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The Case for Health Communications Technology

Why Phone Calls Need a Neurodivergent-First Redesign

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Contents

Executive Summary

The phone call is the only major communication technology that has never been redesigned. Email gained threading and scheduling; messaging gained read receipts; video calls gained captions. The voice call still works the way it did in 1876: it starts without agreement, runs without visible time, and ends only when someone finds the courage to end it.

For tens of millions of people, that design is not an inconvenience but a barrier. People with ADHD lose track of time during calls and avoid them afterwards. Many autistic adults rank phone calls as their least preferred way to communicate, and some avoid essential services that insist on them. For people managing chronic illness and the caregivers who support them, calls carry a heavy coordination burden — and both live with the low-grade fear of a call that does not get through. The difficulty now extends far beyond clinical populations: in one UK survey, nearly one in four adults aged 18–34 said they never answer voice calls at all.

This paper proposes Health Communications Technology (HCT): a new category of technology that changes the structure of the call itself—its timing, sensory environment, consent, and emergency behaviour—rather than delivering health information, which is the job of health records, health apps, and telemedicine. HCT rests on five design principles: make time visible (Time Intelligence); let users shape the call's soundscape (Sensory Modification); let both parties agree on a call's length and purpose before it begins (Consent Architecture); guarantee that life-critical calls always get through (Emergency Priority); and show complexity only to those who want it (Progressive Disclosure).

The paper presents a working implementation—Yapper Phone, an Android dialer publicly available on Google Play—as a case study, states plainly that no clinical trials have yet been conducted, and proposes six specific studies to test whether the approach works. All behavioural data stays on the user's device; the research programme is governed by a Finnish non-profit association that cannot be sold or converted to a for-profit entity.

Features designed for the people who struggle most with phone calls—visible timers, agreed durations, guaranteed emergency reach—turn out to be features almost everyone wants. That is the paper's central claim, and it is offered here as a testable proposition, not a settled fact. Researchers, clinicians, and regulators are invited to test it.

A structured academic abstract follows for specialist readers.

Abstract

Background: Phone calls remain the primary mode of real-time remote interpersonal communication, yet their user experience has not been updated to reflect current understanding of neurodevelopmental variation in time perception, hyperfocus, sensory processing, and social communication. **Objective:** This paper proposes Health Communications Technology (HCT) as a framework for understanding and developing technology that modifies the communication experience itself—rather than the information exchanged—for therapeutic and accessibility benefit. **Methods:** A literature review of existing research on ADHD time perception and hyperfocus, autism communication preferences, chronic illness communication burden, caregiver anxiety, and ambient noise effects on cognition was synthesised with a gap analysis of digital health, mHealth, and telephony design. **Results:** Convergent evidence from multiple clinical domains identifies the unstructured phone call as a site of disproportionate difficulty for neurodivergent and chronically ill populations, while survey data indicates that nearly one in four adults aged 18–34 reports never answering voice calls and that a majority of younger office workers experience anxiety when the phone rings. No existing technology category addresses the communication experience layer. Workplace programme data from multiple industries further demonstrates that designing for neurodivergent needs produces outcomes that benefit entire populations. **Conclusions:** HCT represents a clinically grounded, previously unaddressed intervention layer in the digital health ecosystem. A working implementation is presented. The paper proposes a research agenda and invites academic collaboration.

Keywords: *health communications technology, ADHD, autism, time perception, hyperfocus, object permanence, prospective memory, phone call anxiety, universal design, neurodivergent, digital health, bilateral consent, relationship maintenance*

Author Note

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Conflict of interest disclosure: Janne Mikael Vakkilainen is the inventor and sole developer of Yapper Phone, the application presented as a case study in Section 4. The provisional patent application referenced in this paper — containing 667+ innovation disclosures — was filed by Janne Mikael Vakkilainen personally with the USPTO on February 27, 2026, not by the Institute. Janne Mikael Vakkilainen is also the founder of SUPER SINCE BIRTH (Y-tunnus 2461315-1), the commercial entity that publishes Yapper Phone. The n=1 self-report disclosed in Section 6 is from Janne Mikael Vakkilainen. Maximized Impact ry is a non-profit registered association; SUPER SINCE BIRTH is a separate commercial legal structure. The Institute for The Study Of Humanity operates as a research programme of the association and has no commercial interest in the application. No external funding was received for the research or writing of this paper.

These relationships are disclosed so that readers can assess the paper's claims with full knowledge of the author's interests. The paper's arguments stand or fall on the cited evidence and the proposed research agenda, not on the author's commercial position. Independent replication and critique are invited.

1. Introduction: The Unexamined Phone Call

The telephone was invented in 1876. The smartphone arrived in 2007. In the intervening 150 years, every major communication modality has been redesigned for accessibility and user experience: email acquired threading, priority flags, and scheduled sending; text messaging introduced read receipts, typing indicators, and media sharing; video conferencing added screen sharing, virtual backgrounds, and closed captioning. The voice call, however, has remained functionally unchanged. Its fundamental user experience—open-ended duration, no visible time tracking, no structured consent mechanisms, no sensory customisation—persists as a relic of analogue telephony embedded within digital ecosystems.

This paper argues that the voice call represents the last major communication technology never redesigned to accommodate human neurological diversity. It proposes Health Communications Technology (HCT) as a framework for addressing this gap—not through the digitisation of health information (the domain of electronic health records and mHealth), but through the modification of the communication experience itself.

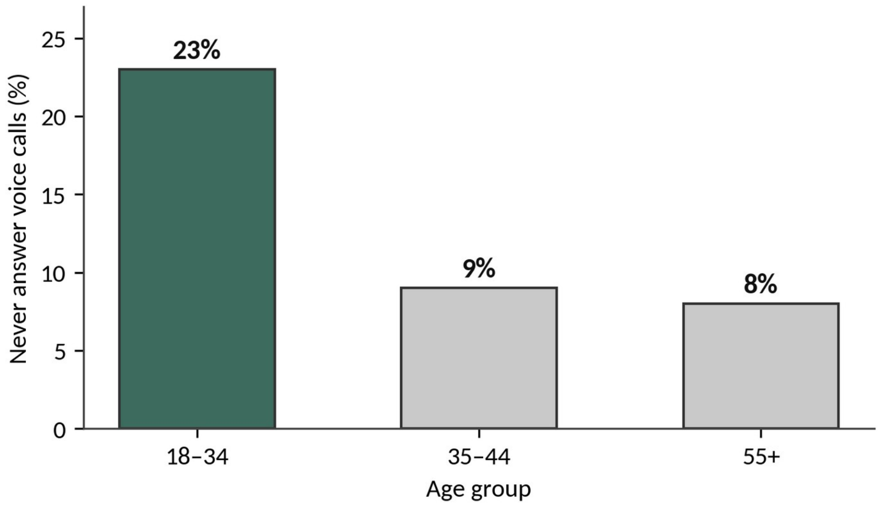
The clinical basis for this argument is substantial. Attention-deficit/hyperactivity disorder (ADHD) affects an estimated 5% of children and 2.5–3% of adults worldwide, with approximately 7 million children aged 3–17 in the United States holding a current diagnosis (Centers for Disease Control and Prevention [CDC], 2026). Autism spectrum conditions affect approximately 1 in 31 children aged 8 years in the United States (CDC, 2025) and an estimated 1 in 127 individuals globally, or 61.8 million people (GBD 2021 Autism Spectrum Collaborators, 2025). Co-occurrence is high: ADHD is the most common co-occurring condition in the autism population, at a pooled prevalence of 28% (95% CI 25–32; Lai et al., 2019). Broader estimates suggest that 15–20% of the global population may be classified as neurodivergent, a figure encompassing dyslexia, dyspraxia and dyscalculia alongside ADHD and autism (Doyle, 2020). These are not marginal populations. They represent a substantial proportion of humanity whose communication needs have been systematically overlooked in telephony design.

These figures should be read as floors rather than as estimates. The Global Burden of Disease programme revised its own global autism prevalence from 369.4 to 788.3 per 100,000 between its 2019 and 2021 iterations—a doubling driven not by any change in the underlying population but by the exclusion of studies relying on passive case-finding from administrative diagnostic records in favour of active case-finding using diagnostic instruments in general populations. The same revision reduced the reported male-to-female ratio from over 4:1 to 2.1:1, explicitly attributed to females having been overlooked. Diagnostic criteria further require current functional impairment, with the consequence that adults who have constructed accommodating circumstances fall below the diagnostic threshold while remaining neurologically unchanged. The prevalence estimates cited here draw largely on United States paediatric surveillance, the most systematic data available; adult and global figures are correspondingly less certain, and in every case more likely to understate than to overstate.

Time perception deficits, hyperfocus, sensory processing differences, and social communication challenges are well-documented across these populations. Yet the phone call—where these challenges converge most acutely—has received virtually no design attention from the telecommunications industry, the digital health sector, or the academic research community. Critically, the problem extends well beyond neurodivergent populations. A 2024 survey found that 23% of UK adults aged 18–34 report that they never answer calls to their mobile phone, against 9% of those aged 35–44 and 8% of those over 55 (Uswitch, 2024). Call reluctance appears to extend well beyond clinical populations, though it has not been systematically measured in the general adult population. An industry survey of approximately 500 UK office workers found that 76% of millennial respondents reported anxiety-related thoughts when the phone rang, against 40% of baby boomer respondents (Face for Business, 2019). Phone call anxiety—sometimes termed telephonophobia—has attracted a growing clinical and research literature. The age gradient is shown in Figure 1. The phone call is not merely inaccessible to neurodivergent populations; it is increasingly dysfunctional for everyone. HCT addresses both realities: designing for the populations most acutely affected produces tools that serve the broader population experiencing milder but widespread call-related anxiety.

Figure 1

Never Answering Voice Calls, by Age Group



Note. Data: Uswitch (2024), survey of 2,000 UK adults.

Emerging evidence from corporate neurodiversity employment programmes suggests that when environments are designed for neurodivergent needs, neurodivergent individuals can match or exceed neurotypical performance (Austin & Pisano, 2017). The evidential status of that literature is examined in Section 3.4. Its implication for communication technology is nonetheless clear: tools designed for the most constrained users may produce universally superior outcomes. This is the curb-cut effect applied to telephony.

This paper proceeds as follows. Section 2 reviews the clinical evidence establishing neurodivergent communication burden during phone calls, including the worry burden experienced by caregivers and families of vulnerable individuals. Section 3 proposes a formal definition and taxonomy for Health Communications Technology, including the universal design argument. Section 4 presents a case study of a working implementation. Section 5 examines bilateral consent as a structural absence in telephony and surveys the regulatory landscape. Section 6 proposes a research agenda. Section 7 addresses institutional architecture and data governance. Limitations and open questions are addressed throughout.

2. The Problem: Neurodivergent Communication Burden

This section reviews clinical evidence from three populations for whom unstructured phone calls present documented, measurable difficulties. The evidence ranges from well-established (ADHD time perception and hyperfocus) to emerging (chronic illness communication burden), and these distinctions are noted throughout.

2.1 ADHD and Time Perception During Phone Calls

2.1.1 Time Blindness as a Core ADHD Feature

Time perception deficits constitute a core feature of ADHD across the lifespan. Ptacek et al. (2019) conducted a comprehensive review of controlled studies comparing time estimation and discrimination in individuals with ADHD and typically developing controls, concluding that difficulties in time perception represent a clinically significant and potentially diagnostic characteristic of the disorder. Weissenberger et al. (2021) extended these findings into adult populations, demonstrating that time perception deficits persist beyond childhood and remain focal symptoms in adults with ADHD.

Barkley (1997; 2015) has argued that ADHD is fundamentally a disorder of executive function and time management, not merely attention. Within Barkley's framework, the inability to perceive, estimate, and respond to temporal signals constitutes a primary rather than secondary deficit. This theoretical position has substantial implications for telephony design: the open-ended phone call—with no visible clock, no external time signal, and no structured endpoint—represents a worst-case scenario for ADHD time blindness. The caller cannot track elapsed time, creating cascading executive function failures including inability to end calls, schedule disruption, and progressive call avoidance.

Critically, intervention evidence suggests that external time-assistive devices can significantly improve time-processing ability in individuals with ADHD. Wennberg et al. (2018) conducted a randomised controlled study of 38 children with ADHD aged 9–15, comparing a multimodal intervention (time-skill training combined with time-assistive devices including visual timers) against an education-only control. The intervention group showed significantly greater improvement in time-processing ability ($p = .019$), with the largest gains in time orientation, and parents rated their children's daily time management as significantly improved ($p = .011$). The reported effect sizes were small. An earlier study (Janeslätt et al., 2014) found a large effect size (Cohen's $d = 0.81$) for time-assistive device interventions on time-processing ability in a mixed clinical sample of 37 children aged 6–11 with ADHD, autism spectrum conditions, intellectual disability, spina bifida or cerebral palsy. These findings provide direct empirical support for the proposition that making time visible through external devices—precisely the function of a countdown timer during a phone call—can improve time perception and time management in ADHD populations.

These findings have implications beyond in-call timers. If time-assistive devices improve time-processing ability through repeated exposure to external temporal signals, then a continuous, ambient time signal—a periodic chime running throughout the day, independent of phone calls—represents a more comprehensive application of the same intervention principle. Rather than providing time awareness only during calls, a system-wide time signal at configurable intervals (from 10 seconds to one hour) would deliver a persistent external temporal anchor that addresses ADHD time blindness across all daily activities: work, study, household tasks, and unstructured time where daydreaming and hyperfocus are most likely to produce schedule disruption. This extension—from call-specific to environment-wide time assistance—is theoretically grounded in the Wennberg and Janeslätt evidence but has not been studied in its continuous, ambient form. It is identified as a research priority in Section 6.

2.1.2 Hyperfocus and the Unresolved Question of Call Duration

Hyperfocus—a state of intense, absorptive concentration in which external stimuli are not consciously perceived—is the complement of time blindness and explains why phone calls are a particularly acute challenge. Ashinoff and Abu-Akel (2021) conducted the most comprehensive review of hyperfocus in the academic literature, identifying four consistent features across all studies: an intense state of concentration, diminished awareness of the environment, engagement with a task that is intrinsically interesting, and improved performance on the focal task. Critically, during hyperfocus, the individual's internal clock effectively ceases to function.

Groen et al. (2020) provide the finding that most complicates the popular account of hyperfocus, and in doing so identifies the gap this paper argues should be filled. Within a healthy sample of 1,124 adults, the frequency of hyperfocus was positively correlated with ADHD traits, and 82.7% of that sample (n = 929) reported having experienced hyperfocus, establishing it as a broadly distributed human experience rather than a categorical marker of ADHD. However, when a clinically diagnosed ADHD patient group (n = 78) was compared against matched healthy controls, the two groups did not differ in the occurrence, frequency, duration or pervasiveness of hyperfocus. More surprisingly still, hyperfocus was less likely to occur in educational and social situations among the ADHD patients.

This finding sits in tension with a widely reported lived experience. Adults with ADHD describe, consistently and in large numbers, losing hours to absorbing conversations. Three explanations are available and none has been tested. The situational categories used by Groen et al. may not capture telephony, which is neither straightforwardly social in the face-to-face sense nor an educational obligation. Self-report may systematically under-detect the phenomenon, since recognising that one has hyperfocused requires the retrospective awareness that hyperfocus itself suppresses. Or the community account may simply be wrong, and long calls may be driven by time blindness (Section 2.1.1) rather than by hyperfocus at all. Each of these possibilities is empirically distinguishable, and none can be resolved by self-report. Distinguishing them requires objective measurement of actual call duration against intended call duration, stratified by a validated hyperfocus measure—which is precisely what the instrumentation described in Section 4 makes possible for the first time. This is identified as a research priority in Section 6.

Hupfeld et al. (2019) conducted the first dedicated empirical study of hyperfocus in adults with ADHD, establishing it as a measurable construct rather than an anecdotal report. Hupfeld et al. (2024) subsequently validated a 12-item dispositional Adult Hyperfocus Questionnaire (AHQ-D) with strong psychometric properties (Cronbach's α = 0.93, factor loadings 0.57–0.81), replicating a positive correlation between hyperfocus scores and ADHD traits, though in a sample not recruited for ADHD—28 of 347 participants reported a diagnosis—and with the authors urging caution in interpreting the group difference. The existence of a validated measurement instrument means that hyperfocus during phone calls can now be studied rigorously in the context of HCT interventions.

The design implication is clear. Visible countdown timers and periodic time signals do not fight hyperfocus—they coexist with it. They provide an external time anchor that the ADHD brain cannot generate internally during a hyperfocus state. The timer is not an interruption; it is the information that the internal clock has stopped providing.

2.1.3 Ambient Noise and Cognitive Performance During Calls

Söderlund et al. (2007), testing the Moderate Brain Arousal (MBA) model proposed by Sikström and Söderlund (2007), demonstrated that white noise improved cognitive performance in children with ADHD while simultaneously degrading performance in neurotypical controls. This differential response is attributed to stochastic resonance effects modulated by dopamine levels: individuals with lower tonic dopamine (characteristic of ADHD) require more environmental noise for optimal neural function.

Nigg et al. (2024) provide the most rigorous quantification of these effects. Across 13 studies with 335 participants, and measured on laboratory attention tasks rather than real-world functioning, white and pink noise produced a small but statistically significant benefit for youth with ADHD or elevated attention problems ($g = 0.249$, 95% CI [0.135, 0.363], $p < .0001$). The same noise exposure produced a negative effect in non-ADHD comparison groups ($g = -0.212$, 95% CI [−0.355, −0.069], $p = .0036$). No studies of brown noise were identified, meaning that while brown noise is theoretically supported by the MBA model, it lacks direct empirical validation. This divergent effect—noise helping one population while harming another—has direct implications for in-call audio design: sensory modification during phone calls must be user-configurable, not a universal default.

Hypothesis: *Time-structured phone calls with visible countdown timers, periodic time signals, and user-configurable ambient audio represent a theoretically grounded intervention for ADHD time blindness and hyperfocus-related time loss during telephonic communication. Clinical validation through randomised controlled trials is a priority research need.*

2.1.4 “Object Permanence”: Prospective Memory and Relationship Maintenance

Executive function deficits in ADHD extend beyond time perception and attention regulation to affect the maintenance of social relationships. ADHD communities have a name for the experience: “object permanence”—borrowing Piaget’s (1954) developmental term to describe the way awareness of a relationship can fade entirely from working memory when the person is not physically present or environmentally cued. Out of sight is, functionally, out of mind. The borrowed term is developmentally imprecise—adults with ADHD know perfectly well that absent people continue to exist—but it names the lived experience more vividly than any construct in the clinical literature, and it names something real.

Its closest empirical correlate is prospective memory: the ability to remember to execute an intended action at the appropriate future moment. Prospective memory is measurably impaired in adults with ADHD, who recall and execute fewer of their own real-life intentions than matched controls (Altgassen et al., 2019). “Call my friend this week” is a prospective memory task—a self-initiated, temporally unanchored intention of precisely the kind the ADHD executive system fails to execute without an external cue. The community found the better name; the literature holds the measurable construct. This paper uses both, because the phenomenon they jointly describe is a design target.

The social consequences are documented from childhood onward. A systematic review of 24 studies covering 1,509 participants with ADHD found significantly fewer friends, lower quality friendships, and poorer friendship interactions compared with typically developing peers, with 22 of the included studies rated as methodologically strong (Spender et al., 2023). The trajectory matters as much as the deficit: perceived social support from friends diminishes across adolescence in youth with ADHD while it increases in typically developing youth (Rokeach & Wiener, 2020)—a divergence consistent with relationships that fade progressively rather than fail at formation. The result is not indifference but involuntary neglect: weeks or months pass without contact, not because the individual does not value the relationship, but because the executive system that should convert valuing into calling does not fire uncued.

The emotional sequelae compound the executive failure. Emotion dysregulation is now recognised as a core-adjacent feature of ADHD, present in an estimated 30–70% of adults with the condition and associated with relationship impairment and poor friendship quality (Shaw et al., 2014). Within this frame, the guilt and shame that follow neglected contact are not incidental: the emotional response to executive function failure becomes itself a barrier to the repair behaviour, producing a shame-guilt-avoidance cycle in which awareness of the neglected relationship generates anxiety that further inhibits contact. Barkley (2015) situates sustained effort toward non-immediately-rewarding social maintenance tasks as precisely the domain where ADHD impairment is most pronounced. Any technology that attempts to support relationship maintenance must therefore be designed to interrupt the shame cycle rather than reinforce it—surfacing information about neglected relationships through encouragement rather than deficit framing.

Autistic individuals experience related but distinct difficulties. Time-based prospective memory—remembering to act at a future time rather than in response to an external event—shows a large impairment in autism (Landsiedel et al., 2017), meaning the same class of uncued social intention is vulnerable in both populations. Critically, the difficulty does not reflect disinterest: the first systematic review of loneliness in autistic adults found a consistent desire for social connection alongside the challenges of achieving it, with loneliness associated with camouflaging demands, sensory avoidance, and lack of autism understanding, and reduced by having relationships (Grace et al., 2022). Variable energy for social interaction and the cognitive cost of initiating communication—particularly phone calls (Howard & Sedgewick, 2021)—produce similar patterns of inconsistent contact from a different mechanism.

Current telephony provides no support for relationship maintenance. A phone's contact list is a static directory; call logs record what happened but do not surface what has not happened—the call not made, the friend not contacted in three months. For individuals whose prospective memory does not reliably execute uncued social intentions, the absence of environmental cues means relationships can deteriorate silently until the damage is difficult to repair.

The HCT framework addresses this through what may be termed "relationship intelligence"—communication tools that make the state of one's social connections visible and actionable without guilt or pressure. Contact groups with configurable frequency goals, gentle notifications about contacts who have not been reached recently, relationship health indicators based on call patterns, and social graph analytics that surface changes in communication behaviour over time—these represent a new category of communication support that treats relationship maintenance as a legitimate function of the communication device rather than a task left entirely to the user's unaided executive function. In prospective memory terms, these features convert a failing time-based intention ("I should call people more") into a supported event-based one (a visible, gentle cue)—the same externalisation strategy that time-assistive devices apply to time perception (Section 2.1.1).

***Limitation:** The friendship evidence is largely developmental, the prospective memory evidence is laboratory-based, and no study has yet measured relationship maintenance behaviour in adults with ADHD in naturalistic settings. The causal chain from prospective memory impairment to relationship deterioration is theoretically coherent but empirically unclosed. Study 6 (Section 6) is designed to close it.*

2.2 Autism and Phone Call Anxiety

Howard and Sedgewick (2021) conducted the most comprehensive study to date of communication mode preferences among autistic adults. Two hundred and forty-five autistic adults ranked six communication modes across seven scenarios. Phone calls were consistently ranked as the least preferred modality across nearly all scenarios. Qualitative analysis identified four themes: avoidance of the phone as a communication medium, strong preference for written communication, the burden of masking during calls versus authentic autistic communication, and outright avoidance of communication when phone-based options were the only ones available.

The masking burden warrants particular attention. Autistic adults reported expending substantial cognitive resources to perform neurotypical communication patterns during phone calls—modulating tone, managing turn-taking without visual cues, producing expected social responses. This masking is itself a source of fatigue and anxiety, compounding the communication difficulty already inherent in a modality that strips away visual and contextual information. Structured calls that explicitly set expectations—duration, topic, communication norms—reduce the social ambiguity that drives masking behaviour. This is a design intervention, not a therapeutic one; it modifies the communication environment rather than requiring the user to modify their behaviour.

The implications extend beyond individual well-being. When healthcare services, government agencies, and financial institutions rely exclusively on phone-based communication, they create systemic access barriers for autistic populations. The Howard and Sedgewick (2021) findings suggest that this reliance is not merely inconvenient but functionally exclusionary for a measurable proportion of the population. HCT offers a path between mandating phone use and abandoning voice communication: restructuring the call experience to reduce its most burdensome characteristics while preserving the immediacy and relational value that voice communication uniquely provides.

It is important to acknowledge that many autistic individuals would prefer to eliminate phone calls entirely. This paper does not argue for compelling phone use. The argument is that when phone calls are unavoidable—medical appointments, emergency contacts, workplace requirements—their structure can be modified to reduce harm.

One specific difficulty warrants attention because it bridges the neurodivergent and general populations: the inability to end a phone call. For autistic individuals, the social scripts governing call termination are ambiguous and anxiety-producing—when is it acceptable to end, what phrases signal closure without offence, how to interrupt a monologue without rudeness. For individuals with ADHD, impulsivity and time blindness combine to prevent timely termination even when the intention to end exists. But difficulty ending calls is not exclusively a neurodivergent experience. People-pleasing, social pressure, power imbalances (employee with employer, patient with clinician, customer with service provider), and the simple absence of a graceful exit mechanism affect the general population. The social cost of being the person who ends a conversation is a universal communicative burden that current telephony does nothing to address.

2.3 Chronic Illness Communication Burden

People managing chronic conditions—including Type 1 diabetes, cardiac disease, and multi-morbidity—rely on phone calls for caregiver coordination, medication management, and medical communication. The cognitive load of managing complex health information during unstructured phone calls is well-documented in the health literacy literature, though direct evidence linking call structure to chronic illness outcomes remains limited.

The theoretical case is grounded in two observations. First, structured communication reduces cognitive load across populations, a finding consistent with cognitive load theory (Sweller, 1988). Time-bounded calls with pre-agreed agendas reduce the executive function demands of managing call duration while simultaneously processing complex health information. Second, emergency communication—the ability to reach a caregiver or emergency contact reliably during a health crisis—is a life-safety requirement that current telephony handles through basic contact lists rather than intelligent priority systems.

Individuals managing multi-morbidity may interact with multiple clinicians, pharmacies, insurance providers, and caregivers through phone calls. Each call demands simultaneous attention to medical information, social communication, and executive function. The cumulative cognitive load is a plausible mechanism for communication avoidance, which in turn may affect medication adherence and care coordination. This causal chain is hypothetical and requires investigation, but it is consistent with cognitive load theory and with the broader literature on health literacy.

Limitation: *Direct clinical evidence linking phone call structure to chronic illness outcomes is thinner than the ADHD and autism evidence. The arguments in this subsection are theoretically grounded but require empirical validation.*

2.4 The Worry Burden: Caregivers, Families, and Vulnerable Populations

The preceding subsections have addressed communication burden from the perspective of the person making or receiving the call. But phone calls exist within relationships, and the communication failures of current telephony impose a burden on the other side of the relationship as well—the person who worries. Caregiver burden—the physical, financial, and psychosocial hardship of caring for a person with a medical condition—is one of the most extensively studied phenomena in health psychology and gerontology, with documented associations with caregiver anxiety, depression, compromised immunity, and mortality (Schulz & Sherwood, 2008). Communication uncertainty—not knowing whether a vulnerable person is safe, being unable to reach them reliably—has been identified as a significant driver of caregiver distress (Thomas Hebdon et al., 2023).

A mother at work whose child has epilepsy. A husband travelling while his wife manages a cardiac condition. An adult daughter living 500 kilometres from her elderly father who lives alone. A teenager whose close friend has depression. Each of these individuals shares a common experience: the unanswered call at the wrong time, the phone that goes to voicemail because it was on silent mode, the 3am thought that something may have happened and the phone will not help them find out. This is not a clinical abstraction. It is one of the most common sources of ambient anxiety in human life—the fear of being unreachable when someone you love needs you, or of being unable to reach someone you are responsible for when you sense something is wrong.

Current telephony provides no architecture for care relationships. A mother's call to her diabetic child is treated identically to a telemarketing call—both are blocked by Do Not Disturb, both are silenced by silent mode, both are subject to the same notification filtering. The phone has no concept of a call that must get through. When a caregiver cannot reach a vulnerable person because of a software setting designed for convenience, the communication system has failed at its most basic function.

Elderly populations are disproportionately affected. An older adult living alone who falls, becomes confused, or experiences a medical event may be unable to operate their phone. Current smartphones offer a basic emergency call function, but no structured medical information for bystanders, no prioritised caregiver contact system, and no mechanism for a caregiver to reach through DND with a welfare check call. The locked phone of an unconscious elderly person is, from a bystander's perspective, a sealed box containing potentially life-saving information—medical conditions, medications, allergies, emergency contacts—with no way to access it.

The HCT Emergency Priority principle (Section 3.2.4) addresses this directly. ICE Checkup calls allow a caregiver to reach their caretakee through any phone setting at any time. Mutual ICE ensures that the care relationship is bidirectional—each party can always reach the other. The lockscreen medical card makes critical health information available to any bystander without phone unlock. Battery alerting ensures that a vulnerable person's phone does not die silently—a dead phone severs the care relationship's communication channel entirely. These are not features for a clinical minority. They are features for every human being who has someone they worry about—which is to say, for everyone.

This is the curb-cut effect at its most fundamental. An emergency communication system designed for a Type 1 diabetic's caregiver serves every parent, every partner, every adult child, every friend who has ever lain awake wondering whether someone they love is safe. The ICE architecture designed for clinical vulnerability reduces the ambient worry of ordinary human attachment.

3. The HCT Framework: Definition and Taxonomy

3.1 Formal Definition

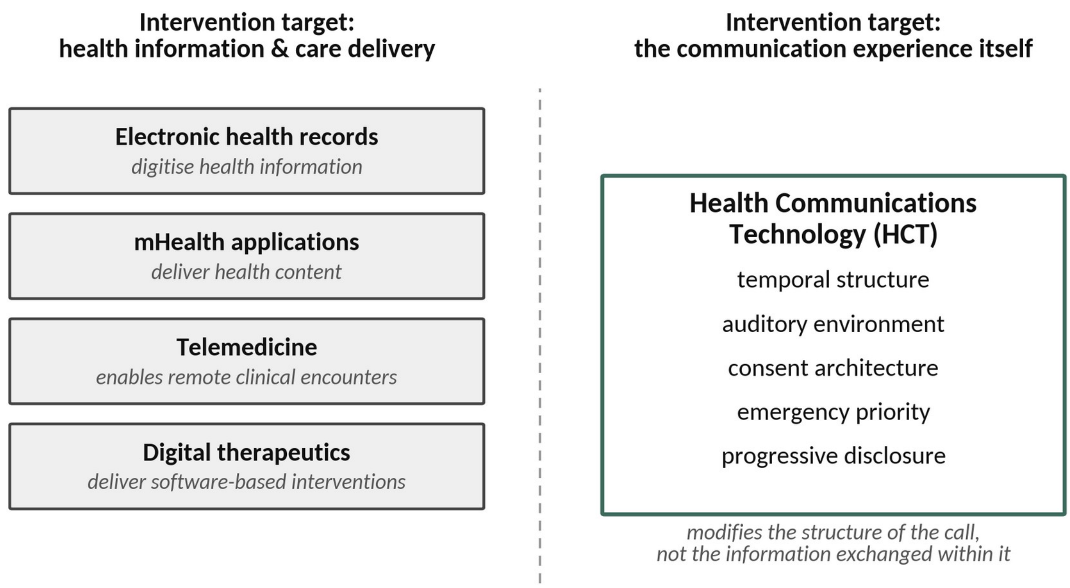
Health Communications Technology (HCT) comprises technology systems that modify the structure, timing, sensory characteristics, and consent architecture of interpersonal communication—particularly real-time voice communication—for the purpose of addressing documented clinical communication difficulties, reducing communication-related health burdens, and enabling accessible participation in essential telephonic interactions.

HCT is distinguished from adjacent categories by its intervention target (Figure 2). The World Health Assembly established eHealth as a formal policy domain in 2005, defining it as the cost-effective and secure use of information and communication technologies in support of health and health-related fields (World Health Organization, 2005); the categories that developed within that frame share a common orientation towards the delivery of health information, content or care. Electronic health records digitise health information. Mobile health applications deliver health content. Telemedicine enables remote clinical encounters. Digital therapeutics deliver evidence-based interventions through software. HCT addresses none of these functions. Instead, it modifies the communication experience itself—the temporal structure, auditory environment, consent framework, and emergency architecture within which interpersonal communication occurs. While this paper focuses on voice calls as the most clinically acute case, HCT principles apply to any real-time communication modality, including video calls, group calls, and asynchronous voice messaging.

The term is also distinct from two established usages with which it should not be confused: health communication, the study and practice of health messaging, and healthcare communication technology, the clinical messaging and coordination infrastructure of care delivery. Both concern the movement of health information; HCT concerns the structure of the conversation itself.

Figure 2

Intervention Targets of Established Digital Health Categories Versus Health Communications Technology



Note. Established categories deliver health information or care; HCT modifies the structure of the communication experience itself.

3.2 The Five Design Principles of HCT

The five principles and their primary evidential anchors are summarised in Figure 3.

Figure 3

The Five Design Principles of Health Communications Technology and Their Primary Evidential Anchors

Time Intelligence	Elapsed and remaining time made visible and negotiable during communication *Ptacek et al., 2019; Wennberg et al., 2018*
Sensory Modification	User-configurable auditory environment supporting cognitive performance *Söderlund et al., 2007; Nigg et al., 2024*
Consent Architecture	Bilateral agreement on communication parameters before the interaction begins *Howard & Sedgewick, 2021*
Emergency Priority	Life-critical communications bypass all restrictions and do-not-disturb settings *Schulz & Sherwood, 2008*
Progressive Disclosure	Complexity presented at a level appropriate to the user *Sweller, 1988*

3.2.1 Time Intelligence

Making elapsed and remaining time visible and negotiable during communication. This addresses documented time perception deficits and hyperfocus-related time loss in ADHD populations and reduces temporal uncertainty for autistic users.

3.2.2 Sensory Modification

Adapting the auditory environment to support cognitive performance during calls. Grounded in the MBA model (Söderlund et al., 2007) and the Nigg et al. (2024) meta-analytic evidence, this principle acknowledges that auditory environments affect ADHD and non-ADHD populations differently and must therefore be user-configurable rather than universally applied.

3.2.3 Consent Architecture

Bilateral agreement on communication parameters before the interaction begins. In current telephony, a phone call is initiated unilaterally: one party calls, the other answers, and no communication parameters—duration, purpose, or expectations—are negotiated before the conversation starts. The caller imposes; the receiver complies. HCT introduces the principle that both parties should consent to the structure of the communication before it begins. In its most immediate form, this means bilateral duration negotiation: both parties negotiate and agree on a call duration before the conversation begins. This is not merely a scheduling convenience. To the best of the author’s knowledge, it is the first bilateral consent mechanism in consumer telephony—a structural redesign of the power dynamic in which one party no longer controls the interaction unilaterally.

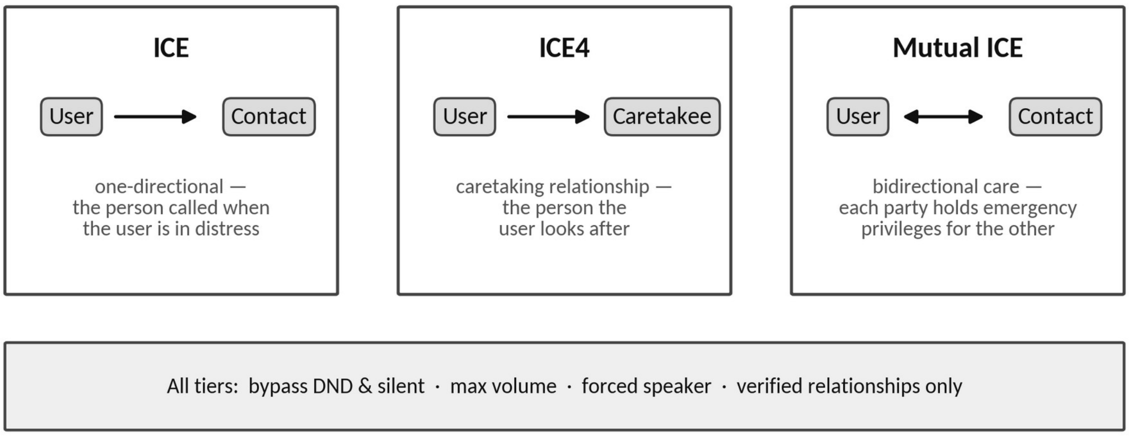
3.2.4 Emergency Priority

Life-critical communications bypass all restrictions, filters, and do-not-disturb settings. This principle extends beyond a simple emergency call button to encompass a structured emergency relationship taxonomy. In the HCT framework, emergency contacts are formalised through three tiers: ICE (In Case of Emergency) designates a one-directional emergency contact—the person the user wants called when in distress. ICE4 designates a caretaking relationship—the person the user looks after. Mutual ICE designates a bidirectional care relationship where both parties have emergency privileges for each other. Each tier carries system-level privileges: ICE and ICE4 calls bypass DND and silent mode, play at maximum volume, and force speaker activation. This ensures that a caregiver's call at 3am during a medical crisis is never blocked by a software setting.

Emergency Priority also encompasses lockscreen access for bystander scenarios. A persistent emergency information display accessible without phone unlock presents the user's medical conditions, medications, allergies, medical devices, and written emergency instructions alongside callable ICE contacts. In a bystander emergency—an unconscious person found with a phone—anyone can access life-critical information and contact the user's emergency network without authentication. The taxonomy is summarised in Figure 4.

Figure 4

The Three-Tier ICE Emergency Relationship Taxonomy



3.2.5 Progressive Disclosure

Communication tools presented at a complexity level appropriate to the user, preventing cognitive overload while preserving access to advanced features. This principle acknowledges the heterogeneity of neurodivergent populations—the needs of a user with ADHD-inattentive type differ from those of a user with autism and co-occurring anxiety.

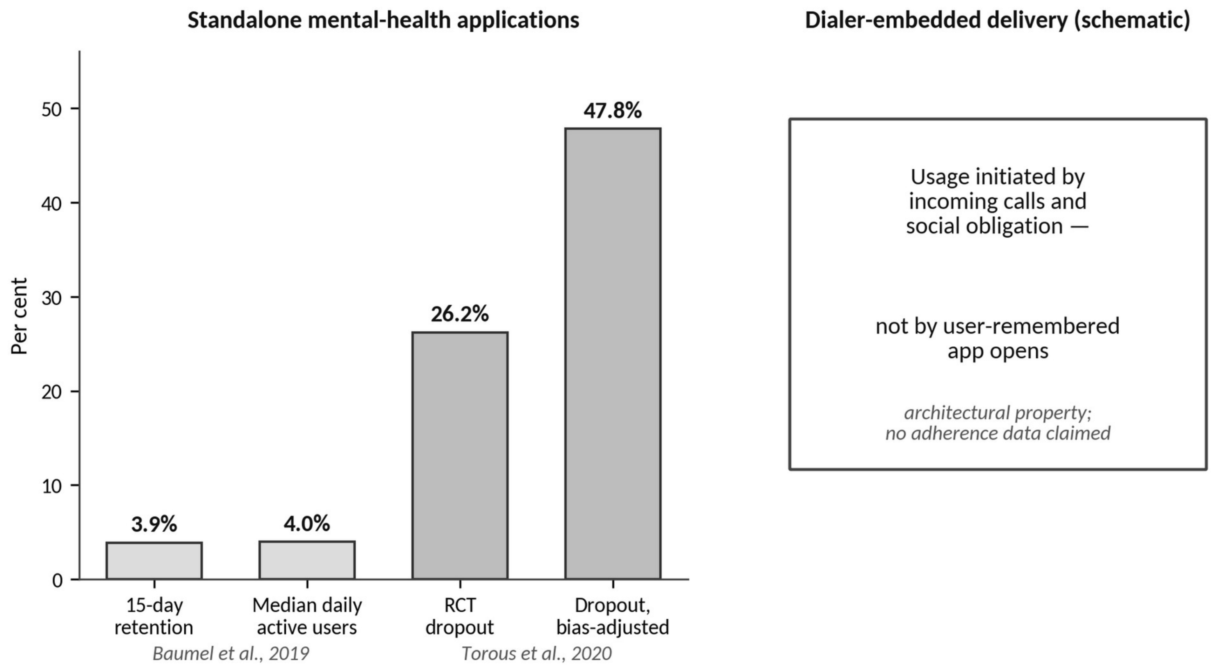
3.3 The Adherence Problem: Why HCT Must Live in the Dialer

Digital therapeutics face a fundamental adherence challenge: users must remember to open the application. For ADHD populations—whose executive function deficits make sustained engagement with non-immediately-rewarding tasks precisely the domain of greatest impairment—a standalone wellness application requiring daily voluntary activation is structurally unsuited to the population it serves. The irony is precise: the cognitive deficits that create the need for the intervention are the same deficits that prevent consistent use of the intervention.

The scale of this problem is documented. Baumel et al. (2019) found that the median 15-day retention rate for mental health apps was 3.9%, with a median daily active user rate of just 4.0%. Torous et al. (2020) reported a pooled dropout rate of 26.2% across 18 randomised trials of smartphone apps for depressive symptoms, rising to 47.8% when adjusted for publication bias. These are not engagement failures of individual apps; they represent a structural limitation of the standalone therapeutic application model. When the intervention requires the user to remember to open it, and the user's condition impairs precisely that kind of self-directed initiation, attrition is not a bug but a predictable consequence of the delivery architecture. Figure 5 summarises these attrition findings.

Figure 5

The Adherence Problem in Standalone Mental-Health Applications and the Structural Response of Dialer-Embedded Delivery



Note. Left panel: Baumel et al. (2019); Torous et al. (2020). The right panel is an architectural property, not a measurement; no adherence data for the case-study application are claimed.

A system-level phone dialer resolves this structurally. The user does not need to remember to open the application. Other people call. Appointments generate calls. The communication behaviour that triggers HCT interventions—time signals, focus sound, countdown timers, relationship health indicators—is externally initiated and socially obligatory. The intervention achieves near-perfect adherence not through gamification, notification pressure, or user willpower, but because it is embedded in the one application that the user's social and professional environment activates on their behalf. Furthermore, features such as the system-wide focus sound and the system-wide time signal extend HCT benefits beyond calls into continuous daily use. Because the dialer is the system-level application that cannot be batteryoptimised away or forgotten in a folder, these background services persist reliably—providing ambient cognitive support throughout the day, not merely during phone calls.

This architectural insight has implications for HCT research and development: communication interventions for neurodivergent populations should be delivered through communication infrastructure, not alongside it. Adherence is a design decision, not a user responsibility.

3.4 HCT as Universal Design: The Curb-Cut Argument

Blackwell (2017) popularised the term “curb-cut effect” for an observation long made in disability advocacy: accommodations designed for vulnerable populations generate benefits for everyone. Curb cuts, originally mandated for wheelchair users, are now used by parents with pushchairs, delivery workers with trolleys, travellers with luggage, and cyclists. The accommodation designed for a specific disability became a universal convenience.

The same dynamic applies to HCT. Time-bounded calls designed for ADHD time blindness benefit every professional managing a calendar. Pre-agreed durations designed for autistic predictability benefit anyone trapped on an unwanted call. Agenda labels designed to reduce autistic anxiety benefit any caller who wants to know the purpose of an incoming call before answering. Emergency bypass designed for chronic illness caretaking benefits any family managing a health concern. Relationship health indicators designed for ADHD object permanence benefit anyone whose friendships have faded through unintentional neglect. The curb-cut effect, applied to telephony, transforms neurodivergent accommodations into universal communication improvements.

The pre-agreed duration deserves particular emphasis as a universal curb-cut. When both parties negotiate and agree on a call duration before the conversation begins, the timer becomes a neutral third party that governs the call’s end. Neither participant bears the social cost of initiating termination. The phrase “our time is up” carries no interpersonal weight—it is a reference to a shared agreement, not a unilateral decision to end the relationship. For people-pleasers who cannot bring themselves to interrupt, for employees who feel unable to end a call with a superior, for patients and clinicians trapped on opposite sides of an overrunning consultation, and for anyone who has ever remained on a call twenty minutes past when they wished to hang up, the pre-agreed duration solves a problem that has existed since the telephone was invented. It was designed for ADHD time blindness. It serves everyone.

Evidence from workplace programmes offers partial support for this principle, and the quality of that evidence merits direct comment. Austin and Pisano (2017) report that software testing teams at one employer, staffed through a neurodiversity hiring programme, ran approximately 30% more productive than comparison teams, and that a team including a neurodivergent employee produced a technical fix valued at an estimated $40 million in savings. Both are presented by their authors as preliminary programme results rather than as controlled findings.

It is worth stating what this literature does not contain. Several figures widely circulated in support of the neurodiversity business case—including frequently quoted productivity multipliers attributed to major financial and professional services firms—cannot be traced to a primary source. They propagate through secondary coverage in which each account cites another, and in some cases the originating organisations no longer publish them. This is not evidence that the programmes failed; it is evidence that the business case rests on a thinner empirical foundation than its confident restatement suggests. The argument advanced here therefore rests on the design principle rather than on the productivity figures.

These are corporate programme findings, not peer-reviewed randomised trials, and should be interpreted accordingly. With that qualification stated, the direction of the available evidence is consistent across organisations and industries: when environments are designed for neurodivergent needs, neurodivergent individuals reach and in places exceed parity with neurotypical performance. The design methodology that produces this outcome is universal design (Connell et al., 1997): building for the most constrained users first, and discovering that the resulting solution serves all users better. HCT applies this methodology to telephony.

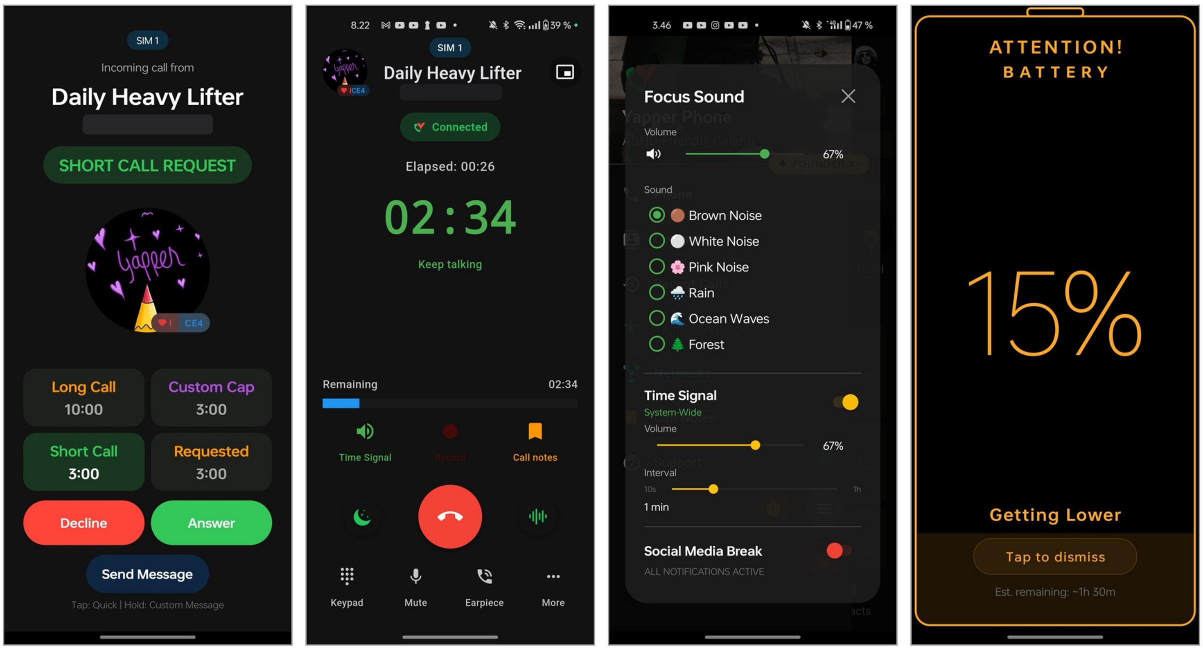
4. Case Study: Yapper Phone

Yapper Phone is a system-level Android application that replaces the device's default dialer, implementing HCT principles through deep telephony integration via InCallService APIs. The application is presented here as a case study in HCT implementation, not as a product endorsement. Independent clinical validation of its efficacy has not yet been conducted. The application has been publicly available on Google Play since June 2026. Yapper Phone is not a medical device: it does not diagnose, treat, screen for, or cure any condition.

A single provisional patent application containing 667+ innovation disclosures was filed with the United States Patent and Trademark Office (USPTO) on February 27, 2026. The application contains its own complete disclosure; this paper references the portfolio as evidence of the scope of innovation across the HCT domain, not as a substitute for or supplement to the patent filing. The application is provisional and has not been examined. No claims of clinical efficacy for any patented method are made or implied by this paper. Feature descriptions in this section are given at the level of user-facing capability; implementation detail is contained in the patent application and is withheld here pending patent prosecution. Readers applying mHealth reporting frameworks such as the mERA checklist (Agarwal et al., 2016) should read the absence of technical implementation detail as deliberate policy rather than incomplete reporting. Four shipped surfaces of the application are shown in Figure 6.

Figure 6

Four Shipped Surfaces of the Case-Study Application



(a) (b) (c) (d)

Note. (a) Incoming call with a pending short-call request (Consent Architecture, Section 4.1); (b) the full in-call screen with elapsed time, phase-coloured countdown, remaining-time bar, and in-call controls (Time Intelligence, Section 4.1); (c) the Focus Sound overlay with sound selection and system-wide time-signal controls (Sensory Modification, Section 4.2); (d) full-screen battery *alert (Emergency Priority, Section 4.3). Production build as distributed on Google Play, English locale; telephone numbers redacted.*

4.1 Time Intelligence Implementation

Every outgoing call begins with a duration selection. When both parties use the application, bilateral duration negotiation allows both caller and receiver to agree on a call length before the conversation begins. During calls, a colour-coded countdown timer provides continuous temporal feedback through progressive colour phases and a distinct overtime display. Periodic time signals—gentle chimes at user-configurable intervals—provide auditory time anchors with configurable volume, vibration, and haptic feedback, creating a multimodal temporal awareness system designed to coexist with hyperfocus rather than disrupt it. Crucially, users can exclude specific contacts and groups from overtime tracking and time mastery analytics entirely. Calls with close friends, partners, and family members who the user wants to talk to without time pressure are exempted from overtime tracking and time mastery analytics—acknowledging that not all calls should be bounded and that lengthy conversations with loved ones are a sign of relational health, not a time management failure.

Six distinct call types—Standard, Body Double, Agenda, ICE Emergency, ICE Checkup, and Custom—each transform the entire call interface with distinct colour schemes. Agenda calls display a short text description under the timer throughout the call, visible to both parties. Body Double calls implement a community-developed ADHD productivity strategy in which the presence of another person—even silently—supports task initiation and sustained focus (Eagle et al., 2023); the call type provides a purpose-labelled companionship mode so that the receiver understands the nature of the interaction.

4.2 Sensory Modification Implementation

In-call focus sound provides ambient noise mixed into the call audio, with separate volume controls capped at hearing-safe levels. The sound auto-pauses during ICE calls. Six sound profiles are available at launch: brown noise, white noise, pink noise, rain, ocean, and forest. A system-wide focus sound runs independently of calls as a persistent background service with lockscreen and Quick Settings controls.

Note: As discussed in Section 2.1.3, the meta-analytic evidence (Nigg et al., 2024) directly supports white and pink noise for ADHD populations; both are available at launch. Brown noise is theoretically supported by the MBA model but lacks direct empirical validation. Nature sounds (rain, ocean, forest) are offered as user-preferred options without clinical claims. The application labels each sound by type rather than making therapeutic assertions.

4.3 Emergency Priority Implementation

The ICE system implements the tiered emergency taxonomy described in Section 3.2.4, with colour-coded badges visible throughout the application. Distinct ICE call types serve different scenarios—emergency calls for when the user is in distress and checkup calls for caregiver welfare checks. Both bypass DND and silent mode and trigger priority alerts. Neither call type contacts emergency services autonomously; both open the dialer for the user to place the call. The system accepts only calls from contacts with verified ICE relationships—unrecognised callers cannot exploit the bypass.

The lockscreen medical card displays conditions, medications, devices, allergies, and emergency instructions—all accessible without phone unlock, with callable ICE contact buttons for bystander access. Battery intelligence monitors six configurable thresholds, each capable of bypassing DND. For users whose glucose monitors, insulin pumps, or automated insulin dosing systems depend on a smartphone to deliver critical safety alerts — a dependency the U.S. FDA addressed in a February 2025 safety communication, after reports of missed alerts contributing to severe hypoglycemia, diabetic ketoacidosis, and death — a dead phone silences those alerts and severs the companion apps through which parents and caregivers follow the same readings remotely. For anyone living with diabetes, a heart condition, or another life-threatening illness, it also cuts the line to help. In every case, a dead battery is a clinical risk.

4.4 Progressive Disclosure Implementation

A master complexity toggle (Gyro Mode) controls interface depth. When disabled, only essential options are visible. When enabled, advanced controls are revealed. This reduces cognitive load for everyday use while making full depth available to users who need it. Pre-built settings profiles allow the entire application experience to be switched in a single action. Three presets ship at launch—default, ADHD, and autism—adjusting sensory intensity across both visual and auditory channels. The ADHD and autism presets use subtle rather than vivid tag and control styling, reflecting the elevated sensory load that high-contrast, high-brightness interfaces impose; the autism preset additionally applies lower default volumes for the time signal and focus sound than the ADHD preset, reflecting the auditory sensitivity commonly reported in autistic individuals. The default preset ships with focus sound and the system-wide time signal disabled: the evidence reviewed in Section 2.1.3 indicates that the auditory stimulation benefiting ADHD populations produces negative effects in non-ADHD comparison groups, and the time signal targets time-perception deficits the default profile does not assume. Sensory support is therefore a configured choice, never a universal default. All preset values remain fully user-adjustable.

4.5 Additional Communication Support Features

Call notes with timestamps capture key points during live calls, saved as plain text files in user-chosen folders outside the application. A Social Media Break system provides granular notification filtering across multiple app categories. A system-wide time signal provides interval chimes independent of calls, automatically pausing during calls and resuming afterward. The application supports 29 languages at launch with full right-to-left support. All behavioural data—call records, notes, analytics, and relationship information—is stored exclusively on the user's device, with no third-party tracking and no server-side retention of user content. Calls are placed over the standard cellular network, so call audio never passes through the application's infrastructure. The sole networked function is bilateral duration negotiation, which uses a transient relay (cloud-agnostic by design; the current implementation runs on Google Firebase) to match the two sides of a call: identifiers are hashed on-device, and the relay carries only the negotiation handshake—no call content, contacts, or behavioural data.

4.6 Relationship Intelligence and Social Connectivity

The application implements the relationship maintenance support described in Section 2.1.4. Contact groups with colour-coded organisation allow users to structure their social network into meaningful categories (family, friends, work, and custom groups) with configurable contact frequency goals (daily, weekly, monthly). A relationship health score based on call frequency and recency indicates which groups and contacts need attention. The Statistics page includes a “People Missing You” section that gently surfaces contacts the user has not called recently—framed as encouragement, not guilt. Relationship tags, social handles across 15 platforms, timestamped photos, and timeline notes provide contextual memory for each contact: when and where they met, who introduced them, and a running record of the relationship beyond call data. For individuals with ADHD whose prospective memory does not reliably execute uncued social intentions, these features serve as an external social memory—making the state of one’s connections visible rather than requiring unaided recall.

4.7 Shame-Free Design as a Clinical Requirement

A cross-cutting design principle warrants explicit discussion. Every user-facing metric, notification, and analytics display in the application is designed to encourage rather than judge—a deliberate response to the shame-guilt-avoidance cycle described in Section 2.1.4. Statistics are framed as “Weekly Wins” rather than performance deficits. Broken calling streaks are never announced—no notifications, no “streak lost” messaging, no failure states; the counter silently resets and begins again with the next qualifying call, eliminating the punishment dynamic that drives disengagement in gamified systems. Whether silent reset or alternative mechanics such as streak pausing better sustain engagement in ADHD populations is an open empirical question on the research agenda. Neglected contacts are surfaced as “People Missing You” rather than “Contacts You Have Neglected.” Relationship health scores indicate which connections could benefit from attention without implying failure. The ability to exclude contacts and groups from time mastery ensures that long calls with loved ones are celebrated as relational investment rather than flagged as time management failures—a distinction that matters profoundly for ADHD individuals whose relationship maintenance is already compromised by object permanence difficulties. The behavioural dashboard’s Coach mode uses warm, plain-language narratives (“You’re a Night Owl caller”) rather than clinical deficit language.

This is not a cosmetic choice. For ADHD populations, shame about executive function failures is itself a clinical barrier—the emotional response to missed obligations produces anxiety that further inhibits the behaviour needed to repair the situation. This pattern intersects with what the ADHD clinical community increasingly terms rejection sensitivity dysphoria (RSD)—a manifestation of the emotion dysregulation documented as a central feature of ADHD (Shaw et al., 2014)—an intense emotional response to perceived criticism, failure, or social rejection that is disproportionate to the triggering event. A communication support tool that frames missed calls as failures, broken streaks as setbacks, or infrequent contact as neglect will trigger precisely this sensitivity, amplifying the cycle it is designed to interrupt. Shame-free design is therefore not a tone preference but a clinical requirement for any technology that aims to support neurodivergent communication patterns without causing harm.

4.8 Behavioural Analytics

A multi-domain behavioural dashboard provides research-grade communication analytics spanning duration intelligence, social graph mapping, chronobiological patterns, focus and sensory impact, relationship health, and self-mastery metrics. The dashboard offers both warm narrative summaries (Coach mode) and raw data views (Research mode), with all processing on-device.

***Limitation:** No clinical trials have been conducted to validate the therapeutic efficacy of any feature described in this section. The features are grounded in the clinical literature reviewed in Section 2, but the causal chain from feature to clinical outcome remains hypothetical. The Research Agenda in Section 6 identifies specific studies required for validation.*

5. Bilateral Consent in Telephony: A Structural Absence

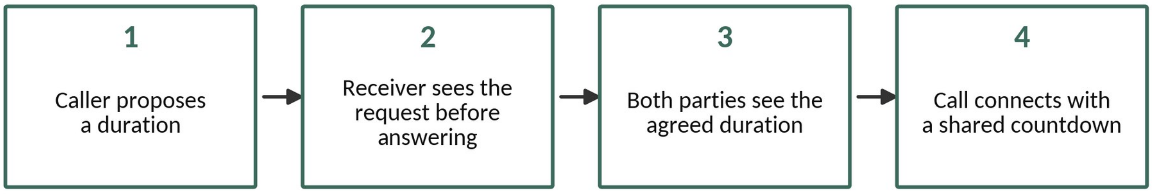
In 150 years of telephony, the standard phone call has never included a mechanism for both parties to agree on its parameters before it begins. The caller decides to call; the receiver decides only whether to answer. Duration, purpose, and expectations are imposed unilaterally by the initiating party. The receiver has no structured means of communicating their availability, their time constraints, or their preferred call length before the conversation starts. This asymmetry is so embedded in the telephony experience that it is rarely recognised as a design choice. It is simply how phone calls work. HCT identifies it as a structural absence—and one with measurable clinical consequences.

For individuals with ADHD, the open-ended call with no pre-agreed duration triggers time blindness, hyperfocus-related time loss, and call avoidance (Sections 2.1.1–2.1.2). For autistic individuals, the unpredictability of an unstructured call—not knowing how long it will last, what it will cover, or when it will end—is a primary driver of phone anxiety (Section 2.2). For caregivers, the inability to reach a vulnerable person reliably because DND treats all calls equally is a source of persistent worry (Section 2.4). For the general population, the absence of a graceful exit mechanism traps people on calls they do not want to continue (Section 2.2). Each of these problems traces to the same root: telephony has no consent layer.

The HCT Consent Architecture principle addresses this by introducing bilateral negotiation into the call initiation process. Both parties agree on communication parameters before the conversation begins—a social contract that governs duration, sets expectations, and provides a neutral mechanism for call termination. This is, to the best of the author's knowledge, the first implementation of bilateral communication consent in the history of consumer telephony. It transforms the phone call from a unilateral imposition into a negotiated interaction. The approach is consistent with Milton's (2012) 'double empathy problem': communication difficulty arises between differing parties, and its remedy is mutual accommodation rather than unilateral adaptation—which is what bilateral negotiation structurally provides. Figure 7 summarises the user-visible sequence.

Figure 7

The Bilateral Duration Negotiation Sequence as Visible to Users



Note. User-visible sequence only; protocol internals are described in the patent application.

The implications extend beyond the neurodivergent populations for whom the feature was designed. In professional contexts, bilateral duration consent eliminates the ambiguity of "do you have a minute?" calls that consume thirty minutes. In power-imbalanced relationships—employee and supervisor, patient and clinician, customer and service provider—the pre-agreed duration gives the less powerful party a socially costless exit mechanism. In personal relationships, agreed durations prevent the resentment that accumulates from calls that consistently overrun. The consent architecture designed for clinical necessity becomes, through the curb-cut effect, a universal improvement to communication culture.

5.1 Regulatory and Classification Questions

The regulatory classification of HCT raises questions without settled answers. Should HCT applications be classified as digital therapeutics if time-structured calls are validated as effective interventions for ADHD time blindness? Could HCT qualify for reimbursement under existing CMS telehealth codes G0552–G0554? Does the European Accessibility Act (effective June 2025) create telephony accessibility obligations that current mobile operating systems do not meet—particularly given evidence that phone calls are demonstrably inaccessible to autistic users (Howard & Sedgewick, 2021)? Does the EU Digital Markets Act gatekeeper designation create obligations for Apple and Google regarding system-level API access for accessibility innovation? The current regulatory framework was not designed with communication structure modification in mind. HCT occupies a regulatory interstitial space whose resolution will require engagement from regulators, industry, and the clinical research community.

The emergence of voice AI technologies—large language models capable of real-time voice interaction, voice cloning, and AI-powered call agents—adds urgency to the broader consent question. When a human caller cannot determine whether they are speaking with another human or an AI agent, consent architecture becomes not merely a usability improvement but a civil liberties concern. HCT's principle that communication parameters must be agreed bilaterally before interaction begins provides a conceptual foundation for addressing this challenge, though the specific regulatory and technical solutions remain open questions.

6. Research Agenda

The following studies are proposed as priorities for independent academic validation of the HCT framework. All proposed studies can be conducted using the application as described in Section 4. The six studies are summarised in Table 1.

Table 1

Proposed Studies for Independent Validation of the HCT Framework

Study	Design	Population and N	Primary outcomes
1. Time-assistive interventions and ADHD time management	Randomised controlled trial, three arms, 12 weeks	150–200 adults with confirmed ADHD	Call duration accuracy; schedule adherence; call avoidance
2. Sensory-modified calls and autistic anxiety	Crossover, 4 weeks per condition	60–80 autistic adults	GAD-7; call completion rates
3. Ambient noise during calls and cognitive performance	Laboratory, five sound conditions	80–120, stratified by ADHD status	Cognitive performance during simulated calls
4. Hyperfocus, call type, and overtime patterns	Observational	200+, stratified by AHQ-D score	Requested versus actual call duration, by call type
5. ICE system effectiveness	Survey and behavioural analysis	500+	DND bypass reach; medical card usage; caregiver confidence
6. Communication patterns and social isolation	Longitudinal observational	Shipping-application analytics cohort	Call frequency and contact diversity versus self-reported loneliness

Disclosure: *The developer of the application described in Section 4, who has ADHD and Type 1 diabetes, reports that seven months of daily use of the system-wide time signal (one-minute intervals), system-wide focus sound (continuous brown noise), and in-call time signals and countdown timers produced a subjective improvement in time awareness, reduced time anxiety, and decreased the schedule disruption associated with hyperfocus and daydreaming—without interfering with sustained concentration. The developer reports that days feel subjectively longer and that the periodic time signal provides a gentle return to temporal awareness ("oh, a minute passed") that coexists with deep focus rather than disrupting it. This is a single self-report from a conflicted source (the developer reporting on their own tool) and does not constitute evidence. It is disclosed here as the experiential observation that motivated the research agenda below and as a transparency obligation to the reader.*

Study 1: Time-Assistive Interventions and ADHD Time Management

Randomised controlled trial, three arms, N = 150–200 adults with confirmed ADHD. Arm A: time-structured calls only (countdown, pre-agreed duration, in-call time signals). Arm B: time-structured calls plus continuous system-wide time signal. Arm C: unmodified calls (control).

Duration: 12 weeks. Primary outcomes: call duration accuracy, schedule adherence, call avoidance. Secondary: self-reported time awareness, subjective day length, hyperfocus-related disruption (AHQ-D; Hupfeld et al., 2024). Extends the Wennberg et al. (2018) findings to ambient, continuous time assistance in adults.

Study 2: Sensory-Modified Calls and Autistic Anxiety

Crossover study, N = 60–80 autistic adults, 4 weeks per condition. Calls with user-selected ambient audio versus standard calls. Primary outcomes: GAD-7, call completion rates. Secondary: masking fatigue measures.

Study 3: Ambient Noise During Calls and Cognitive Performance

Laboratory study, N = 80–120 (stratified by ADHD status). Simulated phone calls with varying noise conditions (silence, white noise, pink noise, brown noise, nature sounds). All conditions are available in the shipping application. This study would provide the first empirical data on brown noise and nature sounds during calls. Nigg et al. (2024) identified no studies of brown noise at all, and none of the six sound profiles has been evaluated during live conversation. Primary outcomes: information recall, task switching, cognitive load.

Study 4: Hyperfocus, Call Type, and Objective Overtime Patterns

Observational study, N = 200+ (stratified by AHQ-D scores). Compares requested call duration against actual call duration across call types, testing whether high-hyperfocus individuals show greater positive deviation on unstructured calls than on agenda-structured calls. This study addresses the tension identified in Section 2.1.2: Groen et al. (2020) found hyperfocus to be less frequent in social situations among adults with ADHD, while community self-report consistently describes time loss during engaging conversations. Because the design measures behaviour rather than recall, it can distinguish a genuine absence of the phenomenon from a failure of self-report to detect it. Primary outcome: mean deviation from agreed duration by call type and AHQ-D stratum. All data available from the application's behavioural dashboard export.

Study 5: ICE System Effectiveness

Survey and behavioural analysis, N = 500+. ICE configuration patterns, DND bypass reach rates, lockscreen medical card usage, Checkup call frequency. Correlation with caregiver confidence and emergency preparedness.

Study 6: Communication Patterns and Social Isolation

Longitudinal observational study. Analysis of call frequency trends, contact diversity, and social graph changes over time. Tests whether declining communication patterns predict self-reported loneliness. Achievable with shipping analytics exports and periodic survey instruments.

7. Institutional Architecture and Data Governance

7.1 Communication Analytics as a Novel Research Dataset

No existing research platform collects structured communication metadata of the type generated by the application described in Section 4. Call duration accuracy, overtime patterns, call type selection, contact frequency, chronobiological distribution, social graph evolution, focus sound activation patterns, and time signal response data constitute a novel dataset for communication health research. This data has never been available to researchers because no prior application has structured the phone call in a way that generates it.

The dataset is inherently communication-focused rather than health-focused, which distinguishes it from existing digital health data sources. It does not measure physiological parameters. It measures how people communicate—and how communication behaviour changes in response to structural interventions like time intelligence and sensory modification. This is a new research domain that HCT creates.

7.2 The 23andMe Governance Lesson

On March 23, 2025, 23andMe filed for Chapter 11 bankruptcy. The genetic data of more than 15 million customers became a bankruptcy asset subject to potential sale, and existing United States federal law was found not to protect consumer data adequately in bankruptcy proceedings (Gerke et al., 2025). The case illustrates a structural vulnerability: when health-adjacent data is collected by a corporate entity, changes in that entity's financial condition can expose participant data to uses never contemplated at the time of consent.

The case has since resolved in a manner that requires direct comment here. In June 2025 the dataset was sold, with court approval, to TTAM Research Institute—a non-profit organisation created by the company's founder and former chief executive. A superficial reading might find that outcome structurally similar to the arrangement described in this section, and the distinction should be stated plainly. TTAM was constituted reactively, within bankruptcy proceedings, by a founder who retained control, and carries no permanent prohibition on subsequent transfer. Maximized Impact ry was constituted before the application described in Section 4 was published, and its registered rules direct that, upon any dissolution, assets may pass only to purposes consistent with the association's non-commercial research mission—a registered structural constraint rather than a revisable corporate policy.

The deeper distinction is architectural rather than institutional. 23andMe's exposure arose because it held the data. The governance lesson is not that custodianship should be better designed, but that the only data which cannot be sold in an insolvency is data that was never collected. The architecture described in Section 4 stores communication records on the user's own device; neither the association nor the Institute holds an equivalent dataset to place at risk. Table 2 contrasts the three governance models.

Table 2

Data Governance Comparison Across Health Research Platforms

Dimension	UK Biobank	23andMe	Yapper / Maximized Impact ry
Communication data	None	None	**Structured call metadata**
Data ownership	Institutional	Corporate → sold	**User (on-device)**
Anonymisation	Post-collection	Corporate-controlled	**On-device, pre-transmission**
Entity sellable?	Possible	YES — happened	**No — Finnish ry; no owners, not convertible**
Participant withdrawal	Limited	Contested in bankruptcy	**Immediate, complete**

Note. UK Biobank: Sudlow et al. (2015). 23andMe filed Chapter 11 bankruptcy March 23, 2025 (Gerke et al., 2025). The Institute for The Study Of Humanity is a research initiative of Maximized Impact ry (Y-tunnus 3564524-7), a Finnish registered association that cannot be sold or acquired as an entity and whose assets are governed by its registered rules.

7.3 Institutional Form as a Data Governance Mechanism

The Institute for The Study Of Humanity operates as a research programme of Maximized Impact ry, a Finnish registered association (ry, Y-tunnus 3564524-7). Under the Finnish Associations Act, a registered association cannot be sold or acquired as an entity, cannot be converted into a limited company, and its assets upon dissolution are distributed according to its registered rules rather than to any owner—an association has no owners to sell to. These structural characteristics address the governance vulnerability exposed by the 23andMe case. Additional protections include on-device anonymisation before any data transmission, immediate and complete participant withdrawal at any time, and open-access publication of all findings under CC BY 4.0.

7.4 Ethical Framework

All research conducted through the Institute operates under the following principles: opt-in participation only with no default enrolment; per-study consent allowing participants to choose which studies to join; revocable consent with immediate data deletion; full transparency through visible research participation interfaces; no diagnostic language in participant-facing communication; independent ethics review before data collection; open-access publication under CC BY 4.0; and on-device data processing ensuring the Institute never receives identifiable data.

8. Conclusions

This paper has argued that the voice phone call represents a significant and unaddressed gap in the digital health and accessibility landscape. Clinical evidence from ADHD research—including time perception deficits, hyperfocus, differential noise response, and impaired relationship maintenance through prospective memory deficits ("object permanence" in community terms)—autism communication studies, and chronic illness management identifies the unstructured phone call as a site of disproportionate difficulty for neurodivergent and chronically ill populations. The worry experienced by caregivers and families of vulnerable individuals extends this burden to the relational context within which communication occurs.

Health Communications Technology (HCT) is proposed as a framework for addressing this gap. HCT is defined not by the health information it processes but by the communication experience it modifies: temporal structure, auditory environment, consent architecture, emergency priority, and progressive disclosure. The framework is grounded in existing clinical evidence and draws on established principles of universal design.

The curb-cut argument is central to the HCT proposition. Workplace programme data, subject to the evidential limits noted in Section 3.4, indicate that designing for neurodivergent needs does not merely accommodate—it enhances. The same principle applies to telephony: features designed for ADHD time blindness, autistic phone anxiety, and chronic illness caretaking produce communication tools that serve all users better. The emergency communication architecture designed for a diabetic child's caregiver reduces the ambient worry of every parent, partner, and family member who has someone they care about. Building for the most constrained users first is not an act of charity. It is a design methodology that produces superior outcomes for everyone.

The case study in Section 4 demonstrates that HCT implementation at the system level is technically feasible, with a working application that implements all five design principles and supports 29 languages at launch. The institutional architecture described in Section 7 demonstrates that privacy-preserving, governance-robust research infrastructure can be established at minimal marginal cost through appropriate institutional design.

This paper does not claim that HCT has proven clinical efficacy. It claims that the theoretical foundation is sufficient to warrant rigorous investigation, that a working implementation now exists to support that investigation, and that the potential benefits—for neurodivergent populations specifically and for all communicators generally—justify sustained academic attention to a communication modality that has been neglected for 150 years.

The Institute for The Study Of Humanity invites academic institutions, clinical researchers, and regulatory bodies to engage with the HCT framework, challenge its assumptions, and collaborate in building the evidence base that either validates or refines its propositions.

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