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Living Counter-Maps: A Board Game as Critical Design for Relational Communication in Dementia Care

Shital Desai ^{1,*} , Sheryl Peris ^{1,2}, Ria Saraiya ^{1,3} and Rachel Remesat ^{1,4}
¹ Social and Technological Systems (SaTS) Lab, York University, Toronto, ON M3J 1P3, Canada; periss1@my.yorku.ca (S.P.); riav@my.yorku.ca (R.S.); rjremesa@yorku.ca (R.R.)

² School of Global Health, York University, Toronto, ON M3J 1P3, Canada

³ Design Department, School of the Arts, Media, Performance and Design (AMPD), York University, Toronto, ON M3J 1P3, Canada

⁴ Computational Arts Department, School of the Arts, Media, Performance and Design (AMPD), York University, Toronto, ON M3J 1P3, Canada

* Correspondence: desais@yorku.ca; Tel.: +1-4167383965

Abstract

Dementia disrupts communication not only as a cognitive process but as a relational practice, leaving people living with dementia (PLwD) at risk of exclusion when language fragments. This study examines how communication closeness, the felt sense of being understood, emotionally attuned, and socially connected, might be supported through Research in and through Design (Ri&tD). Drawing on formative mixed-reality studies and a participatory co-design workshop with PLwD, caregivers, and stakeholders, we iteratively developed a series of playful artifacts culminating in Neighbourly, a tactile board game designed to support relational interaction through rule-based, multimodal play. Across this design genealogy, prototypes were treated as Living Counter-Maps: participatory mappings that made patterns of gesture, rhythm, shared attention, and material engagement visible and discussable. Through iterative interpretation and synthesis, the study identifies three guiding principles for designing for communication closeness: supporting co-regulation rather than correction, enabling multimodal reciprocity, and providing a shared material focus for joint agency. The paper consolidates these insights in the Living Counter-Maps Framework, which integrates counter-mapping and Ri&tD as a methodological approach for studying and designing relational communication in dementia care.

Keywords: relational communication; communication closeness; dementia care; research in and through design (Ri&tD); critical design thinking; social innovation; design justice; empathic design



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1. Introduction

Dementia is often characterized by cognitive decline, yet its disruption of communication can be equally consequential. When speech fragments and conversational flow break down, people living with dementia (PLwD) risk being misunderstood or excluded from social participation. Relational perspectives on dementia have reframed this loss not as a disappearance of self but as a transformation in how identity and connection are expressed. Sabat and Harré demonstrated that selfhood persists through respectful dialogue even when verbal expression falters [1]. Kitwood argued that personhood is maintained through recognition and emotional attunement rather than cognition alone [2]. Kontos introduced the notion of embodied selfhood, showing that gestures, posture, and affective cues remain

powerful communicative resources [3]. Hydén further observed that people with dementia and their caregivers co-construct meaning through fragmented speech, gesture, and rhythm in everyday activities such as cooking [4].

These perspectives shift communication from a cognitive to a relational practice, where meaning arises through reciprocity, rhythm, and shared engagement. When reciprocity becomes difficult to sustain, the consequences are practical, emotional, and social. Misunderstanding can produce frustration, while withdrawal can lead to loneliness and loss of confidence. People with dementia describe communication breakdown as among the most painful aspects of the condition [5]. Supporting communication, therefore, involves more than restoring information exchange; it requires sustaining communication closeness: the felt sense of being understood, emotionally attuned, and socially connected.

Despite growing awareness of relational communication, most interventions still frame interaction and communication in functional or therapeutic terms. Reminiscence therapy stimulates conversation through memory recall [6] but often focuses on the past rather than fostering present-tense connection [7]. Augmentative and alternative communication (AAC) systems help structure conversation [8] but can position caregivers as facilitators in ways that may limit reciprocity [9,10]. Social robots such as PARO reduce agitation [11] yet produce directive rather than dialogic exchanges. Even interactive projection systems like Tovertafel increase engagement but rarely examine the relational quality of those interactions [12]. Studies show that while multimodal and non-verbal strategies can support meaningful connections, they remain inconsistently implemented in care practice [13,14]. Collectively, these interventions succeed functionally but remain relationally thin, overlooking the affective and embodied dynamics that underpin communication closeness.

To address this gap, this study introduces the concept of Living Counter-Maps, a way of understanding and designing communication through relational mapping. The term builds on counter-mapping traditions in participatory and critical geography, where mapping is used to challenge dominant narratives and reclaim representational agency [15,16]. Here, mapping is reinterpreted as an embodied and relational process through which patterns of interaction become visible, discussable, and open to reconfiguration. In dementia care, where communication is often experienced as fragmentation, such mapping offers a way to visualize, reflect on, and reconfigure patterns of closeness and connection. Rather than producing static representations, Living Counter-Maps evolve through interaction, functioning simultaneously as artifacts of design, reflection, and care.

The study operationalizes this concept through Research in and through Design (Ri&tD) [17], a methodological framework that treats design artifacts as mediators of inquiry. Ri&tD extends Research through Design (RtD) [18] by tracing how design activities form a genealogy, a sequence of artifacts and reflections through which knowledge is generated. Within this study, design prototypes, participatory workshops, and reflective sessions are not outcomes but Living Counter-Maps themselves: iterative, situated interventions that make relational communication observable and discussable.

The resulting design, Neighbourly, a tactile board game, embodies this approach. Developed through iterative engagements with PLwD, caregivers, and older adults, it explores how rule-based, embodied play can scaffold communication closeness. Through shared gestures, turn-taking, and tactile interaction, Neighbourly transforms everyday communication into an act of mapping, each move tracing emotional proximity, reciprocity, and attention.

By connecting counter-mapping, relational communication, and critical design thinking, this study contributes both conceptually and methodologically. Conceptually, it extends counter-mapping beyond spatial politics to the relational terrains of communication and care. Methodologically, it develops the Living Counter-Maps Framework, which integrates

counter-mapping into Ri&tD to study and design for communication closeness. This framework positions design not as the production of tools and products but as a relational practice that learns from, visualizes, and reshapes everyday interactions.

2. Background and Related Work

2.1. Relational Communication in Dementia Care

Building on the relational perspectives outlined in the introduction, which position communication as the foundation of selfhood and personhood, subsequent research has examined how these principles manifest in everyday care. Rather than focusing on language restoration, recent studies highlight how relational quality and attunement determine well-being and inclusion. Williams et al. showed that mirroring tone, rhythm, and pace during conversation reduces agitation and fosters connection [19]. Moyle et al. found that the quality of interaction outweighs its frequency alone in predicting satisfaction with care [20].

Growing evidence also underscores the role of multimodality in sustaining communication closeness. Non-verbal strategies such as gesture, gaze, touch, and physical proximity have been shown to promote mutual understanding between caregivers and PLwD [13]. Bender et al. identified six overarching categories of supportive nonverbal strategies, eye contact and gaze, facial expression, body movement and gesture, touch, spatial behaviour and proximity, and paralinguistics, that enhance empathy and relational engagement [13]. Staehler et al. linked verbal and non-verbal expressions to indicators of person-centred care, demonstrating that small, embodied cues often signal recognition and emotional reciprocity more effectively than speech alone [14].

Recent empirical studies deepen this multimodal perspective by illustrating how communication is co-regulated through temporal, embodied, and material coordination. Studies of everyday dementia interactions show that partners sustain communication by modulating rhythm, coordinating pauses, mirroring movements, and jointly orienting toward objects or activities [21–23]. Temporal alignment plays a key role: micro-adjustments in pacing and turn timing support affective attunement and facilitate shared understanding [24]. Interactional adaptation, including gesture repetition, rephrasing with altered prosody, modifying movement size, or offering stabilizing tactile cues, is frequently used to negotiate breakdowns and repair emerging misunderstandings [25]. These findings underscore that communication is not transmitted but ‘co-authored’, emerging through mutual adjustment and embodied responsiveness rather than verbal precision.

Collectively, this body of work reframes communication support as the cultivation of relational presence, in which mutual adjustment, shared activity, and multimodal engagement sustain connection. These insights establish the empirical and theoretical foundation for designing interventions, such as Neighbourly, that engage gesture, rhythm, materiality, and co-regulation as core communicative resources.

2.2. Communication Interventions: Therapy or Relationship?

A wide range of communication interventions has been developed for dementia care, yet most continue to frame interaction as therapy or functional training rather than as a relational practice. Reminiscence therapy remains among the most widely used approaches, promoting conversation through autobiographical recall [6]. While this method reliably increases talk, it often anchors dialogue in the past and limits opportunities for co-constructing new meanings in the present [7]. Music and art-based activities similarly demonstrate benefits for mood, engagement, and quality of life [26], but their outcomes are usually measured in therapeutic terms, such as reduced agitation rather than in relational terms such as mutual empathy or shared authorship.

Augmentative and Alternative Communication (AAC) systems support conversation by structuring expression through symbols, picture boards, or speech-generating devices [8]. However, these tools frequently structure interaction so that caregivers mediate or interpret communication, potentially constraining reciprocity [9,10]. Social robots such as ‘PARO’ and ‘JOY for All’ provide emotional comfort and reduce behavioural symptoms [11], but exchanges often resemble instruction or imitation rather than dialogue. Similarly, interactive projection systems like ‘Tovertafel’ increase engagement and physical activity, yet evaluations rarely analyze the relational quality of these interactions [12].

Taken together, these interventions demonstrate functional and affective benefits yet often under-address the relational dynamics, mutual regulation, shared control, and co-created meaning that shape communication quality. They focus on stimulation, task completion, or symptom reduction, overlooking the subtler dynamics of attunement, co-presence, and co-regulation that sustain communication closeness.

Moyle et al. emphasized that the quality of social interaction, not its quantity, determines well-being [20], while Bender et al. and Staehler et al. showed that embodied responsiveness, through gaze, gesture, and touch, forms the basis of empathy and mutual recognition [13,14].

Designing with relational communication in mind, therefore, requires shifting from therapeutic framing toward collaborative, co-created interaction, an orientation that guides the design approach developed in this study.

2.3. Mapping and Counter-Mapping

Participatory mapping has long been used to represent lived experience, memory, and place. Cognitive and neurocognitive studies describe mapping as an embodied process through which humans orient, interpret, and make sense of their environments. Jacobs and Schenk proposed the parallel map theory to explain how hippocampal function supports both spatial and relational cognition [27]. Stufflebeam and Rosen later extended this work to show how mapping reflects distributed cognitive activity rather than static representation [28], while González-García and Butler conceptualized mapping as a dynamic process that links cognitive and linguistic meaning-making [29]. These perspectives establish mapping as more than cartography; it is a multimodal practice of sense-making that can be adapted to study relational processes such as communication in dementia care.

The concept of counter-mapping reframes mapping as a critical and participatory act. Originating in political geography, Peluso used the term to describe how marginalized communities reclaim representational authority by mapping their own territories and narratives [15]. Extending this idea, Rattray conceptualized counter-mapping as situated knowledge that integrates lay expertise and lived experience into participatory research [16]. Here, mapping is not a detached depiction of reality but a dialogic and iterative process through which participants make meaning together.

Applied to dementia care, counter-mapping becomes a means of visualizing and negotiating relational dynamics, capturing how gestures, rhythms, and spatial patterns shape communicative practice. Existing uses of mapping in dementia studies often emphasize data representation, creating outputs that are analytically rich but socially inert. As Sanders and Stappers argued, participatory methods must redistribute authorship and agency to avoid reproducing extractive dynamics [30]. For mapping to contribute to relational communication, it must extend beyond representation toward participation, functioning as an ongoing, co-created exchange that sustains engagement between participants.

This study develops that evolution through the concept of Living Counter-Maps, iterative, participatory artifacts that both represent and generate relational understanding. Within the framework of Research in and through Design (Ri&tD) [17], mapping becomes an

embodied form of inquiry, co-produced, revisable, and reflective. Rather than documenting communication as a static event, Living Counter-Maps trace how interaction unfolds across gesture, material engagement, and affect, creating a methodological bridge between critical geography, relational communication, and design research.

2.4. Play as Relational Embodied Practice in Dementia Care

Play has long been recognized as a powerful medium for connection, imagination, and shared meaning-making. Within dementia care, play offers an alternative communicative space where interaction is guided not by correctness or cognitive performance but by reciprocity, exploration, and affective attunement. Unlike therapeutic exercises aimed at assessment or remediation, playful encounters allow participants to engage on their own terms, using gesture, rhythm, material manipulation, or symbolic action to express preferences and emotions. As such, play provides opportunities for relational engagement even when verbal language becomes less accessible.

In this study, play is treated not only as a mode of engagement but as a relational and methodological lens. Because play offers a bounded, yet flexible structure governed by shared rules, it supports co-regulation, turn-taking, and interpretive freedom, qualities central to communication closeness in dementia care. Within this framework, play becomes a way to explore how reciprocity, pacing, and multimodal expression emerge when linguistic demands are minimized. These relational affordances informed the use of rule-based, tactile games as design artifacts, grounding the study's methodological choice to examine communication through structured yet adaptable interaction.

Recent scholarship has expanded the understanding of play as a multimodal and relational activity that supports communication in dementia contexts. Ruitenburg et al. conceptualize play as a temporal and embodied modality in which gesture, gaze, prosody, and shared attention form the scaffolding for participation [31]. Huizinga et al. similarly show that playful, non-linear activities, such as object arrangement, storytelling, or improvisational exchanges, enable PLwD to take up roles as collaborators rather than care recipients [22]. These forms of engagement allow meaning to be negotiated through micro-coordination and shared sensory focus rather than through verbal logic alone.

Embodied and rhythmic dimensions of play have also been shown to foster affective alignment and co-regulation. In studies of everyday interaction, PLwD engage through mirroring, rhythmic pacing, and simple embodied patterns that create a sense of synchrony and mutual presence [21,24]. Such temporal coordination supports emotional resonance and offers a way to sustain connection despite fluctuating expressive capacities. Research further suggests that material play, manipulating objects, arranging tactile elements, or manipulating familiar artifacts, can anchor attention, evoke memory, and externalize meaning in ways that speech alone cannot [32].

Although play offers these relational possibilities, play is not inherently or universally inclusive. Its effectiveness depends on the flexibility of rules, the clarity and accessibility of materials, and the extent to which participants can negotiate pace, interpretation, and rest. Studies in dementia and ageing contexts show that play can become exclusionary when cognitive load is high, sensory cues are ambiguous, or when activities do not permit reinterpretation or shared control [20,33,34]. These critiques emphasize that play must be intentionally designed to accommodate fluctuating attention, varied communicative repertoires, and differing comfort levels. Within this project, these considerations informed the decision to design play as structured yet permeable, prioritizing multimodal cues, adaptable rules, and opportunities for co-authorship.

Taken together, these perspectives frame play as a relational and embodied practice through which communication closeness can be supported via shared action, co-regulation,

and mutual authorship. These qualities are particularly important in dementia care, where interaction must adapt to fluctuating capacities and moment-to-moment variability. This theoretical foundation underpins the design of Neighbourly, which treats play not merely as a recreational activity but as a communicative modality through which relational presence and shared meaning can emerge.

Play provides a structured yet flexible medium for exploring how relationships form and evolve. Huizinga described play as a bounded cultural activity governed by shared rules and mutual understanding [35,36], while Caillois identified cooperation, turn-taking, and reciprocity as the foundations of social order within play [37]. Sutton-Smith later emphasized that play's ambiguity, both serious and frivolous, makes it a powerful mode for experimenting with relationships and meaning [38].

Research on games across the lifespan confirms play's role in sustaining social connectedness. Whitbourne, Ellenberg, and Akimoto reported that adults of all ages engage in casual games to maintain feelings of belonging and interaction [39]. Volda, Carpendale, and Greenberg demonstrated that multiplayer console play requires continuous negotiation of agency and empathy among participants [40]. These findings highlight play as a communicative act that depends on rhythm, reciprocity, and shared attention, the same principles that underpin communication closeness in dementia care.

Within dementia contexts, diverse playful and interactive systems have been developed to support engagement, reminiscence, and social participation. Interactive projection environments such as Tovertafel and Magic Table promote movement, touch, and shared attention through light-based stimuli [12,41]. Music-game systems such as MINWii showed increased participation and positive affect [42]. However, evaluations typically emphasize engagement metrics (time-on-task, movement, affect) rather than the reciprocity and co-regulation that constitute communication closeness. Sensor-based systems such as TangiBalls encourage cooperative, rhythmic play [43], while robot-assisted and gesture-based activities have likewise been shown to foster engagement and emotional resonance among PLwD [44]. Board game adaptations such as The Dementia Awareness Game or Musical Memories integrate tangible materials and familiar routines to foster turn-taking and storytelling [37,38]. Although these interventions successfully promote participation and positive affect, many continue to approach play as a therapeutic or behaviour-focused activity rather than as a relational process co-created with participants. Evaluations tend to emphasize engagement metrics, frequency of movement, time-on-task, or affective valence, rather than the quality of reciprocal interaction or co-regulation that defines communication closeness.

2.5. Critical Design Thinking and Ri&tD

Critical design thinking reframes design from solving problems to questioning the conditions that produce them. Dunne and Raby proposed critical and speculative design as a means of provoking reflection on cultural and ethical assumptions embedded in everyday artifacts [45,46]. Fry described this orientation as design futuring, a practice that anticipates how present decisions shape social and ecological trajectories [47]. Manzini situated such approaches within design for social innovation, emphasizing participation and collective learning as ways of 'designing for new ways of being together' [48]. Extending this trajectory, Costanza-Chock articulated design justice, arguing that equitable design redistributes authorship and values the knowledge of those most affected [49].

Within this critical lineage, Ri&tD provides a methodological bridge for generating situated, practice-based knowledge [17]. Dalsgaard distinguishes Ri&tD from RtD by emphasizing three interrelated dimensions: genealogy, intervention, and argument. Artifacts are not endpoints but mediators that trace how design activity unfolds and what insights it

produces. This recursive process of making, reflection, and re-making enables designers to theorize directly through practice, connecting design action to epistemic contribution.

In the context of dementia care, this synthesis of critical design and Ri&tD offers a way to interrogate and transform communication practices. By embedding critique within lived, participatory settings, design becomes a situated form of inquiry grounded in everyday interaction rather than a detached analytical exercise. The present study extends this approach through the development of Living Counter-Maps, iterative artifacts that operate simultaneously as interventions and arguments. Each map documents how communication closeness materializes through play, gesture, and shared material focus, turning design itself into a relational, ethical, and reflective act.

2.6. Learning and Unlearning in Design for Dementia

Critical design is not only about imagining alternatives but about learning and unlearning within practice. Manzini describes social innovation as a process of collective learning that transforms how communities live and collaborate [48], while Costanza-Chock argues that equitable design requires the unlearning of exclusionary norms embedded in conventional methods [49]. In dementia care, such unlearning involves questioning the habitual privileging of verbal communication, cognitive performance, and caregiver authority. When design processes assume that speech is the primary mode of expression, they inadvertently marginalize embodied, sensory, and affective forms of interaction that remain vital for people living with dementia.

Ethnographic and interactional research has long shown that gestures, facial expression, rhythm, and shared material engagement continue to convey meaning even as language fragments. Kontos conceptualized this persistence as embodied selfhood [3], while Hydén illustrated how joint activity, such as cooking, enables mutual understanding through movement and rhythm [50]. Alsawy et al. emphasized that over-correction or insistence on ‘proper’ speech can undermine dignity and participation [5]. Together, these findings indicate that effective design for dementia requires the unlearning of normative communication hierarchies and the cultivation of relational awareness that recognizes multimodal reciprocity as communication competence.

Playful and participatory design settings provide ideal contexts for this learning. Through co-creation, designers and participants negotiate meaning, adapt rules, and reveal tacit values that shape communication. These iterative encounters allow both researchers and practitioners to understand care as a shared, negotiated capacity rather than a unidirectional service. In this way, learning and unlearning function as ethical mechanisms within the broader Living Counter-Maps framework, ensuring that design remains reflexive, responsive, and accountable to the lived realities of those it seeks to support.

3. Materials and Methods

3.1. Research Design

This study employed a Research in and through Design (Ri&tD) methodology [17] to explore how relational communication might be supported through playful, rule-based interaction. Ri&tD treats design as an iterative and recursive mode of inquiry rather than a linear process. Within this framework, artifacts of varying fidelity, maps, sketches, prototypes, and games, are not conceived as endpoints but as mediators of knowledge. Knowledge is generated through three interrelated dimensions: genealogy (the sequence of design activities and artifacts), intervention (how these artifacts operate in practice), and argument (how insights are translated back into discourse).

In contrast to approaches that treat the final artifact as the primary locus of insight [18,51], Ri&tD emphasizes that design knowledge is produced across the entire genealogy of

making. The iterative nature of this process is illustrated in Figure 1, which maps the recursive relationship between participatory inquiry, synthesis, ideation, and reflection.

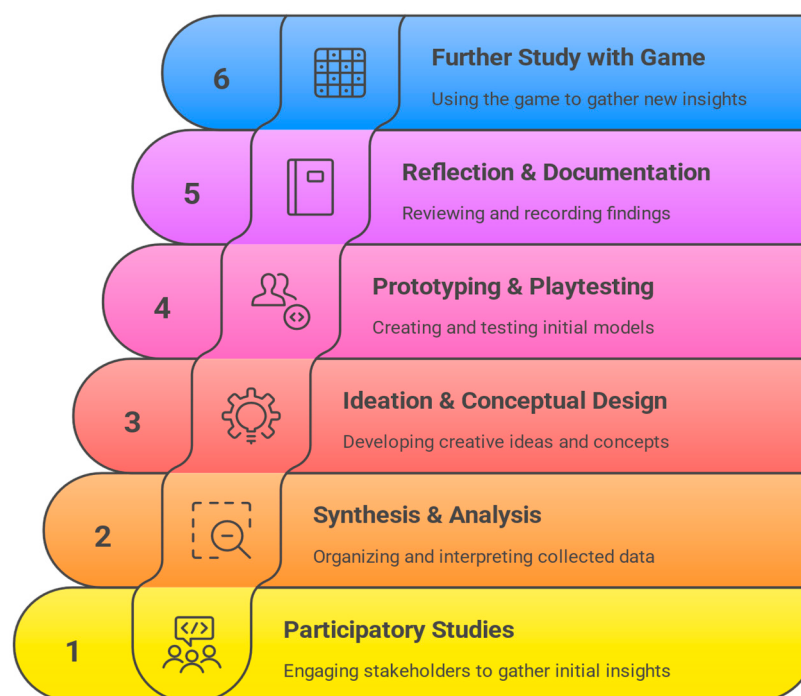


Figure 1. Research in and through Design (Ri&tD) process. The diagram shows an iterative cycle of activities and artifacts, where each pairing generates knowledge. The board game is one artifact in this genealogy rather than a final outcome, feeding back into new participatory studies and knowledge generation.

Within this framework, the Neighbourly board game operates as a Living Counter-Map, an artifact that both intervenes in care practice and generates knowledge about relational communication. Each iteration contributes to the framework's genealogy of learning, unlearning, and relational reflection.

3.2. Participants and Setting

The Research in and through Design (Ri&tD) process unfolded through a series of iterative engagements with people living with dementia (PLwD), caregivers, and older adults. Two formative studies informed the conceptual development of the Neighbourly board game: an observational study examining PwD's interaction with mixed reality (MR) technologies, and a co-design workshop employing the Tools for User Needs Gathering to Support Technology Engagement (TUNGSTEN) participatory toolkit.

The observational study examined how PLwD interact with mixed reality technologies, specifically Augmented Virtuality and Augmented Reality [52], during everyday activity tasks. Participants were recruited through Memory & Company using purposive sampling to ensure variation in cognitive ability and comfort with everyday technologies [53,54]. Inclusion criteria required: (a) a formal diagnosis of mild to moderate dementia or mild cognitive impairment (MoCA range 18–24), (b) sufficient visual and auditory acuity (with correction) to perceive MR prompts and interface elements, and (c) the ability to participate in 60 min guided play sessions involving short interaction loops with physical or digital stimuli. The study involved 22 PLwD (MoCA 11–25). Within this sample, 10 participants played Osmo, 9 played HoloLens, 6 engaged with StackAR on ARKit, and 15 played Kinect-based games.

Exclusion criteria included behavioural symptoms or sensory sensitivities that would make MR interaction uncomfortable or unsafe. Caregivers were included when they could contextualize the participant's familiarity with everyday devices or assist with consent. The criteria ensured that participants could meaningfully engage with mixed reality prompts and interaction modalities (visual, auditory, gestural) without imposing excessive cognitive or sensory burden, aligning with previous findings on presence, engagement, and prompt perception in mixed reality environments for dementia.

The TUNGSTEN workshop was designed to explore how PLwD, caregivers, healthcare professionals, and technology developers collectively make sense of everyday technologies as they appear in routine activities—not to evaluate communication or clinical outcomes. Participants were recruited through community collaborators, Memory & Company, the Alzheimer Society of Toronto, the Alzheimer Society of Durham Region, and the Alzheimer Society of York Region, using purposive sampling to ensure diversity of lived experience and familiarity with everyday technologies. Inclusion criteria for PLwD required: (a) a formal diagnosis of mild to moderate dementia, (b) comfort participating in a half-day, table-based workshop with multimodal facilitation, and (c) regular interaction with common household or personal technologies (e.g., calendars, pill organizers, smart speakers, mobile phones). Caregivers, healthcare professionals, and technology developers were eligible if they routinely supported, observed, or designed for technology use in dementia care contexts. Exclusion criteria included sensory or behavioural challenges that would make group-based activities uncomfortable or distressing. This approach resulted in 22 participants—7 PLwD, 3 caregivers, 5 healthcare professionals, and 7 technologists, distributed across four mixed-role tables, each intentionally structured to include at least one PLwD. PLwD could elect to sit with their caregiver or independently. The workshop format (Show and Tell; Technology Interaction) used familiar objects and off-the-shelf devices as boundary objects to elicit lived experiences, tacit knowledge, and everyday practices, as described in the published protocol. These criteria ensured that the workshop captured a wide spectrum of experiential, affective, and practical insights into technology use in daily life while maintaining accessibility and comfort for all participants.

The observation study was conducted in collaboration with Memory & Company, a dementia care facility in Markham, Ontario. Twenty-two PLwD and two caregivers engaged with a suite of MR technologies through visual, auditory, and spatial prompts [54,55]. Data were collected using video recordings, think-aloud protocols, and contextual field notes, capturing multimodal interaction patterns across visual, auditory, and embodied modalities. Analysis focused on non-verbal interaction and communication modalities such as gesture, object manipulation and gaze, revealing how PwD co-regulated communication through non-verbal reciprocity rather than directive exchange.

Each session lasted 45–60 min and followed a consistent structure: (1) warm-up orientation, (2) guided interaction with 3–4 MR prompt modalities (visual, auditory, spatial), and (3) open exploration. Prompts were presented in counterbalanced order to reduce modality fatigue. Researchers documented interactional sequences, caregiving strategies, hesitation or negotiation in task interpretation, and emergent relational behaviours.

The co-design workshop was a half-day session held in Toronto using the Tools for User Needs Gathering to Support Technology Engagement (TUNGSTEN) participatory toolkit, a suite of creative mapping and communication tools designed to explore people's relationships with technology in everyday contexts. The toolkit includes activities—Show and Tell, Technology Interaction, and Scavenger Hunt, which use tangible props, visual templates, and open-ended prompts to help participants articulate needs, emotions, and values that often remain implicit in conventional interviews or surveys. 22 participants: seven PLwD, three caregivers, five healthcare professionals, and seven technology developers and

researchers took part in the session [56]. Activities were structured around exploring how everyday tools and technologies shape, enable, or disrupt communication in care settings. Discussions were audio-recorded, photographed, and complemented by the researcher's reflection notes. The workshop generated rich qualitative data and discussion, capturing relational experiences and highlighting tensions between independence, assistance, and connection. The Ontario Shores Centre for Mental Health Sciences and York University Research Ethics Boards granted ethical approvals for both studies, and all participants provided informed consent.

Together, these studies provided empirical grounding for the design phase of *Neighbourly*. Observational insights revealed the significance of gesture, rhythm, and shared spatial attention in sustaining communication closeness, while the TUNGSTEN workshop surfaced the emotional and cultural textures of technology-mediated interaction. These findings informed the subsequent ideation, prototyping, and playtesting stages described in Sections 3.3 and 3.4.

3.3. Iterative Phases of the Ri&tD Process

The Ri&tD process was structured across six interrelated phases (Figure 1): formative participatory studies, synthesis and analysis, ideation, prototyping and playtesting, refinement and integration, and ongoing evaluation. Each phase informed the others, embodying the recursive logic of Ri&tD. Artifacts generated across these phases served as knowledge mediators that advanced understanding of relational communication within dementia care networks.

Analytic rigour was supported through triangulation across video observations, workshop artifacts, and researcher memos, ensuring convergence of insights across modalities. These analytical reflections created explicit traceability between phases, linking empirical findings to material decisions in the evolving design genealogy.

3.3.1. Phase 1–2: Synthesis and Analysis

Video data from both formative studies were coded in Noldus Observer XT, focusing on multimodal behaviours such as gesture, rhythm, gaze, hesitation, and turn-taking. Video data were analyzed using Noldus Observer XT to capture multimodal interaction patterns. A coding framework was developed iteratively, combining deductive categories informed by existing communication research (e.g., gesture, gaze shift, object manipulation, rhythm of turn-taking) with inductive codes emerging from the data. Coding proceeded in two stages: an initial segmentation of interaction sequences, followed by a second-pass analysis identifying patterns of co-regulation, hesitation–repair cycles, and multimodal cue integration.

Thematic analysis revealed three key insights:

- i. Communication was sustained through co-regulation rather than directive exchange.
- ii. Multimodal reciprocity, gesture, gaze, rhythm, supported *communication closeness* even when verbal fluency fluctuated.
- iii. Predictability and relational trust enabled meaningful participation despite cognitive variation.

These findings were synthesized into design principles that position communication as mutual regulation and shared meaning-making rather than information transmission. This reframing aligns with relational communication theory [57,58] and redirects the design inquiry from therapeutic efficiency toward relational awareness and co-created interaction.

To substantiate these themes, we describe below empirical patterns observed across the two formative studies, illustrating how PLwD enacted communication closeness through embodied, relational, and multimodal strategies:

1. Empirical Grounding of Design Decisions

The design of *Neighbourly* was grounded in empirical insights from two formative studies: an observational study examining how PLwD interact with MR technologies, and a participatory workshop using the TUNGSTEN toolkit. Across both contexts, PLwD demonstrated consistent patterns of embodied, relational, and tactile engagement that shaped subsequent design decisions. These findings provided evidence for how communication closeness is supported, and where it breaks down, in everyday cognitive and social environments.

2. Embodied Co-Regulation During Interaction

In the MR study, interactions were sustained through gesture and mutual pacing rather than verbal explanation [53]. Participants often relied on embodied adjustment and sought confirmation through shared monitoring with the facilitator. While interacting with HoloLens, PwLD often needed verbal prompting to keep their index finger within the camera's field of view, as the gesture was difficult to position consistently. At the same time, the study found that more embodied interactions, such as touching, holding, or aligning physical objects, resulted in successful interactions compared with abstract mid-air gestures.

Participants often adjusted their actions only after observing the caregiver's movements. Rather than acting immediately, they paused, waited for the caregiver to demonstrate or mirror a gesture, and then continued. This pattern showed that interaction was coordinated through shared pacing and mutual adjustment, which we describe as co-regulated turns, rather than through directive instruction. This insight informed *Neighbourly*'s emphasis on flexible turn-taking and rhythm-based coordination.

These observations align with recent empirical work showing that temporal coordination, gesture-based scaffolding, and embodied attunement are key mechanisms through which PLwD sustain interaction and co-regulate turn-taking in everyday care encounters [21,24].

3. Tactile Manipulation as a Shared Focus of Attention

While interacting with the Tangram game in OSMO ARKit, PLwD used the material properties of physical objects, including colour, contour, and weight, to scaffold their actions [54]. People were using the natural and material properties of the physical object as prompts to put the puzzle pieces together. Through repeated handling, rotation, and alignment of Tangram pieces, joint attention spontaneously emerged. Caregivers often leaned into co-manipulate pieces or mirror the participant's gestures, turning cognitive interpretation into embodied collaboration. Such tactile, co-manipulated interactions are consistent with findings that material engagement can anchor joint attention and support embodied forms of meaning-making in dementia care [32].

This pattern directly influenced *Neighbourly*'s reliance on textured tiles, object tokens, and physical placement to anchor shared engagement.

4. Multimodal Prompts Shaped Confidence and Participation

Auditory, visual, and spatial prompts produced different levels of clarity and participant confidence. Audio prompts delivered in a familiar human voice were understood most reliably, whereas abstract spatial cues in HoloLens and ambiguous text-only prompts often produced hesitation or checking behaviours [55]. Touch interactions were effective, contributing to 40–65% of the total, allowing PwD to become equal partners in the interaction with their caregivers.

Participants frequently paused and shifted their gaze toward caregivers when prompts were unclear, showing that interaction depended on layered, multimodal cues and social confirmation. Recent studies similarly show that multimodal cueing, combining touch, visual affordances, gesture, and prosody, enhances participant confidence and supports

collaborative coordination when linguistic comprehension varies [22,59]. These insights motivated Neighbourly's multimodal scaffolds, pictorial cards, tactile feedback, and binary and open-ended response options.

5. Difficulty Shifting Between Physical and Virtual Contexts

Task breakdowns occurred when participants were expected to shift between physical manipulation and virtual interface actions [53]. This revealed the cognitive burden of context switching. Accordingly, Neighbourly maintains consistent visual language, stable physical anchors, and avoids abrupt changes in modality.

6. Everyday Objects as Affective and Cognitive Anchors

The TUNGSTEN study demonstrated that everyday objects evoke rich, contextualized narratives even when verbal fluency fluctuates. During Show & Tell, participants described technologies through emotional associations, routines, and personal histories. Show and Tell surfaced rich, affective, tacit, and experiential knowledge. Objects served as boundary markers, enabling PLwD to signal meaning, initiate shared stories, or gesture toward familiar activities [56]. This directly informed Neighbourly's focus on everyday activity cards, recognizable environments, and low-abstraction prompts.

7. Boundary Objects Facilitated Cross-Stakeholder Sense-Making

Everyday technologies acted as boundary objects bridging diverse knowledge systems, PLwD, caregivers, professionals, and technologists [56]. These interactions affirmed that shared artifacts foster collective interpretation. Neighbourly's material components, therefore, function similarly. Tiles, tokens, and shared spaces are used to externalize and negotiate relational meaning.

8. Comfort, Familiarity, and Material Affordances Guided Engagement

Participants chose devices based on perceived familiarity ('like something I already use') and simplicity ('looks easy'). They avoided devices with small text, unclear steps, complex accessory requirements and slippery or heavy materials.

Discussions revealed tensions between independence, assistance, and connection, particularly when materials hindered participation. These insights shaped Neighbourly's emphasis on high-contrast colours, minimal text, lightweight tactile materials and non-linear, choice-based prompts.

9. Multimodal, Relational Meaning-Making Spanned Both Studies

Across both studies, PLwD used combinations of gesture, object handling, rhythm, gaze, pauses and co-orientation to co-construct shared moments of understanding. This multimodal, relational orientation corresponds with contemporary analyses of dementia communication that emphasize layering of sensory cues, embodied reciprocity, and mutual adjustment as the foundations of engagement [60]. These multimodal, relational behaviours are foundational to Neighbourly's interactive model.

Together, these empirical findings illuminated how PLwD sustain communication through rhythmic coordination, tactile engagement, multimodal reciprocity, and shared material focus. These insights not only grounded the design principles but also shaped the iterative prototyping and refinement processes described in the following sections.

3.3.2. Phase 3: Ideation and Conceptualization

Building on findings from the observational and TUNGSTEN studies, the ideation phase translated relational communication principles into playable, embodied forms. Ideation was treated as material inquiry, where tactility, spatial arrangement, rule-making, and multi-sensory cues were explored as ways to support communication closeness rather than merely observe it.

Eight conceptual prototypes were developed, each representing a distinct metaphor for relational communication, multimodal interaction, and turn-taking (Figure 2). These prototypes were iteratively refined and later reviewed in a co-reflective session with five older adults, advisory lab elders from the Social and Technological Systems (SaTS) Lab. The advisory group members provided feedback on sensory affordances, clarity, material comfort, and emotional resonance. Each prototype is briefly outlined below. Together, these prototypes formed the design genealogy through which relational communication was iteratively reimagined and materialized.

RELATIONAL COMMUNICATION BOARDGAME PROTOTYPING

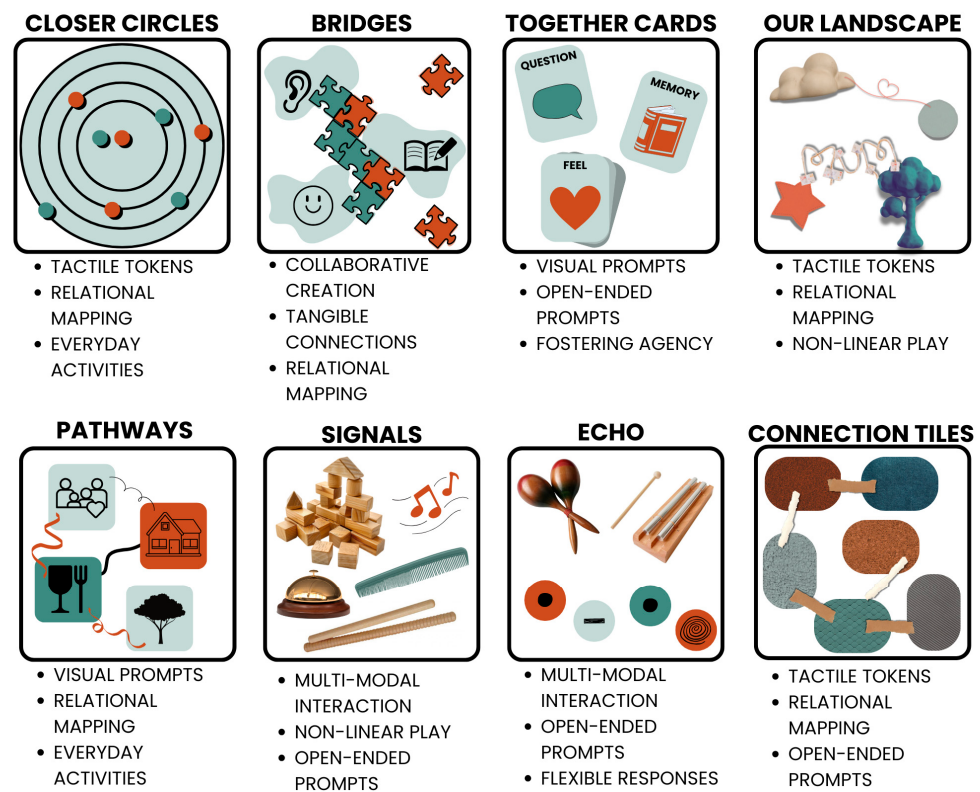


Figure 2. Eight exploratory prototypes developed during the translation of formative-study insights into material interaction concepts: Closer Circles—emotional proximity through rings; Bridges—collaborative construction; Together Cards—sequential visual prompts; Our Landscape—collaborative contour mapping; Connection Pathways—relational linking through tiles; Signals Between Us—multimodal gesture-based play; Echo—rhythmic mimicry and attunement; and Connection Tiles—integrated tactile mapping and turn-taking.

Closer Circles use tactile tokens and concentric visual rings to support reflection on emotional proximity during everyday activities. Players draw scenario cards and place markers on rings representing levels of connectedness (Connected, Attentive, Neutral, Distant). Over rounds, these placements form a relational map that visualizes shifts in closeness and attunement. The prototype emphasizes everyday experiences as a familiar anchor for interpreting communication quality.

Bridges frames relational communication as a collaborative construction activity. Players sit on islands representing aspects of connection (Listening, Memory, Emotion) and draw open-ended prompts that lead to shared reflections or actions. Wooden bridge pieces are placed to link islands, making intangible relational moments tangible. The prototype highlights relational mapping through cooperative building and embodied connection.

Together Cards uses simple visual prompts and open-ended cues (e.g., share a memory, ask a question, make a gesture) to structure gentle, multimodal dialogue. Players can speak,

gesture, or use objects, fostering agency through flexible response options. Icons and colours support comprehension and emotional expression, creating an intuitive, accessible interaction rhythm. The design foregrounds reciprocity as a co-created flow of giving and receiving.

Our Landscape invites players to co-construct a tactile map using clay, felt, fabric, and symbolic tokens in response to relational prompts. Players sculpt paths, boundaries, and landmarks that reflect shared memories and emotional geographies. The focus is on relational mapping and non-linear play, enabling communication closeness to emerge through shared making rather than verbal explanation. The prototype draws on spatial storytelling as a relational medium.

Pathways use visual prompts and symbolic tiles to help players co-create a shared map of relational meaning. Players link tiles using threads or materials to show associations, transitions, or shared experiences. Through iterative mapping, players reveal tacit relational cues and emotional patterns. The prototype emphasizes everyday activities and relational mapping as foundations for co-regulation.

Signals Between Us uses tactile objects and simple sound-making materials to explore multimodal, non-linear communication. Players respond to prompts by expressing feelings through sound, rhythm, or gesture rather than words. Improvisation reveals patterns of resonance and misalignment, highlighting attunement as an embodied process. The prototype emphasizes multi-sensory participation and open-ended interaction.

Echo explores mimicry, rhythm, and coordinated movement as foundations for non-verbal attunement. Players respond to prompt cards by repeating, modifying, or extending rhythmic patterns using small percussion objects. Visual rhythm tokens guide pacing, turns, and pauses, enabling flexible, improvisational exchanges. Synchrony becomes a medium of connection, showcasing multimodal communication closeness.

Connection Tiles uses textured, tactile tiles and connective materials (e.g., cork, felt, thread) to map relational meaning. Players draw open-ended prompts and place or link tiles to represent feelings, memories, or experiences. The tactile qualities of the tiles encourage sensory engagement and shared authorship. The prototype reveals how tactile co-creation can support communication closeness without relying on verbal articulation.

Across the eight conceptual prototypes, several recurring themes emerged that helped shape the material, relational, and experiential direction of the design genealogy. Although each prototype explored communication closeness through different mechanisms, four core themes: tactility, relational mapping, everyday activities, and multimodal interaction- consistently supported individuals' ability to externalize, negotiate, and co-create relational meaning.

Tactile tokens and material co-creation played a central role across the prototypes, particularly in Closer Circles, Our Landscape, and Connection Tiles. Textured materials and hands-on placement activities enabled players to externalize emotional nuance and co-author reflective surfaces. These tactile interactions highlighted how communication closeness can emerge through gestures of attention, shared manipulation, and collaborative making, even when speech is limited.

Relational mapping and tangible connections functioned as another significant pattern. Closer Circles, Bridges, Our Landscape, Pathways, and Connection Tiles each used spatial metaphors, concentric rings, bridges, sculpted terrains, or linked tiles to visualize relational dynamics. These mapping practices de-emphasized linearity and correctness, instead highlighting the fluid, iterative, and negotiated nature of relationships.

Everyday activities, as familiar anchors, appeared prominently in Together Cards and other prompt-based designs. By drawing on daily practices such as sharing meals, listening to music, or recalling routines, these prototypes grounded interaction in contexts familiar to

PLwD. This grounding supported agency, comfort, and recognition, connecting gameplay to the rhythms of lived experience.

Multimodal and non-verbal interaction emerged strongly in *Signals Between Us* and *Echo*, which used sound, rhythm, gesture, and mimicry as accessible forms of relational engagement. Improvised exchanges highlighted resonance, misalignment, and repair in real time, demonstrating how multimodal cues can sustain communication closeness when verbal expression is effortful.

Across the series, collaborative creation remained a consistent mechanism of connection. Whether sculpting terrains, linking tiles, placing tokens, or creating rhythmic sequences, players co-constructed artifacts that acted as both records of interaction and prompts for further reflection. These processes underscore that relational communication is continually produced through joint activity and shared sensory engagement.

The recurrence of co-regulated pacing, tactile co-creation, open-ended multimodal prompts, and shared spatial mapping shaped the subsequent synthesis of these concepts into a unified design. These recurring mechanisms directly informed the development of *Neighbourly*. The game consolidates tactile affordances explored in *Closer Circles*, *Our Landscape*, and *Connection Tiles*; rhythm, synchrony, and flexible turn-taking from *Echo* and *Signals Between Us*; relational linking and mapping practices from *Bridges and Pathways*; and everyday activity-based prompting from *Together Cards*. Synthesizing these experiential insights into a cohesive rule-based system, *Neighbourly* emerges as a culmination of the prototype genealogy, carrying forward its shared relational logic into a playable and adaptable design.

3.3.3. Phase 4–6: Prototyping, Refinement, and Evaluation

Insights from the advisory workshop were consolidated into the *Neighbourly* prototype, which merged spatial mapping with turn-based play to embody co-regulation and negotiation (see Figure 3). In this iteration, PLwD and caregivers collaboratively place textured tiles in response to prompts, forming flexible relational maps that externalize moments of connection, hesitation, preference, and co-attunement.

A subsequent participatory study is currently underway to evaluate *Neighbourly* with PLwD–caregiver dyads. This evaluation examines how communication closeness is enacted during gameplay through adapted interaction analysis and observational coding schemes that measure co-regulation, emotional resonance, multimodal reciprocity, and mutual engagement. The evaluation stage provides an empirical foundation for understanding how structured play fosters relational reciprocity and how board game artifacts operate as *Living Counter-Maps* that make tacit communicative processes visible.

Building on this evaluative phase, *Neighbourly* will be used as a boundary artifact in future co-design sessions. By grounding co-design in the shared actions, gestures, and relational patterns surfaced during gameplay, the board game will support PLwD and caregivers in collaboratively articulating where communication feels intuitive, where it breaks down, and what forms of technological, service, or environmental support could sustain relational communication in everyday contexts. In this two-stage approach, evaluation followed by co-design, the game becomes both a probe for understanding relational communication and a medium for generating design directions that emerge from lived experience.

Together, these iterative stages collectively enact the *Living Counter-Maps* framework: each phase produces not only a prototype but also a relational insight that reconfigures understanding of communication closeness through play and lays the groundwork for co-designing future relational communication supports.

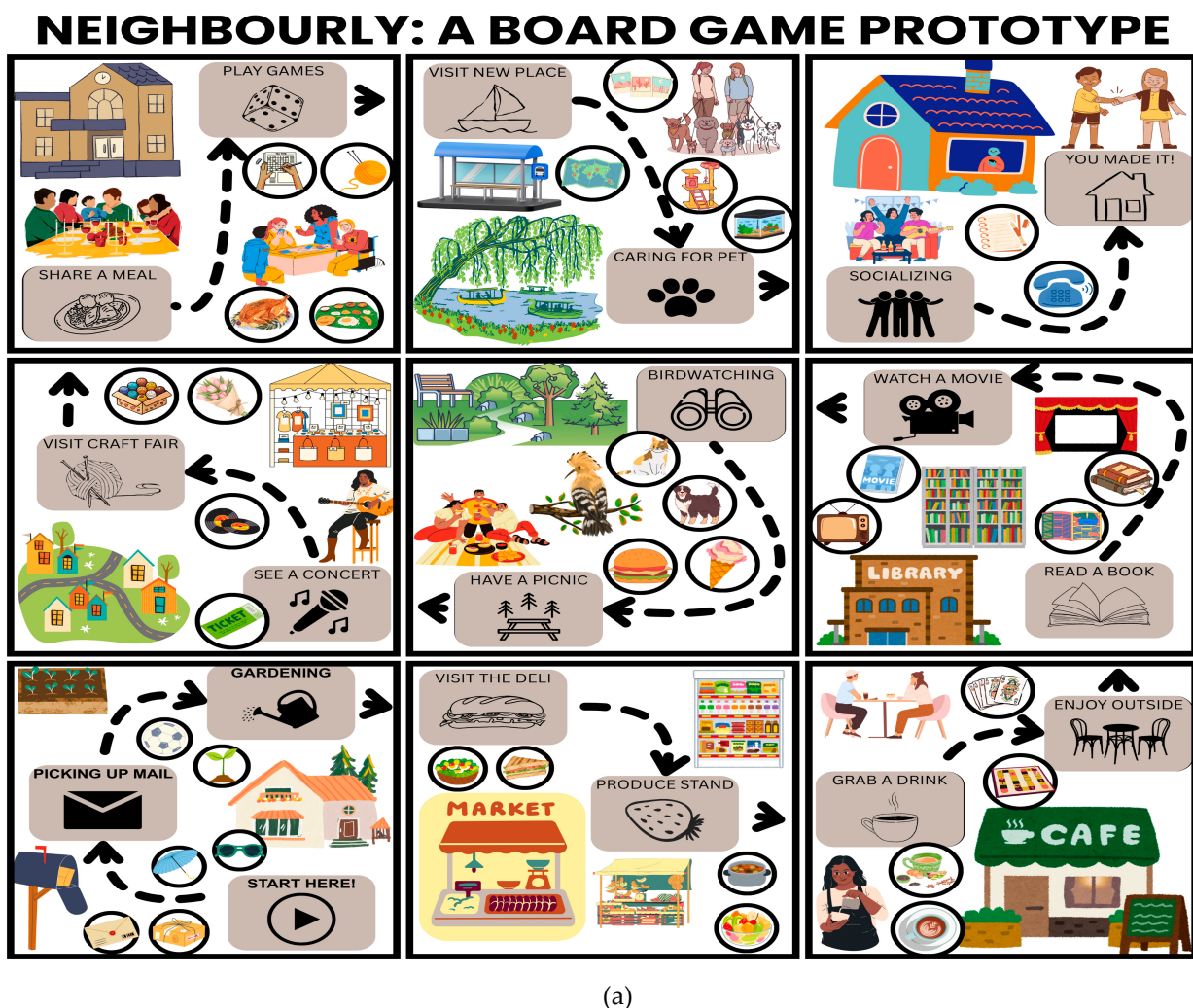


Figure 3. The *Neighbourly* Prototype: Modular Board, Tactile Tiles, and Symbolic Question Prompt Cards used during Playtesting. (a) Full game board layout with all Place Tiles arranged, (b) Home Tile—example location tile with associated activity cards and Question Prompts, (c) Cafe Tile—another location tile illustrating associated activity cards and Question Prompts.

3.4. Materials

The *Neighbourly* prototype includes:

- A modular game board comprising nine Place Tiles representing neighbourhood spaces (e.g., market, library, community center).

- Activity Cards depicting everyday activities with clear iconography and minimal text.
- Special Action Tiles introduce flexibility through swapping or skipping.
- A Moodboard with six slots per player, used to curate preferred activities.
- Tactile tokens, game pieces, and dice facilitate turn-based coordination.

These materials were designed to support multimodal interaction, prioritize player agency, and accommodate fluctuating attention and energy levels during play. Design decisions emphasized high contrast colours, familiar iconography, predictable physical layouts, and lightweight components to enhance perceptual clarity and comfort.

4. Findings and Outcomes

4.1. From Iteration to Refinement

The development of *Neighbourly* unfolded through an iterative Ri&tD process that integrated insights from formative studies, the ideation prototypes, and advisory reflection. The empirical patterns documented in Section 3, co-regulation, multimodal reciprocity, and tactile collaboration, served as the conceptual backbone for the subsequent design work.

Early prototypes explored how tactile materials, embodied actions, rhythm, and shared spatial attention might scaffold relational communication. A co-reflective workshop with an advisory group of five older adults (aged 62–78) provided formative feedback on sensory comfort, visual accessibility, affordances, and emotional resonance. Although participants did not have dementia, they offered practical guidance on legibility, fatigue, and choice-making. Their reflections reinforced the importance of open-ended prompts, flexible rules, and materials that support calm pacing.

Feedback from the advisory group guided the refinement of exploratory prototypes into a more cohesive and unified artifact. *Neighbourly* emerged as a synthesis, structured enough to create rhythm and predictability, yet open-ended enough to support autonomy, interpretation, and shared authorship.

4.2. Emerging Design Principles and Patterns of Relational Communication

Analysis across the empirical (Section 3.3.1) and advisory phases revealed three recurrent relational dynamics that shaped the design of *Neighbourly*.

1. Co-regulation sustained communication more reliably than instruction: The formative studies demonstrated that PLwD engaged most successfully when interactions unfolded through mutual adjustment and shared pacing. Caregivers and facilitators often slowed gestures, mirrored movements, or paused with participants, establishing a relational rhythm. This informed the incorporation of flexible turn-taking mechanics and slow, predictable interaction cycles in *Neighbourly*.
2. Multimodal reciprocity enabled participation when verbal fluency fluctuated: Across prototypes and empirical observation, tactile handling, rhythmic sequences, gesture, and spatial placement consistently fostered engagement. These modalities provided alternative pathways for expressing preference and emotion. Consequently, *Neighbourly* incorporates tactile tiles, pictorial cues, and dual-response prompts (open-ended and binary) to accommodate varied expressive capacities.
3. A shared material focus anchored joint attention and supported mutual agency: When interaction centred on tangible tasks, placing tokens, arranging tiles, and manipulating objects, participants naturally coordinated with caregivers, often without needing verbal instruction. This affirmed the potential of material play as a medium for relational attunement and guided the choice of textured components, modifiable layouts, and embodied actions within the game.

Collectively, these principles reframed communication not as message transmission but as a rhythmic, co-authored process. Neighbourly was therefore conceived as a means of exploring how reciprocity, rhythm, and shared manipulation might support communication closeness in dementia care.

4.3. *The Neighbourly Prototype*

The Neighbourly board game synthesizes the project's design genealogy into a single artifact that functions both as a communication aid and a research instrument. It reimagines the neighbourhood environment as a structured yet flexible space for relational play, enabling PLwD and caregivers to express preference, emotion, and memory through coordinated action. The design elements are shown in Figure 3a–c.

The board comprises nine textured Place Tiles arranged along a modular path, each representing a recognizable neighbourhood location (e.g., café, park, town square). Players roll a die, move game pieces, and draw an Activity Card depicting an everyday task illustrated with high-contrast pictograms and minimal text. Each card offers two prompts, one open-ended and one binary, so players can respond verbally, through gesture, or via tokens. Responses are followed by selecting an Object Token linked to the activity, which is later revisited during the closing Moodboard Search.

Special Action Tiles (swap, skip, reverse) introduce playful negotiation and variability, while the Moodboard allows participants to curate preferred activities and pace the depth of engagement. Together, these mechanics support shared pacing, autonomy, and multimodal meaning-making. Materially, the prototype includes textured tiles, 36 Activity Cards, six Special Action Tiles, two Moodboards, a wooden die, and coloured Object Tokens. High contrast colours, matte finishes, and lightweight components were selected to support perceptual clarity and comfort. The modular format enables play across varied domestic and care settings.

At this stage, Neighbourly operates as both a communication aid and a research instrument. It probes how rule-based, embodied play might support mutual attention, emotional resonance, and shared decision-making in dementia care. Rather than aiming to restore verbal abilities, the design focuses on nurturing the relational fabric that makes communication meaningful.

A participatory evaluation study with PLwD–caregiver dyads is currently underway. Key elements for analysis include co-regulation, gesture synchrony, affective resonance, shared pacing, and negotiation of task meaning. These studies extend the Ri&tD cycle by treating Neighbourly not as a final product but as a Living Counter-Map, a material and relational probe that traces how design mediates reciprocity, attention, and understanding in everyday care interactions.

Beyond evaluation, Neighbourly is also designed to function as a co-design medium through which PLwD and caregivers collaboratively construct meaning. The structured yet flexible rule system invites participants to negotiate choices, reinterpret prompts, and manipulate spatial relationships in ways that redistribute interpretive authority. By grounding interaction in shared material action rather than verbal explanation, the board game maintains a more equitable balance of agency and supports a co-creative dynamic central to relational communication. In future phases, Neighbourly will serve as a boundary artifact in co-design sessions, enabling participants to articulate where communication feels intuitive, where difficulties arise, and what kinds of technological, service, or environmental supports could sustain relational communication in everyday contexts. Together, these iterative stages enact the Living Counter-Maps framework: each phase produces not only a prototype but also a relational insight that reshapes understanding of communication closeness through play and supports future co-design of relational communication tools.

5. Toward a Framework for Critical Design Thinking in Dementia Care

5.1. Research in and Through Design as Relational Inquiry

The study positions Ri&tD as a form of inquiry grounded in participation and reflection, evolving through the lived and situated experiences of communication in dementia care instead of starting from a predefined problem. This aligns with Dalsgaard's framing of Ri&tD as recursive and generative, where design artifacts are not endpoints but mediators of knowledge that emerge through iterative cycles of making and interpretation [17]. Within this process, each prototype became a means to engage, observe, and think through communication, revealing that relational understanding often arises in the act of co-creation itself.

This orientation departs from the linearity often implied in practice-based design and extends Zimmerman et al.'s notion of RtD by foregrounding design as relational knowledge-making [18]. Rather than constructing a final product, the design process sustained a dialogue between theory and lived practice, where meaning was generated collectively. The methodology's emphasis on genealogy, intervention, and argument proved particularly generative for dementia research, allowing artifacts to be situated within evolving networks of care rather than isolated experiments. The iterative process revealed that the design's epistemic value lies not in producing tools for care but in creating conditions in which relationships of care can be explored and reflected upon, a principle that underpins the project's contribution to critical design thinking. This relational orientation provides the foundation for the methodological and ethical arguments developed in the sections that follow.

5.2. Critical Design Thinking as Situated and Ethical Practice

Critical design thinking has often been associated with speculative provocation rather than situated transformation [45,46]. Within Neighbourly, critique emerged through direct engagement with care practices instead of detached observation. The process extended critical design beyond its traditional stance of questioning assumptions toward what Manzini describes as design for social innovation, a form of practice that reconfigures social relations through participation [48]. Here, the design artifacts were not thought experiments but lived mediations, created within and for everyday care interactions.

By situating critique in practice, the study reframed design as an ethical mode of attention. Drawing on Costanza-Chock's notion of design justice, the process recognized that equity arises not merely from inclusion but from redistributing authorship and control [49]. The iterative prototyping cycles invited caregivers, older adults, and PLwD to shape the meanings, rules, and metaphors that structured communication. In this sense, the study enacted what Haraway describes as 'staying with the trouble', working within the complexity of care relationships rather than seeking to simplify or abstract them [61]. Design here was neither a solution nor a service but a way of learning to be attentive to the shared conditions of communication.

This repositioning of design as relational and ethical expands critical design thinking from a reflective stance into an active practice of co-presence. Rather than proposing alternatives from a distance, this approach cultivates possibilities from within ongoing relationships, allowing design to function as a mode of shared inquiry. Such situatedness allows design to function as a language of empathy, one that operates not through critique alone but through care.

5.3. Communication Closeness as Relational Praxis

A key insight across the study is that *communication closeness* in dementia care cannot be reduced to cognitive comprehension or linguistic success. The observational and proto-

typing phases suggested that communication is sustained through attunement, gesture, rhythm, gaze, and shared activity rather than through the transfer of verbal information. These findings substantiate relational communication theory [57], which conceives meaning as emergent and co-regulated, and extend Kontos's work on embodied selfhood [3], which identifies the persistence of social agency beyond language.

Within the design process, these theoretical positions materialize into tangible artifacts: turn-taking tokens, tactile maps, and activity cards. Each mechanism provides a rhythm for reciprocity, allowing participants to synchronize attention and emotion. The design anticipates that such structures may enable moments of 'feeling seen' or 'being together' even when verbal exchange is minimal, experiences that forthcoming evaluations aim to explore. Such moments are supported by the game's rule-based design, which balances predictability and interpretive freedom to enable shared meaning-making.

The study, therefore, demonstrates that critical design thinking becomes most effective when it functions as relational praxis, a sustained engagement that transforms understanding through encounter. By embedding care, attention, and mutual regulation into design mechanics, Neighbourly moves beyond the therapeutic framing of communication tools toward a model of co-constructed meaning. These design encounters demonstrate how communication closeness operates as both a design objective and a mode of inquiry, allowing relational communication itself to become a site of social innovation.

5.4. Methodological Challenges and Adaptations in Designing with People Living with Dementia

Designing with PLwD requires methods that are flexible, relational, and ethically attuned to the lived realities of participation. Across the mixed reality studies, the TUNGSTEN workshop, and the iterative prototyping process, the research team encountered methodological challenges that shaped how the study was designed and conducted. These challenges did not emerge as discrete problems to be solved but as conditions that required continuous adaptation, reinforcing the choice of a Research in and through Design (Ri&tD) methodology and the use of play as a relational mode of inquiry.

Recruitment and consent required ongoing negotiation rather than a single procedural act. Participants were recruited through established partnerships with Memory & Company and regional Alzheimer Societies of Toronto, York and Durham, which supported familiarity and reduced anxiety. However, seeking informed consent from PLwD also required more accessible approaches than conventional, text-heavy consent documents. Lengthy written forms were often cognitively overwhelming and inappropriate for participants with fluctuating capacity. Instead, consent discussions were delivered verbally, broken into shorter segments, and supported by visual or plain-language explanations that described what participation involved, what would happen during a session, and the voluntary nature of involvement. Caregivers assisted in contextualizing information and monitoring comprehension and comfort in some cases. Consent was revisited throughout sessions to ensure continued understanding and assent, aligning with a relational and responsive model of ethical participation rather than a one-time administrative requirement [53–55].

Fluctuating attention, sensory tolerance, and energy levels presented additional methodological challenges. Participants' readiness to engage could shift within minutes, necessitating adjustments to pacing, activity sequence, or the sensory environment. Sessions often required slowing down, shortening tasks, reducing visual complexity, or shifting from cognitively demanding activities to more tactile or open-ended ones. Ri&tD provided a methodological rationale for this flexibility: by allowing insights to emerge from situated, real-time adaptation, the design process could be shaped by what participants were able and willing to do in each moment rather than adhering to a rigid protocol.

Communication variability further influenced methodological decisions. Many participants preferred to express themselves through gesture, pointing, facial expression, touch, or material interaction rather than through extended verbal discussion. Instead of treating these forms of expression as secondary to speech, the study intentionally elevated them as legitimate contributions to knowledge-making. This justified the incorporation of tactile materials, turn-taking structures, and multimodal prompts throughout the design process. Play became an effective methodological modality because it provided a shared temporal rhythm, reduced linguistic pressure, and created opportunities for meaningful participation regardless of verbal fluency.

A significant methodological concern involved maintaining balance in multi-stakeholder interactions, particularly between PLwD and caregivers. Caregivers sometimes assumed interpretive authority or completed tasks on behalf of participants, not out of disregard but out of habit or a desire to reduce frustration. To counteract this tendency, the study relied on boundary artifacts—first, everyday objects within the TUNGSTEN workshop, and later the Neighbourly board game, to anchor participation in shared material action [56]. These artifacts redistributed agency by grounding contribution in doing rather than explaining, enabling PLwD to influence the direction and meaning of the activity through choice, placement, and spatial organization. This approach aligns with justice-oriented co-design principles in which power is intentionally rebalanced to centre the lived experience of PLwD.

Environmental and safety considerations also shaped methodological practice. Room layout, lighting, noise levels, and material weight could meaningfully affect participants' sense of orientation and comfort. The research team often rearranged furniture, simplified tablescapes, adjusted lighting, or reduced competing stimuli to ensure accessibility and calmness. These modifications were not ancillary but integral to creating environments where relational communication could unfold safely and without undue cognitive load.

Across these challenges, Ri&tD and co-design provided a methodological structure that embraced uncertainty and valued responsiveness. Rather than requiring uniform conditions, Ri&tD treats variability as part of the generative landscape of inquiry. Play further supported this orientation by creating a low-pressure, co-regulated format in which engagement could be modulated, paused, or reinterpreted collaboratively. Within this methodological frame, Neighbourly serves not only as an evaluative probe but also as a boundary artifact for future co-design. In subsequent participatory work, the game will anchor conversations about relational communication, enabling PLwD and caregivers to identify where communication feels intuitive, where tensions emerge, and what kinds of technological, service, and environmental supports could sustain relational closeness in daily life.

Together, these methodological adaptations highlight that research with PLwD requires attunement, flexibility, and ethical reflexivity. They also demonstrate how design methods, particularly Ri&tD and play, can create inclusive, empowering contexts in which PLwD actively shape the knowledge and futures being designed with them. This methodological stance offers practical guidance for dementia researchers seeking to support meaningful, equitable participation and lays the groundwork for co-designing relational communication technologies and resources in later phases of the project.

5.5. Living Counter-Mapping as Method and Metaphor

The project's methodological innovation lies in adapting the concept of counter-mapping from critical geography to relational communication. Traditionally, counter-mapping contests dominant spatial narratives by reclaiming representational authority [15]. In this study, the concept evolved into Living Counter-Mapping, a participatory process

through which emotional and relational terrains were collaboratively mapped. Artifacts such as Our Landscape and Connection Tiles allowed participants to externalize relationships and emotional proximities as tactile, spatial compositions.

This process renders communication visible as movement rather than message—an unfolding of gestures, negotiations, and traces. As PLwD and their caregivers shaped clay landscapes or connected textured tiles, they remapped the experience of dementia away from deficit narratives and toward relational creativity. The maps that emerged were not static records but evolving topographies of connection, echoing Buse and Twigg’s notion of ‘materialities of care’, where meaning arises through ongoing interaction with objects and spaces [62].

Methodologically, this reframing reinforces Dalsgaard’s argument that knowledge in design emerges through the interrelation of genealogy, intervention, and argument [17]. Each iteration contributed to this triad: tracing evolving relational forms (genealogy), restructuring communicative routines (intervention), and enabling reflective reinterpretation (argument). In this way, counter-mapping extended beyond representation to become a performative and epistemic practice, a way of thinking and caring through design.

By translating critical geography’s counter-mapping into a relational design practice, the study shows that mapping can be not only descriptive but generative, an act of world-making that produces new forms of care. These insights provide the conceptual groundwork for the Living Counter-Maps Framework, as described in Section 5.4.

The Living Counter-Maps Framework

The Living Counter-Maps Framework extends critical design thinking by integrating the participatory and representational processes of counter-mapping into Ri&tD. It provides a methodological structure for examining and designing relational communication, positioning mapping as both method and metaphor for co-creating knowledge within lived care contexts. Whereas traditional counter-mapping challenges dominant spatial or political representations, Living Counter-Maps adapts the concept to relational terrains—those emotional, embodied, and communicative spaces negotiated between PLwD and their caregivers.

The framework comprises five interrelated dimensions: Grounding, Material Inquiry, Relational Mapping, Reflexive Mediation, and Ethical Reframing. Together, these dimensions form a cyclical process through which design becomes a practice of visualizing, reflecting on, and transforming relationships of care (Figure 4).

‘Grounding’ situates design within the lived experience of communication and care. It involves deep contextual immersion—observing, listening, and co-experiencing moments of closeness and disconnection. This dimension ensures that critique and creativity emerge from within relationships rather than being imposed from analytical distance.

‘Material Inquiry’ treats making as a form of theorizing. Through sketches, prototypes, and playful artifacts, designers and participants externalize tacit relational knowledge. Each artifact acts as a probe that surfaces how communication closeness is enacted through gesture, rhythm, and shared material focus.

‘Relational Mapping’ introduces the counter-mapping process to relational communication research. Participants collaboratively represent and re-negotiate their communicative landscapes, creating maps, diagrams, or spatial arrangements that visualize feelings of proximity, reciprocity, and attunement. These maps are ‘living’ because they are revisited, layered, and re-interpreted over time, transforming from representations into relational dialogues. Mapping becomes an act of care, a way of seeing, tracing, and reshaping the dynamics of connection.

‘Reflexive Mediation’—Insights generated through mapping feed back into the design cycle. Participants and researchers collectively analyze patterns, reinterpret meanings, and adapt artifacts. This reflexivity sustains reciprocity between inquiry and practice, allowing the framework to remain open, iterative, and responsive.

‘Ethical Reframing’ translates mapped understandings into new relational possibilities. It foregrounds the moral and social implications of design decisions, who benefits, who is heard, and how care is enacted. Through this dimension, Living Counter-Maps contributes to transformative social innovation by cultivating empathy, co-agency, and justice within design processes.

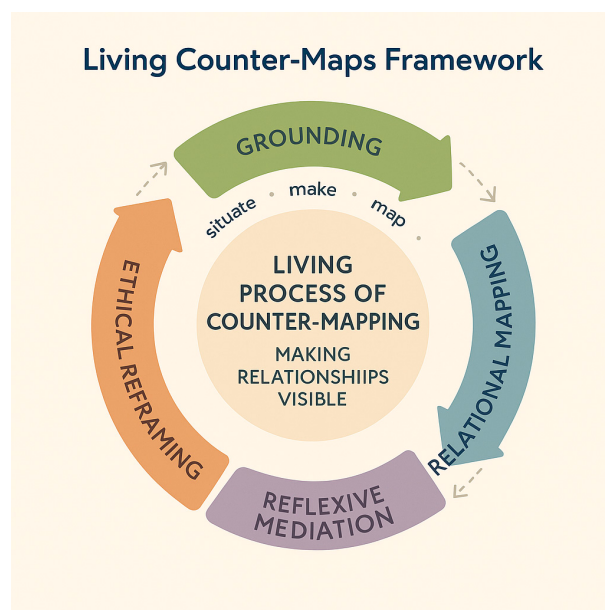


Figure 4. The Living Counter-Maps Framework—a five-dimensional methodological model integrating counter-mapping into Ri&tD for relational communication research.

Together, these five dimensions articulate Living Counter-Maps as a methodological framework for relational communication studies. The framework bridges the spatial imagination of counter-mapping with the embodied practice of Ri&tD, turning mapping into an ongoing, participatory form of relational inquiry. It positions critical design thinking as a relational and transformative methodology that enables researchers and practitioners to work with, rather than about, care relationships, mapping communication not as a static representation but as an evolving, co-authored process.

5.6. Implications and Future Directions

The Living Counter-Maps Framework redefines how design operates within dementia care by foregrounding communication as a relational and social practice rather than a technical or therapeutic task. Through its integration of counter-mapping and Ri&tD, the framework offers a methodological approach that makes relational dynamics visible, negotiable, and open to transformation. This reconceptualization positions design not as the creation of finished artifacts but as a continuous process of mapping, reflecting, and reframing how care relationships are lived and understood.

For dementia research, this reframing offers both practical and theoretical contributions: it provides new ways to observe and support communication closeness, the felt sense of being understood, emotionally attuned, and socially connected, while advancing design’s role as a relational methodology. By treating communication as a co-created map rather than a unidirectional exchange, the framework invites participatory interventions that empha-

size mutual regulation and reciprocity. Theoretically, it extends counter-mapping beyond spatial and political terrains to relational and affective ones, offering a methodological lens through which emotional geographies of care can be traced, visualized, and reimagined.

For design research, the framework demonstrates that critical design thinking can operate as a transformative social innovation methodology. Each dimension, Grounding, Material Inquiry, Relational Mapping, Reflexive Mediation, and Ethical Reframing, constitutes a mode of transformation: situating design in lived context, revealing hidden patterns of attunement, co-producing new relational knowledge, and translating insight into ethical action. This positions critical design not only as a practice of reflection or critique but as an active mode of relational inquiry that builds alternative social futures through participation and care.

Future research will apply and evaluate the Living Counter-Maps Framework in extended participatory studies with PLwD and their caregivers. These studies will examine how the framework's mapping and reflexive processes can facilitate communication, generate new design knowledge, and guide the co-creation of supportive tools and environments. Beyond dementia care, the framework holds potential for other contexts where relational dynamics are central, such as intergenerational communication, rehabilitation, and mental health, offering a transferable approach for studying and designing relational systems of support.

Ultimately, Living Counter-Maps positions design as a way of learning from relationships. By bringing together the spatial imagination of counter-mapping, the embodied inquiry of Ri&tD, and the ethical orientation of critical design, it establishes a methodology for understanding and strengthening communication closeness in socially complex settings. In doing so, it contributes to an emerging movement in design research that seeks not only to imagine better futures but to practice them through relational, caring, and co-created acts of innovation.

6. Conclusions

This study presents an empirically grounded, relational approach to designing for communication closeness in dementia care. Through n Ri&tD genealogy, Neighbourly emerged as a Living Counter-Map that materializes co-regulation, shared attention, and multimodal reciprocity through rule-based play. Rather than offering therapeutic claims or prescriptive solutions, the game creates a structured yet interpretive space in which relational communication can be enacted, explored, and reflected upon. The findings presented here are formative; an ongoing evaluation with PLwD–caregiver dyads will further examine how Neighbourly operates within everyday care relationships. More broadly, the project contributes to design research by demonstrating how counter-mapping, multimodal interaction, and adaptive participatory methods can surface tacit communicative practices and enable more inclusive, ethical, and relational design processes. It also highlights the critical role of play, not as a diversion, but as a relational modality that supports presence, co-regulation, and shared authorship in dementia care.

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Data Availability Statement: The datasets presented in this article are not readily available because the dataset represents sensitive information of human participants. The participants did not consent to sharing their data as it is (raw data). Requests to access the datasets should be directed to Dr. Shital Desai.

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