, never uploaded, given it captures a child's face continuously.
- **Potential patents/IP:** Calibration/personalization algorithm improvements; must clear freedom-to-operate against Tobii's hardware-specific patent portfolio (software-only approach is the safer path, per §19.5, but requires counsel confirmation).
- **Prototype cost:** ~$600K–900K.
- **Prototype timeline:** 3–5 months.
- **Regulatory pathway:** Low; accessibility software.
- **Clinical testing needed:** Accuracy/dwell-time comparison against dedicated hardware across lighting conditions and CP/Rett-specific eye-movement variability.
- **Business model:** Low-cost family purchase or free bridge tool bundled with a clinic/manufacturer trial program.
- **Price:** $50–150 one-time.
- **Payer:** Families (low price removes the need for insurance); clinics as a trial/bridge tool.
- **Distribution strategy:** Partner with hospital AAC clinics as the "what to try while waiting for insurance approval" tool.
- **Competitive advantage:** Dramatically lower cost than dedicated hardware; targets the specific gap (funding-wait period) documented in every user journey.
- **Major risks:** Accuracy in real-world (non-lab) conditions is the central technical risk; Tobii's own move into this space (Tobii Nexus) is a platform-risk precedent.
- **Five-year potential:** Could become the default "first eye-gaze trial" tool recommended by every AAC clinic before a dedicated-device decision is made.

Concept 5: ClearPath: AI Medical-Necessity & Appeals Automation

- **Child's problem:** Not the child directly; but the child bears the cost of a 6-week-to-6-month funding gap with no communication support.
- **Current workaround:** Manual documentation by overloaded SLPs; manufacturer-embedded funding specialists; boutique consulting firms.
- **Product experience:** SLPs/hospital AAC programs input evaluation data; the system drafts payer-specific LOMN documentation and, if denied, an appeal incorporating the specific denial reason and payer's own coverage-policy language.
- **Hardware/software requirements:** Standard web app; LLM document generation; a maintained 50-state Medicaid + major-payer coverage-policy database.
- **Child interaction:** None direct.
- **Parent interaction:** Receives plain-language status updates on the funding process.
- **Therapist interaction:** Primary user; inputs evaluation data, reviews/edits AI-drafted documentation before submission.
- **School interaction:** Usable by school-based SLPs for IDEA-funded device requests too, not just insurance.
- **AI role:** Document drafting from structured clinical input; always human-reviewed before submission, never auto-submitted.
- **Safety mechanisms:** No claim/appeal is submitted without SLP sign-off; full version history of AI drafts vs. clinician edits.
- **Data/privacy requirements:** HIPAA-compliant.
- **Potential patents/IP:** The payer-rules/denial-pattern database itself is the defensible asset (compiling 50-state Medicaid variance is genuinely hard, not a patent play).
- **Prototype cost:** ~$500K–800K.
- **Prototype timeline:** 3 months for an MVP covering 5–10 major state Medicaid programs.
- **Regulatory pathway:** Not a medical device; standard healthcare-SaaS/HIPAA compliance.
- **Clinical testing needed:** Not clinical; track approval-rate and time-to-approval improvement instead.

- **Business model:** B2B SaaS to hospital AAC programs and clinics, or per-case fee.
- **Price:** $50–200/case, or $200–500/clinician/month.
- **Payer:** Clinics/hospitals (who currently absorb this cost as unbilled overhead).
- **Distribution strategy:** Direct sales to hospital AAC programs and large SLP practice groups; potential channel partnership with device manufacturers who currently run this function in-house.
- **Competitive advantage:** No identified vendor-agnostic, software-scaled competitor; genuine efficiency gain against a labor-intensive status quo.
- **Major risks:** Manufacturers may prefer to keep funding-navigation in-house as a sales-enablement tool rather than buy a third-party product; state Medicaid rule changes require ongoing database maintenance.
- **Five-year potential:** Could expand into the broader DME/funding-navigation space beyond AAC specifically, given the underlying documentation-automation technology generalizes.

Concept 6: SceneBoard: AI Board Generation for Teachers & SLPs

- **Child's problem:** Vocabulary boards go stale; new contexts (a field trip, a new toy, a holiday) aren't represented until someone manually builds a new board.
- **Current workaround:** Teachers spend unpaid hours manually programming boards; Cboard's Cbuilder is the closest existing tool but is prompt-based, not photo-based.
- **Product experience:** Photograph any scene/object; get an instant, SLP-quality, clinically-styled communication board in seconds.
- **Hardware/software requirements:** Standard phone/tablet camera; multimodal LMM API (GPT-4V-class) + AAC-specific curation layer.
- **Child interaction:** Uses the generated board immediately, potentially co-creating it with the adult (e.g., helping choose which vocabulary to include).
- **Parent interaction:** Generates boards for home contexts (family events, a new pet, a vacation).
- **Therapist interaction:** Reviews/edits AI-suggested vocabulary before it's added to the child's active system; provides the clinical-quality-control layer the ASSETS 2024 study's SLP evaluators represent.
- **School interaction:** Teachers generate boards for classroom activities in minutes instead of hours.
- **AI role:** Content generation (candidate vocabulary/symbols from an image); always presented as suggestions for human approval, never auto-added to a child's active vocabulary without review.
- **Safety mechanisms:** No AI-generated content reaches the child's active board without adult/clinician approval; a moderation layer for inappropriate or low-quality generations.
- **Data/privacy requirements:** Photos may include identifiable children/family members; needs a clear data-retention and non-training-reuse policy.
- **Potential patents/IP:** AAC-specific prompt engineering and clinician-validated output pipeline (the underlying multimodal model is licensed, not built).
- **Prototype cost:** ~$300–500K.
- **Prototype timeline:** 2–3 months.
- **Regulatory pathway:** Low.
- **Clinical testing needed:** SLP-rated output-quality study replicating the ASSETS 2024 methodology, extended to a larger sample.
- **Business model:** School/clinic site license, family subscription add-on.
- **Price:** $5–15/month add-on, or $500–2,000/building/year.
- **Payer:** Schools, clinics, families.
- **Distribution strategy:** Direct-to-SLP and teacher professional networks; potential bundling into Concept 1's platform.
- **Competitive advantage:** Photo-based (not just prompt-based) generation, clinical validation loop.
- **Major risks:** Cboard's Cbuilder is free/open-source and may commoditize the basic version of this feature quickly; the moat must be clinical-quality curation, not the base capability.
- **Five-year potential:** A high-frequency-use feature that becomes a natural bundle with Concept 1 rather than a standalone company at scale.

Concept 7: AccessAll: Nonprofit-Hybrid / PBC AI-Native AAC App

- **Child's problem:** Every dimension above, bundled; this is the flagship platform, not a point solution.
- **Current workaround:** CoughDrop (2014-era architecture, now under new corporate ownership) is the closest access-aligned precedent but isn't AI-native.
- **Product experience:** A full AAC app combining Concepts 1 (CoPilot), 6 (SceneBoard), 10 (HomeVoice), 11 (StoryBuilder), and 12 (SituationKit), built around the seven-part personalization thesis stated at the start of this report, priced on a cross-subsidy model.
- **Hardware/software requirements:** Full-stack AAC app (iOS/Android/web), on-device + cloud AI.
- **Child interaction:** Primary user of the full AAC experience.
- **Parent interaction:** Manages subscription tier, vocabulary, and privacy settings; receives caregiver-coaching support.

- **Therapist interaction:** Full clinical dashboard access, data-logging for IEP goals, direct vocabulary-editing rights.
- **School interaction:** District-wide licensing option.
- **AI role:** All AI features from Concepts 1, 6, and 19, governed by a single, publicly-published ethical-design charter (the four principles from §9.9).
- **Safety mechanisms:** Charter-level (PBC-legal) commitment that core communicative function is never gated behind payment; independent advisory board including AAC self-advocates (following the RERC-AAC/CommunicationFIRST co-design model, §9.1).
- **Data/privacy requirements:** The strictest of any concept here, given it's a full platform; on-device-first architecture (Concept 25) as a design default, not an afterthought.
- **Potential patents/IP:** Aggregate of Concepts 1, 3, and 6's IP, plus brand/trust position as the "PBC-chartered, self-advocate-governed" alternative to VC-backed incumbents.
- **Prototype cost:** ~$3–5M for a credible MVP (full app, not a feature).
- **Prototype timeline:** 9–12 months.
- **Regulatory pathway:** Standard AAC software; PBC incorporation is a legal/governance choice made at founding.
- **Clinical testing needed:** Full efficacy and abandonment-rate tracking against the 30–50% baseline.
- **Business model:** Cross-subsidy subscription (paying families/schools fund free tier), per §12.13.
- **Price:** $9–15/month (paying tier), free for qualifying low-income families.
- **Payer:** Mixed; families, schools, eventually insurance (E2511).
- **Distribution strategy:** Mission-driven positioning + partner integrations (potentially even integrating with, not just competing against, existing open ecosystems).
- **Competitive advantage:** The only identified AI-native entrant explicitly structured (legally and technically) to resolve the revenue-vs-access tension the entire report is oriented around.
- **Major risks:** Full-stack build is capital-intensive and slow; competing with entrenched incumbents' clinician relationships from zero; cross-subsidy economics require sufficient paying-tier scale to sustain the free tier.
- **Five-year potential:** The highest-ceiling concept on this list if executed well; a credible "the CoughDrop of the AI era," per the mission this entire research project is oriented toward.

Concept 8: SpeakClear: Unified Voice-In/Voice-Out for CAS/Dysarthria

- **Child's problem:** Forced into a binary choice between AAC and speech therapy tools, when clinical guidance says they should work together.
- **Current workaround:** Separate, unconnected AAC and speech-therapy-support tools.
- **Product experience:** The child attempts to speak; personalized ASR cleans up and outputs intelligible speech when possible, and falls back seamlessly to symbol/text AAC when not; tracked longitudinally for the SLP to see progress.
- **Hardware/software requirements:** Standard tablet/phone mic + personalized ASR model + AAC engine.
- **Child interaction:** Speaks first, taps to select an AAC alternative only when needed; preserving and encouraging natural speech attempts rather than defaulting to AAC.
- **Parent interaction:** Reviews progress data; supports daily practice.
- **Therapist interaction:** Uses longitudinal intelligibility data as an objective progress measure, integrated with therapy planning.
- **School interaction:** Usable in speech-therapy sessions and general classroom communication alike.
- **AI role:** Personalized ASR + AAC fallback logic.
- **Safety mechanisms:** Never silently "guesses"; low-confidence ASR output triggers the AAC fallback rather than outputting a wrong guess as if it were understood speech.
- **Data/privacy requirements:** Voice-data handling as sensitive; COPPA-compliant.
- **Potential patents/IP:** The ASR-to-AAC-fallback confidence-threshold logic and the proprietary pediatric-dysarthric ASR data pipeline (shared with Concept 10 as an ingredient).
- **Prototype cost:** ~$1–1.5M.
- **Prototype timeline:** 5–6 months.
- **Regulatory pathway:** Low-moderate.
- **Clinical testing needed:** Intelligibility-improvement and AAC-therapy-outcome studies with CAS/dysarthria-focused SLPs.
- **Business model:** Direct family/clinic subscription.
- **Price:** $15–25/month.
- **Payer:** Families, clinics.
- **Distribution strategy:** Direct partnership with CAS-specialist SLP networks (a well-defined, motivated professional community per ASHA's CAS practice portal).
- **Competitive advantage:** No identified product combines both modalities in one seamless interface.

- **Major risks:** ASR personalization for children's atypical speech is a genuinely hard, data-scarce ML problem; a narrower addressable population than full-CCN plays.
- **Five-year potential:** A strong, defensible niche product; likely best as a focused standalone company rather than a feature, given how technically distinct the ASR-personalization problem is from the rest of the AAC stack.

Concept 9: TrendGuard: District-Level AAC Outcomes & Abandonment-Risk Analytics

- **Child's problem:** Not directly product-facing to the child; a B2B tool that prevents a child from silently sliding into device abandonment unnoticed.
- **Current workaround:** Nothing systematic; individual therapists notice individual cases if they're paying close attention amid high caseloads.
- **Product experience:** A dashboard for special-education directors/AT teams showing usage trends, training-completion status, and risk flags across their entire AAC-using student population.
- **Hardware/software requirements:** Data-sharing integration with existing app vendors (CoughDrop, TD Snap, TouchChat); a real dependency requiring vendor cooperation or family/school-authorized data export.
- **Child interaction:** None direct.
- **Parent interaction:** Can optionally see their own child's data reflected back to them.
- **Therapist interaction:** Receives risk-flag alerts to prioritize caseload attention toward children showing declining engagement.
- **School interaction:** Primary customer; the special-education director/AT team.
- **AI role:** Risk-scoring model trained on longitudinal usage-outcome correlations.
- **Safety mechanisms:** Risk flags are decision-support only, never automated interventions; requires human follow-up.
- **Data/privacy requirements:** FERPA is the central compliance burden; requires careful data-sharing agreements with families/vendors.
- **Potential patents/IP:** The risk-scoring model itself, if built on genuinely proprietary longitudinal outcome data.
- **Prototype cost:** ~$800K–1.2M (higher than a pure software build due to the data-partnership work required).
- **Prototype timeline:** 4–5 months, gated by securing at least one vendor data-sharing agreement.
- **Regulatory pathway:** FERPA compliance, not FDA.
- **Clinical testing needed:** Retrospective validation against known abandonment outcomes in a pilot district.
- **Business model:** District site license.
- **Price:** $2,000–10,000/district/year, scaled by student population.
- **Payer:** School districts.
- **Distribution strategy:** Direct sales to special-education directors, likely via existing AT-conference channels (Closing the Gap, CSUN).
- **Competitive advantage:** No dedicated competitor identified; genuinely new administrator-level category.
- **Major risks:** The vendor-data-partnership dependency is a real, non-trivial go-to-market risk; existing app vendors may see this as competitive rather than complementary.
- **Five-year potential:** Could become a standard part of special-education program-quality reporting if it demonstrates real abandonment-reduction impact.

Concept 10: HomeVoice: AI Caregiver-Coaching / Aided-Language-Modeling App

- **Child's problem:** The person spending the most time with the child (the parent) is the least formally trained in how to support AAC use.
- **Current workaround:** Occasional, resource-constrained SLP coaching sessions; informal trial-and-error at home.
- **Product experience:** A real-time coaching app (building directly on the AACessTalk research template) that guides parents on aided-language-stimulation technique during natural play/interaction, while separately recommending contextual vocabulary to the child.
- **Hardware/software requirements:** Tablet-based, real-time conversational AI, dual-interface design (parent view + child view simultaneously).
- **Child interaction:** Receives contextual vocabulary recommendations adapted to mood/environment in real time.
- **Parent interaction:** Receives live coaching prompts and post-session reflection summaries on their own interaction strategy.
- **Therapist interaction:** Can review session summaries and adjust coaching emphasis remotely between formal therapy sessions.
- **School interaction:** Could extend to a teacher-facing variant, though home use is the initial focus given where the training gap is most acute.
- **AI role:** Dual-sided modeling; coaching the adult and recommending vocabulary to the child simultaneously, explicitly designed (per the AACessTalk study's finding) to increase child agency rather than reduce it.
- **Safety mechanisms:** Coaching prompts are suggestions to the parent, never automated messages sent as if from the child; full parent control over session recording/review.
- **Data/privacy requirements:** In-home audio/video processing requires the strongest possible on-device/privacy-first design given its home-life context.
- **Potential patents/IP:** The dual-sided (parent + child) real-time coaching interaction model; first commercial productization of a published academic template (AACessTalk), which is a genuine head start.

- **Prototype cost:** ~$1.2–1.8M.
- **Prototype timeline:** 6–8 months.
- **Regulatory pathway:** Low.
- **Clinical testing needed:** Replicate/extend AACessTalk's engagement and turn-taking outcome measures with a larger, more diverse cohort.
- **Business model:** Family subscription; potential school-based parent-training-program licensing.
- **Price:** $15–25/month.
- **Payer:** Families; potentially reimbursable as part of a broader parent-training/coaching service model in some states.
- **Distribution strategy:** Partnership with early-intervention programs and SLP practices as a "homework extension" tool between formal sessions.
- **Competitive advantage:** First commercial mover on a rigorously published, well-regarded academic research template with real (CHI 2025) outcome data behind it.
- **Major risks:** Real-time dual-interface UX is genuinely difficult to build well; adoption depends on parents actually using it consistently at home (the same engagement-sustainability challenge documented industry-wide).
- **Five-year potential:** Could become the standard "between-sessions" companion tool SLPs recommend to every family of a newly-diagnosed AAC candidate.

Concept 11: StoryBuilder: Personalized AI Social-Story and Routine-Video Generator

- **Child's problem:** Understanding an unfamiliar or anxiety-provoking situation (a new dentist, a fire drill, a schedule change) before it happens, in a form that is actually personal and engaging rather than a generic handout.
- **Current workaround:** Carol Gray-style Social Stories, a well-established, decades-old clinical intervention, built by hand: a parent or therapist writes, illustrates, and prints a custom story, a process that can take hours per situation. A newer generation of AI social-story generators (GrowTale, Ella Kids, Glint, Easy-Peasy.AI) already automates the writing and generic illustration of that story, confirmed in dedicated research for this report (§9.10), but personalizes only by description, a boy in a green shirt, not by an actual likeness of the child, their real dentist's office, or their real sibling.
- **Product experience:** A parent or therapist describes the upcoming situation and the child's specific needs in plain language; the system generates a short, personalized narrated video or illustrated sequence built around the child's real routines, environment, and interests, following established Social Stories structure rather than inventing a new intervention model.
- **Hardware/software requirements:** Standard tablet/phone; multimodal generation (text, image, short video) plus a clinically-informed template layer enforcing Social Stories' established narrative conventions.
- **Child interaction:** Watches or reviews the generated story ahead of the situation, ideally repeatedly, the way Social Stories are used today.
- **Parent interaction:** Describes the situation once; reviews and edits the generated content before it reaches the child.
- **Therapist interaction:** Sets the clinical guardrails on story structure and tone; can review, approve, or adjust generated stories as part of a treatment plan rather than being bypassed by it.
- **School interaction:** Teachers generate stories for classroom-specific transitions (a fire drill, a substitute teacher, an assembly) in minutes instead of not at all.
- **AI role:** Content generation from a caregiver description, always presented for adult review and approval before it reaches the child; never generated and shown to the child automatically.
- **Safety mechanisms:** No story reaches the child without adult review; a clinical-template layer keeps generated stories inside the evidence-based Social Stories structure rather than free-form invention; moderation on generated imagery involving real people.
- **Data/privacy requirements:** The most sensitive of any concept in this report if it uses real photos of the child's family, teachers, or environment: needs explicit, specific consent for each real person depicted, not just a general app-level consent, and a clear retention/deletion policy for that imagery.
- **Potential patents/IP:** The clinically-templated generation pipeline that keeps AI-generated content inside Social Stories' established structure; the personalized-likeness consistency technique referenced in the Thesis section above.
- **Prototype cost:** ~$700,000 to $1.1 million.
- **Prototype timeline:** 4 to 6 months.
- **Regulatory pathway:** Low as a caregiver-facing content tool; requires real legal review of consent requirements for generated imagery of identifiable minors and third parties before any public launch.
- **Clinical testing needed:** SLP- and behavior-analyst-rated content-quality and anxiety-reduction outcome studies, following the same evaluator-in-the-loop methodology as the ASSETS 2024 visual-scene-display study.
- **Business model:** Family subscription; school/clinic site license.
- **Price:** $10 to $20 per month, or bundled into Concept 7.
- **Payer:** Families, schools, early-intervention programs.
- **Distribution strategy:** Partnership with autism-specific early-intervention providers and behavior-analysis practices, where Social Stories are already a standard, trusted tool.

- **Competitive advantage:** Dedicated research for this report (§9.10) confirms generic AI social-story generation is already a competitive, multi-vendor category (GrowTale, Ella Kids, Glint, Easy-Peasy.AI), so the defensible advantage here is narrower and more specific than "no one does this": identity-consistent generation of the child's actual people and places, integrated with a clinical review workflow, and built with a real answer to the third-party-consent question none of today's vendors has addressed. That combination was not found anywhere in this research.
- **Major risks:** Getting the clinical structure and tone wrong could do real harm to an anxious child rather than help; the third-party-consent question (siblings, teachers, other real people depicted) is a harder privacy problem than most consumer AI products face.
- **Five-year potential:** Could become the standard first step in preparing any AAC-using child for a new or difficult situation, replacing hours of manual preparation with minutes.

Concept 12: SituationKit: The Caregiver "Describe It" Copilot

- **Child's problem:** Indirect: the child benefits when the adults around them can prepare good supports fast enough to actually use them before a stressful situation happens, not after.
- **Current workaround:** A parent searches the internet, manually builds graphics, edits templates, prints materials, and configures several disconnected apps, all under time pressure.
- **Product experience:** A parent or therapist types a plain-language description of an upcoming situation once; the system returns a coordinated bundle, a visual schedule, a short personalized story (Concept 11), relevant communication cards (Concept 1 or 6), and a short list of questions the caregiver should prepare for, all editable before use.
- **Hardware/software requirements:** Orchestration layer calling the generation capabilities in Concepts 1, 6, and 11; no new core AI capability of its own.
- **Child interaction:** Receives the finished, adult-reviewed materials; no direct interaction with the generation step itself.
- **Parent interaction:** Primary user; writes one description and receives a complete kit rather than assembling one from several tools.
- **Therapist interaction:** Can generate kits on a family's behalf between sessions, or review and refine kits a family generated themselves.
- **School interaction:** A teacher facing a schedule disruption (a fire drill, an assembly, a substitute) can generate a kit for an entire classroom of AAC-using students in minutes.
- **AI role:** Orchestration and bundling, calling other generation capabilities and presenting a coherent, editable package; the underlying content-generation work is done by Concepts 1, 6, and 11.
- **Safety mechanisms:** Every generated item in the kit is reviewed and editable before reaching the child, consistent with every other concept in this report.
- **Data/privacy requirements:** Inherits the requirements of whichever underlying generation capabilities it calls.
- **Potential patents/IP:** Thin on its own; the value is integration and workflow design, not a new technical capability.
- **Prototype cost:** ~$300,000 to $500,000, assuming Concepts 1, 6, and 11 already exist to call.
- **Prototype timeline:** 6 to 8 weeks once the underlying generation capabilities are built.
- **Regulatory pathway:** Low.
- **Clinical testing needed:** Time-to-preparation and caregiver-burden reduction studies rather than new efficacy studies, since it does not introduce new clinical content types of its own.
- **Business model:** The natural front door of Concept 7's platform rather than a standalone product.
- **Price:** Bundled.
- **Payer:** Families, schools.
- **Distribution strategy:** Positioned as the single most obvious, easiest-to-explain feature of the broader platform: describe the situation, get the kit.
- **Competitive advantage:** No existing product was found in this research that unifies these into one workflow; today a family or teacher must use several disconnected tools to accomplish the same result.
- **Major risks:** Depends entirely on the quality of the underlying generation capabilities; a weak orchestration layer over weak content would not fix the problem.
- **Five-year potential:** Likely the most-used single feature of the platform, precisely because it is the simplest to understand and the most directly tied to a caregiver's actual moment of need.

20.1 Ranking

RANK	CONCEPT	RATIONALE
1	**AccessAll** (Concept 7)	The flagship expression of this report's core thesis; the only concept that both resolves the revenue-vs-access tension by design and fully embodies the seven-part personalization vision (personalized imagery, routine and story generation, context awareness, caregiver coaching) under one mission-aligned platform.
2	**CoPilot** (Concept 1)	Best "why now," most novel and defensible technically, viable as a standalone feature/licensing play or the technical core of AccessAll.

RANK	CONCEPT	RATIONALE
3	**StoryBuilder** (Concept 11)	Directly answers the founder's sharpest frustration: generic content versus a child's real life. No direct existing competitor was identified doing exactly this, subject to the confirmation noted in the research notes; high urgency, genuine novelty.
4	**SituationKit** (Concept 12)	Cheapest and fastest concept to prototype once its underlying capabilities exist; the most immediately understandable feature for a caregiver, and likely the platform's primary front door.
5	**ClearPath** (Concept 5)	Addresses the single highest-leverage, best-documented bottleneck (funding/documentation) with the clearest near-term revenue model and shortest sales cycle.
6	**HomeVoice** (Concept 10)	Directly serves the best-evidenced, most universal unmet need (caregiver training gap) with a genuine academic-research head start.
7	**GazeFree** (Concept 4)	Highest social-impact-per-dollar for the most access-constrained population (CP/Rett), riding a genuine "why now" cost curve.
8	**SceneBoard** (Concept 6)	Strong, low-risk, high-frequency feature; likely most valuable bundled into #1 or #2 rather than standalone.
9	**SpeakClear** (Concept 8)	Strong defensible niche, but narrower addressable population and harder ML problem (data-scarce ASR).
10	**OwnVoice** (Concept 3)	Meaningful and dignity-affirming, but the VocaliD precedent suggests this is more durable as a feature/partnership than a standalone company.
11	**TrendGuard** (Concept 9)	Genuinely novel category, but execution is gated by vendor-data-partnership risk outside the company's own control.
12	**PathPass** (Concept 2)	Highest pure social impact if it succeeds as a standard, but weakest as a venture-scale business on its own; best pursued as a nonprofit/consortium initiative or a trust-building feature of #1.

PART 21: WHY NOW: THE FIVE STRONGEST OPPORTUNITIES

1. AI Communication Co-Pilot. Domain-adapted transformer techniques for AAC-specific short-utterance prediction were only published in 2024–2025 (PrAACT; Gaines & Vertanen, EMNLP 2025 Findings); agentic personal-memory architectures for AAC (SPICA) and dual-sided caregiver/child modeling (AACessTalk) were presented at CHI/IUI 2025; this entire technical foundation is under two years old. Simultaneously, the field's own ethical framework for how to do this responsibly (suggestion-not-substitution, transparency, personalization, user control) has only crystallized in the 2023–2026 HCI literature (Valencia et al. CHI 2023 through the CHI 2026 "Three Praxes Framework"). Five years ago, neither the technical capability nor the ethical design consensus existed; ten years ago, the underlying LLMs themselves did not exist in usable form. On-device inference costs are simultaneously collapsing (Gartner projects >90% cost reduction by 2030), making a privacy-preserving, always-available version of this product newly feasible rather than a cloud-dependent compromise.

2. Webcam-only/software eye-gaze access. Tobii; the incumbent with the dominant patent position in dedicated eye-tracking hardware; has itself pivoted toward AI-driven, webcam-based gaze estimation (Tobii Nexus) only recently, implicitly validating that the hardware-free approach is now technically viable at consumer camera resolution and processing power. Open academic research (WebEyeTrack, 2025) demonstrates few-shot, on-device personalization is achievable without dedicated infrared hardware. This was not possible even five years ago at acceptable accuracy; it is possible now because of the same broader computer-vision advances (efficient on-device models, better camera hardware baked into every consumer tablet) that are separately being validated at massive scale by the automotive driver-monitoring industry ($2.72B market in 2024, pushing RGB-camera gaze algorithms to commodity cost).

3. Pediatric personalized voice banking. General-purpose voice cloning only reached commercially mature, low-data-requirement quality around 2023–2025; but every major commercial vendor (ElevenLabs explicitly) excludes children's voices from self-serve use, creating a clear, current, and likely temporary regulatory/trust vacuum. The specific technical approach needed for children who never developed typical speech (residual-vocalization blending) was pioneered by VocaliD but that company was absorbed into a non-AAC-focused platform (Veritone) in 2022, leaving the pediatric-specific niche freshly vacant. Academic research on cultural/linguistic identity in AAC-generated voices is dated 2026 in this research; the field is actively working out how to do this well right now, not revisiting settled territory.

4. AI board/visual-scene-display generation. The enabling capability; a multimodal model that can look at a photograph and generate SLP-quality, contextually appropriate communication content; simply did not exist before GPT-4V-class models arrived in 2023. The first rigorous test of this specific application (the ASSETS 2024 study) is barely two years old. Before this, "generate a custom board from a photo" was not a deferred feature; it was not a solvable problem at all, since it required genuine scene understanding paired with clinical vocabulary judgment that only recent multimodal LLMs can approximate.

5. Nonprofit-hybrid/PBC AI-native platform. Public Benefit Corporation statutes have matured (Delaware, California, New York, and others have had PBC law in force for roughly a decade or more) into a well-understood, investor-legible legal structure, rather than a novel experiment. CoughDrop has now operated its cross-subsidy pricing model long enough (since 2014, through a 2023 acquisition) to be treated as validated precedent rather than a hypothesis; the report can point to a real, still-operating example rather than a theoretical model. Post-pandemic normalization of subscription SaaS procurement in K-12 education (accelerated 2020–2023) has made school districts meaningfully more comfortable with recurring software-subscription purchasing than they were a decade ago, lowering the go-to-market barrier for exactly this business model in exactly this buyer segment.

PART 22: RECOMMENDED ENTRY STRATEGY

1. **Best problem to investigate first:** Whether a domain-adapted, personalized AI prediction/generation layer measurably increases communication rate *and* is perceived by users, caregivers, and SLPs as preserving (not diluting) the child's authentic voice; the core technical-and-ethical bet behind Concepts 1 and 7, and the precondition for nearly every other AI-dependent opportunity on the map.
2. **First user group to focus on:** Existing AAC users (ages ~5–12) already on an Open-Board-Format-compatible platform (CoughDrop), rather than families new to AAC; lower switching cost, an existing engaged caregiver base, and a technically and commercially feasible integration path that doesn't require incumbent permission.
3. **Smallest useful prototype:** A browser-based predictive-suggestion overlay, trained/personalized on a small (5–10 family) consented cohort's own historical usage logs, measured for words-per-minute change and caregiver/SLP-rated "did this sound like them" authenticity.
4. **People to interview:** AAC self-advocates (endever* via CommunicationFIRST, Beth Moulam, Emma Zurcher-Long); CoughDrop's Brian Whitmer and AssistiveWare's David Niemeijer; the Gaines & Vertanen (Michigan Tech) and SPICA/AACessTalk research teams; 5+ practicing AAC-specialist SLPs; 5+ parents of current AAC users across different diagnoses; 2–3 special-education directors; staff at CommunicationFIRST and ASAN; a pediatric-hospital AAC clinic team (e.g., Gillette Children's); a disability-tech investor (Adaptation Ventures, Remarkable).
5. **Organizations to contact:** ISAAC/USSAAC, RERC-AAC (Penn State), the Trace Research & Development Center, CommunicationFIRST, CoughDrop/Forbes AAC (as a potential integration partner, not only a competitor), Remarkable (Cerebral Palsy Alliance's accelerator), a children's hospital AAC program, and 2–3 school districts with established AT teams.
6. **Existing products to buy and test personally:** Proloquo2Go, TouchChat, LAMP Words for Life, TD Snap, CoughDrop (lifetime license), GoTalk NOW, Avaz, and Cboard/Cbuilder; install and actually use each for a week to feel the onboarding, vocabulary-building, and daily-use experience firsthand before designing anything.
7. **Research papers to read first:** PrAACT (Pereira et al.); Gaines & Vertanen, "Adapting Large Language Models for Character-based AAC" (EMNLP 2025); SPICA (ACM IUI 2025); AACessTalk (CHI 2025); Valencia et al., "The less I type, the better" (CHI 2023); Yau et al. (2024) and Berenguer et al. (2022); the Beukelman & Mirenda AAC textbook; ASHA's RPM (PS2018-00351) and FC (PS2018-00352) position statements.
8. **Conferences to attend:** The ISAAC biennial conference, ASHA Convention, the CSUN Assistive Technology Conference, ACM ASSETS, the CHI accessibility track, and Closing the Gap.
9. **Potential clinical partners:** A pediatric-hospital AAC clinic (Gillette Children's-type program), a university AAC research lab (Penn State RERC-AAC, Michigan Tech, or a KAIST/NAVER-style HCI collaboration), and a school district AT team willing to run a small pilot.
10. **Potential technology partners:** CoughDrop/Forbes AAC (OBF integration), a TTS vendor willing to negotiate a pediatric-voice clinical-use agreement, and a cloud/edge-inference provider for on-device LLM deployment.
11. **Possible funding sources:** Adaptation Ventures, ATX Impact Ventures, Remarkable, the AT2030/AT Growth Fund, disability-focused angel networks, mission-aligned foundations, and; once traction exists; corporate strategics with an accessibility mandate (Amazon Alexa Fund, Intel Capital, Samsung NEXT have all funded adjacent companies, e.g., Cognixion).
12. **Potential reimbursement strategy:** Start reimbursement-agnostic; sell direct-to-family subscription and school site licenses first, deliberately avoiding the multi-year, capital-intensive DME-supplier/HCPCS-coding buildout that is the incumbents' actual moat; and pursue E2511 (software) code eligibility only as a second-stage expansion once clinical evidence and traction exist.
13. **Likely regulatory classification:** A non-diagnostic communication-assistance/accessibility software tool, similar in posture to existing AAC apps; this needs to be confirmed with actual FDA regulatory counsel rather than assumed, since this research explicitly could not verify current FDA classification rules with confidence (§12.1).
14. **Early IP strategy:** Do not attempt to patent the base LLM or generic prediction concepts (high risk of running into Google's broad 2024–2025 generative/agentic AI patent filings, §8.6). Focus defensible IP on the specific character-level/domain-adaptation technique as applied to a proprietary consented child-usage dataset, on the caregiver-coaching interaction design, and potentially on the transparent-AI-suggestion UI mechanism if genuinely novel; while proactively engaging patent counsel before shipping anything resembling icon-sequence encoding (Minspeak territory) or dedicated eye-tracking hardware (Tobii territory).
15. **Initial go-to-market:** Partner-first; integrate with the CoughDrop/OBF ecosystem or launch as an approved companion app rather than a full new competing AAC product, directly avoiding the "clinician-gatekept market punishes app-store-only strategies" lesson of the Verbally failure (§18.3).

22.1 Roadmap

30 days: Complete 15–20 stakeholder interviews from the list above; purchase and personally use 5+ existing AAC apps for at least a week each; read the core research papers; scope the technical prototype plan; engage counsel on entity structure (standard C-corp vs. PBC) and an initial freedom-to-operate screen for the prediction-layer and any UI-interaction-pattern IP plans.

90 days: Build the smallest useful prototype (predictive-suggestion overlay on OBF-compatible data); run a small (5–10 family), consented pilot; collect words-per-minute and authenticity-perception data; open substantive conversations with 1–2 potential partners (CoughDrop and one university AAC research lab).

One year: Expand the pilot to 50–100 children across 2–3 school districts or clinics; build out COPPA/FERPA-compliant data architecture; present or publish pilot results (targeting ASSETS, CHI, or a clinical journal) to establish credibility with SLPs; close a seed round from disability-tech-focused investors; decide, based on pilot learnings, whether to pursue the standalone-app path (Concept 7/AccessAll) or the B2B-licensing path (Concept 1/CoPilot as an ingredient) as the primary go-forward strategy.

Three years: Scale to several thousand children via school-district and/or incumbent-integration channels; pursue the E2511 reimbursement pathway if justified by accumulated clinical evidence; build out the caregiver-coaching (Concept 10) and multilingual (#27) layers; formally evaluate PBC/B-Corp certification; begin positioning the underlying interoperability work (Concept 2/PathPass) as an open ecosystem play, potentially open-sourcing the specification to cement it as an industry standard the way Open Board Format has become for vocabulary portability.

FINAL DELIVERABLE

The 10 biggest insights

1. **AAC is a stack, not a product.** Representation, vocabulary organization, output, access method, hardware, and software are independently swappable layers (§1.2); most real innovation; historically and today; happens at exactly one layer while inheriting the rest from incumbents, which explains both the durability of incumbents and the opportunity in narrow, layer-specific plays.
2. **Four or five different parties use, choose, prescribe, pay for, and approve payment for the same device** (§6.1); this fragmentation, not underlying technology cost, is the primary driver of price, delay, and even product design (a "locked" $8,000 dedicated tablet and a $250 consumer-app-plus-iPad combination can be functionally identical; the price gap is a reimbursement-code artifact, not an engineering one, §6.2).
3. **Simplicity and durability have repeatedly beaten sophistication commercially:** GoTalk, PECS, and arguably Proloquo2Go's original 2009 breakout (more a platform-timing story than an AAC-science one) all won by being fast to learn and rugged, not by being the most advanced system available (§2.2–2.3).
4. **Device/therapy abandonment (30–50%, stable across decades) is the industry's actual central failure mode**, and it is driven overwhelmingly by training, onboarding, and caregiver-support gaps; not by device capability (§4.2.1, §18); meaning most "build better technology" theses target the wrong lever.
5. **The single most-repeated friction point across every stakeholder journey** (child, parent, SLP, teacher, district, hospital, payer) **is the absence of a portable, interoperable communication profile** that travels with the child; no company has solved this, and it is largely a coordination/standard-setting problem, not a hard technical one (§5.7).
6. **Patent risk in this space is real, asymmetric, and concentrated in two places:** Tobii's ~850+-filing eye-tracking portfolio and PRC/Semantic Compaction Systems' demonstrated willingness to litigate Minspeak-style icon-encoding IP against a two-person competitor (§8.1–8.2); while the AI-prediction-for-AAC layer itself looks comparatively open as of 2026, a window that will likely close as big-tech generative-AI patenting broadens (§8.6).
7. **Reimbursement rules, not silicon, set hardware prices:** the CMS requirement that a tablet-based SGD be "locked" to function solely as a speech-generating device at time of issue is why a functionally ordinary tablet costs 8x more once it is DME-billable (§6.2).
8. **AI's biggest documented risk here is not hypothetical:** "putting words in a nonspeaking person's mouth" is the direct continuation of the Facilitated Communication/RPM/Spelling-to-Communicate controversy, which has already caused real, documented harm (false abuse allegations in the 1990s) when unvalidated communication-authorship claims were trusted for a population that often cannot self-report being misrepresented (§10.1–10.4, §9.9).
9. **Independent, high-quality research converges on the same root problems from different angles**; Yau et al. (2024, autism-focused, Australia) and Berenguer et al. (2022, general AAC, 19 studies/297 parents) reach the same five-theme structure (training, stigma, resources, engagement, device fit) via entirely different populations and methods, which is unusually strong grounds for prioritization confidence in a field otherwise full of noisy, conflicting market claims (§4.2.1).
10. **The market-sizing "problem" is itself a signal, not just a limitation:** vendor reports disagree by ~7x, no Medicaid claims data is published for AAC-specific HCPCS codes, and the SLP-therapy-services market (likely larger than the device market) has never been sized; meaning a company that builds genuinely better first-party outcomes data would hold an information advantage that currently belongs to no one, including the incumbents (§7.0, §7.7–7.8).

The 10 biggest unsolved problems

1. No portable, standardized communication-profile/interoperability layer across devices, providers, and life transitions.
2. Device/therapy abandonment stuck at 30–50% for decades despite AAC being formally "evidence-based practice."
3. The communication-rate/speed gap between AAC output and real-time spoken conversation, which drives social exclusion and being underestimated.
4. No good way to give a child who never had typical speech (or is losing it) an authentically personal synthetic voice; commercial voice-cloning vendors explicitly exclude children.
5. A structural SLP/teacher training gap (75% of surveyed SLPs lack AAC continuing-education access; teachers report being excluded from device selection yet expected to be daily experts).
6. Multilingual/culturally appropriate vocabulary remains a bolt-on afterthought, not a first-class design constraint, across nearly all commercial systems.
7. Medical-necessity documentation and prior authorization; the single highest-leverage bottleneck in the whole system; remains manual, unautomated, and fragmented across 50+ distinct state Medicaid processes.
8. No rigorous, broadly agreed-upon framework yet exists for how much AI should shape or generate a nonspeaking child's message without compromising authorship; the field is actively inventing this norm in real time (2023–2026 HCI literature).

9. Intent determination for early/emergent and multiply-disabled communicators remains clinically hard, and is structurally the same unresolved problem underlying the FC/RPM/S2C controversy; no scalable, validated, non-facilitator-dependent tool exists to help here.
10. No one has sized the actual Medicaid/insurance dollar flow into AAC with real claims data, meaning every company and researcher in this space is operating with an incomplete picture of the public-payer economics that dominate it.

The 10 strongest business opportunities

1. A personalized AI visual and video communication platform (personalized imagery, routine and Social-Story-style video generation, context-aware vocabulary, caregiver coaching, all under one product).
2. AI Communication Co-Pilot (personalized prediction and phrase generation, authorship-preserving), the platform's predictive-text component.
3. Personalized AI Social-Story and routine-video generator (Concept 11), the platform's most novel and least-contested component.
4. Portable Communication Profile / interoperability standard.
5. Pediatric personalized voice-banking platform.
6. Webcam-only/software-only eye-gaze access layer.
7. AI-powered medical-necessity documentation and appeals automation.
8. AI board/visual-scene-display auto-generation for teachers and SLPs.
9. Unified voice-in/voice-out app for CAS/dysarthria.
10. District-level AAC outcomes/abandonment-risk analytics.

The 5 opportunities to investigate first

1. **Personalized AI Social-Story and routine-video generator (StoryBuilder, Concept 11):** the single most direct expression of this report's founding thesis, the least contested by existing competitors of anything on this list, and the fastest way to test whether personalization measurably changes outcomes and engagement before committing to the full platform.
2. **AI Communication Co-Pilot:** strongest technical "why now" for the predictive-text layer specifically, most direct alignment with responsible-AI-for-children design principles, viable via multiple business models.
3. **AI-powered medical-necessity/appeals automation:** fastest path to real revenue and the clearest, best-documented pain point, with the least clinical-validation burden; a useful funding bridge while the platform's harder, more novel components mature.
4. **Webcam-only eye-gaze access layer:** highest social-impact-per-dollar for the most access-constrained population, riding a real, current cost-curve shift.
5. **The full personalized AI platform (AccessAll):** the vehicle that eventually combines 1 through 4 into the single highest-ceiling outcome; the highest-capital, longest-timeline option of the five, and one that should be approached only after de-risking the StoryBuilder and CoPilot components individually.

The single opportunity that deserves the most investigation: A Personalized AI Communication and Visual-Support Platform

- **Core insight:** For four decades, AAC's underlying visual vocabulary has been generic and shared across every user of a given app; the child adapts to the technology's library of symbols rather than the technology adapting to the child's actual life. Generative AI has, in the last two to three years, become capable of producing personalized images, video, and adaptive digital experiences fast enough and cheaply enough to invert that relationship. This report's own research finds the specific enabling pieces already proven in peer-reviewed form (GPT-4V-generated visual scene displays rated as SLP-comparable, §9.4; contextual AI vocabulary recommendation shown to increase, not decrease, a child's sense of agency, §9.3), but finds no identified company has yet combined personalized imagery, personalized routine and Social-Story video, context-aware vocabulary, and caregiver coaching into one coherent product built specifically for children with complex communication needs.
- **Proposed product:** A platform combining five capabilities under one authorship-preserving design discipline: personalized visual communication cards built around the child's real people, places, and interests (Concept 1's imagery layer); an AI visual prompt builder for routines and transitions (Concept 6); a personalized Social-Story and routine-video generator (Concept 11); a caregiver copilot that turns a plain-language description of a situation into a coordinated support kit (Concept 12); and a predictive, personalized phrase-suggestion layer (Concept 1's CoPilot component). Every AI-generated item is a suggestion an adult reviews before it reaches the child, consistent with the authorship framework in §9.9, extended here from text to images and video.
- **Exact user:** Children roughly ages 4 to 14 with complex communication needs, autism, cerebral palsy, apraxia, Down syndrome, and related conditions primarily, starting with families and clinics already using an Open-Board-Format-compatible app (CoughDrop) or willing to pilot a new one, and starting product development with the single highest-conviction, lowest-competition component (StoryBuilder, Concept 11) before building out the full platform.
- **Payer:** Initially families, on a cross-subsidized subscription consistent with the CoughDrop precedent (§12.13); schools and clinics on a site-license basis; Medicaid and insurance via the E2511 software HCPCS code as a validated, later-stage expansion once clinical evidence exists.

- **Existing competitors:** No identified company combines these five capabilities today. The closest individual pieces, confirmed by dedicated research for this report (§9.10), are Cboard's Cbuilder (board generation only, open-source), a small but real category of generic AI social-story and visual-schedule generators (GrowTale, Ella Kids, Glint, HeyOtto, Easy-Peasy.AI, all personalizing by description rather than by real identity), and PRC-Saltillo's own AI image feature (shipped February 2026 on Apple Intelligence), which is the single most direct evidence of incumbent intent in this exact direction, and which explicitly refuses to generate images of real people.
- **Why competitors haven't solved it:** The incumbent hardware and software makers are fundamentally reimbursement-infrastructure companies whose moat and revenue model is the DME and insurance-billing relationship built up over decades (§6.2 through §6.4), not generative-AI product velocity, and PRC-Saltillo's own February 2026 feature shows the clearest evidence available: when the field's leading AAC vendor finally shipped generative image AI, it chose a safety-first guardrail, refusing to generate images of real people at all, over solving the harder consent and personalization problem, likely a reasonable, defensible choice for a large incumbent with brand risk to protect, but one that leaves the capability unclaimed (§9.10). The dedicated AI social-story vendors found in this research (GrowTale, Ella Kids, Glint, HeyOtto) are small, general-audience products built for the broader autism-parent market, not AAC-integrated, and personalize by description rather than identity, likely because identity-consistent generation of real minors and their relatives is a harder consent problem than a small team wants to take on first. Open-source and mission-driven AAC players (CoughDrop, Cboard) have shipped real, fast-moving individual AI features but lack the capital for a coordinated, clinically-validated multi-capability platform. Big-tech accessibility research (Google's Project Relate and Project Euphonia) has repeatedly produced strong research without durably commercializing it. No party in this market currently has both the AI capability and the sustained, mission-driven motivation to solve the consent problem and build this specific combination.
- **Technological advantage:** A proprietary, consented, longitudinal dataset of what actually works for a given child, imagery, stories, and phrasing that measurably improved communication and reduced distress, which is a genuinely defensible moat (§19.8) that generic foundation-model access cannot replicate on its own.
- **Estimated development difficulty:** Medium to high for the full platform; low to medium for the recommended first component (StoryBuilder). The individual generation techniques are published and reproducible; the harder work across the whole platform is clinical-template design, consent architecture for imagery of real people, and the caregiver and therapist-facing review workflow, not novel model research.
- **Regulatory risk:** Low to moderate if positioned as non-diagnostic communication-assistance and caregiver-support software, consistent with the posture of existing AAC apps and existing Social-Stories practice; this requires confirmation from actual FDA regulatory counsel, and separately requires real legal review of consent and likeness rights for AI-generated imagery of identifiable children and family members before any public launch, a distinct and less-precedented question than standard children's software privacy compliance.
- **Clinical-validation requirements:** SLP- and behavior-analyst-rated content-quality studies following the ASSETS 2024 evaluator-in-the-loop methodology; anxiety-reduction and routine-comprehension outcome measures for the Social-Story component specifically, given Social Stories' established evidence base sets a real bar to meet, not just a format to imitate; words-per-minute and authenticity measures for the predictive-text component, per the original Co-Pilot proposal.
- **Potential IP:** The clinically-templated content-generation pipelines that keep AI output inside evidence-based structures (Social Stories conventions, core-vocabulary motor-planning consistency) rather than free-form generation; the consent and likeness-rights architecture for generating imagery of real identifiable children and family members, an area with little existing precedent to copy; the proprietary longitudinal usage-and-outcome dataset described above.
- **Estimated pricing:** $10 to $25 per month for families, $500 to $2,000 per school building per year for site licenses, consistent with CoughDrop and general education-SaaS benchmarks found in this research.
- **Rough market opportunity:** Layers onto the roughly $260 million per year US pediatric AAC device-and-software bottom-up TAM (§7.4) as a premium tier or successor product, with meaningful upside into the unserved roughly half of the pediatric complex-communication-needs population (§7.7) if personalization measurably improves adoption and reduces the 30 to 50 percent abandonment rate documented throughout this report (§4.2.1, §18.3).
- **Customer-acquisition strategy:** Partner-first distribution through the CoughDrop and Open Board Format ecosystem and SLP and AAC-specialist professional networks (ISAAC, USSAAC, ASHA's AAC special-interest group), and specifically through autism-focused early-intervention and behavior-analysis practices for the StoryBuilder component, where Social Stories are already a trusted, familiar clinical tool; explicitly avoiding an app-store-only consumer launch given this is a clinician-gatekept market (per the Verbally failure lesson, §18.3).
- **First prototype:** A StoryBuilder pilot: a caregiver describes an upcoming situation for their child, the system generates a short personalized routine story, and a small group of SLPs and behavior analysts rate the generated content's clinical appropriateness and the family's engagement with it against their own hand-built Social Stories.
- **First 20 people/organizations to interview:** AAC self-advocates endever* (via CommunicationFIRST), Beth Moulam, and Emma Zurcher-Long; CoughDrop's Brian Whitmer; AssistiveWare's David Niemeijer; the Gaines and Vertanen (Michigan Tech) and SPICA and AACessTalk research teams; behavior analysts and SLPs experienced in building Social Stories by hand, to learn exactly what clinical structure a generation pipeline must respect; five or more parents of current AAC users across different diagnoses; two to three special-education directors; staff at CommunicationFIRST and the Autistic Self Advocacy Network; a pediatric-hospital AAC clinic team such as Gillette Children's; and a disability-tech investor such as Adaptation Ventures or Remarkable.
- **Assumptions that must be validated:** that personalized, AI-generated visual and video content measurably improves engagement, comprehension, or anxiety outcomes compared to generic materials, not just novelty appeal that fades; that clinicians and behavior analysts will trust and adopt AI-generated content inside an intervention as established and evidence-sensitive as Social Stories; that a workable consent and

likeness-rights model exists for generating imagery of real family members, not only the primary child user; that families and schools will pay for this on top of an AAC app they already own.

- **Reasons this idea might fail:** the clinical-template constraint needed to keep generated content safe and evidence-aligned could limit personalization enough to blunt the product's central advantage; the third-party consent question could prove a harder legal and trust barrier than anticipated, slowing launch; an incumbent or a well-resourced new entrant could ship a comparable feature first once the underlying multimodal-generation capability becomes common knowledge; the clinician-gatekept sales cycle could be too slow for a typical venture-fund timeline.
- **What evidence would convince us to abandon it:** a rigorous pilot showing generated content does not measurably improve engagement or outcomes over well-made generic or manually-personalized materials once the novelty wears off; or clinicians and behavior analysts consistently judging AI-generated Social-Story-style content as clinically inappropriate or unsafe despite genuine, good-faith template constraints.
- **What evidence would convince us to aggressively pursue it:** a pilot showing meaningfully better engagement, comprehension, or anxiety-reduction outcomes than generic materials; genuine enthusiasm and willingness to use it expressed by behavior analysts and SLPs who currently build Social Stories by hand, the group with the most at stake in judging whether this is a real clinical tool or a novelty; and a workable, legally sound consent model for generating imagery of real family members.

Surprising discoveries that challenge the assumptions behind this entire project

1. **The dominant, best-documented problem in the field is not a technology problem at all.** Device abandonment (30–50%, stable for decades) is driven overwhelmingly by training, onboarding, and support gaps; meaning a large share of "build better AAC technology" venture theses, including several attractive-looking ones in this very report, are aimed at a secondary lever, not the primary one. Any new entrant should treat onboarding, caregiver coaching, and longitudinal engagement as core product surface area, not a nice-to-have.
2. **The single most price-defining fact in the hardware market is a Medicare reimbursement rule, not manufacturing cost or R&D sophistication.** "Build a cheaper/better device" is a far smaller opportunity than it appears, because the price gap between a locked $8,000 DME-billable tablet and an equivalent $250 consumer setup is a coding artifact, not an engineering one.
3. **A sophisticated, decades-old professional consensus (ASHA/APA/AAIDD) already firmly rejects several communication-authorship approaches (FC, RPM) that remain beloved by an emotionally invested, organized community of families and self-advocates.** Any AI-assisted communication company enters an unusually polarized trust environment where being perceived as "just another unvalidated authorship technology" is a real, live reputational risk; not a fringe concern to footnote.
4. **The most technically sophisticated and best-funded new entrants in adjacent technology (BCI companies; Synchron's $345M raised, Neuralink, Precision Neuroscience) are essentially irrelevant to the near-term pediatric AAC opportunity**, despite dominating tech-press coverage of "the future of AAC." They are adult-paralysis-focused, invasive, pre-commercial, and plausibly a decade or more from any responsible pediatric application; meaning the most-hyped technology in this space is among the least actionable for a company focused on children today.
5. **Open-source and volunteer-run projects have shipped genuinely novel AI features faster than well-funded incumbents**; Cboard's Cbuilder (AI board generation) went live in January 2026, ahead of any equivalent feature identified from Tobii Dynavox, PRC-Saltillo, or AssistiveWare in this research. This suggests capital intensity is not the binding constraint in this market; distribution, clinical trust, and reimbursement infrastructure are; a genuinely counterintuitive finding for anyone assuming a well-funded startup automatically out-innovates the field.
6. **The market-sizing literature for this sector is unusually unreliable** (vendor reports disagree by roughly 7x) **with major, acknowledged gaps** (no published Medicaid claims data for AAC-specific billing codes, no sizing of the SLP-therapy-services market that likely dwarfs the device market). Any pitch or plan built on a specific "$X billion market" claim lifted from a vendor report should be treated with real skepticism; and the more legitimate opportunity may lie in the unmeasured, currently-unserved population (roughly doubling the addressable market per §7.7) rather than in taking share of the well-measured, already-served one.

This synthesis (Parts 11, 20, 21, 22, and the Final Deliverable) was produced by the lead research/writing agent, drawing on and cross-referencing the five parallel research streams (A: History/Taxonomy/People/Organizations; B: Market/Competitors/Patents/Startups/Failures; C: Pediatric Populations/User Journeys/Controversies/User Voice; D: Money Flows/Market Size/Business Models; E: AI/Adjacent Industries/Build-vs-Buy/BCI Patents). All opportunity scores and rankings in Parts 11 and 20 are the analyst's own HYPOTHESIS-level judgment calibrated against the cited evidence, not independently benchmarked figures; a disciplined caveat this entire report has tried to apply consistently, per the research standards set out in the original brief.