Embrace Sociable Technology! A Plea for Health as a Model Field of Human-Technology Team Research

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Abstract

CHI submissions encourage *originality*, Health venues strive for improved *patient outcome*. Across multiple projects, we found that our most insightful contributions at the intersection of HCI & Health are related to *team interaction*. As one focus for the spin-off conference we, therefore, suggest putting an emphasis on the social dimension that either (1) emerges from the introduction of original artifacts or (2) is required to facilitate improved patient outcome. Through the heterogeneity in motivations, needs, abilities and perspectives between care providers and care receivers, the intersection of HCI & Health offers a unique field for research of technology mediated interaction between humans.

CCS Concepts

• **Human-centered computing** → **Human computer interaction (HCI)**; • **Applied computing** → *Health care information systems*.

Keywords

Human-AI Teaming, Anesthesiology, Healthcare

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1 Studying Social Roles Highlighted or Taken by Technology in Health

In healthcare contexts, technology use typically involves multiple individuals, for instance the patient and one or multiple clinicians. Teams of clinicians (at least one specialist and one nurse) use technology during anesthetic inductions or surgery. Patient data is written by one clinician and retrieved by another. Additionally, when patients are awake their collaboration with clinicians affects the success of procedures (e.g., receiving injections, holding still during medical imaging or positioning themselves for examinations). Therefore, all technology applications in healthcare can be viewed through the theoretical lenses of HCI and Computer Supported Cooperative Work (CSCW) [6]. While the two disciplines overlap, in the past, CSCW mainly contributed to an understanding of existing cooperative settings, and only rarely resulted in artifact designs [6]. In HCI & Health, the introduction of artifacts is more common. Typically, artifacts result from an extensive requirement analysis and the artifacts' originality lies rarely within a technical revolution but within the smart combination and application of existing technology. Main contributions often lie within studying social interactions in health settings with the technology already in place [e.g., 9, 17], or the description of how through the introduction of technology, team behavior changed, for instance with respect to situation awareness [15], information management [16], workflows [1] or overall teamwork [8, 14]. Another unique aspect introduced through HCI theories is the focus on health care providers' individual experiences [22], in holistic as well as reductionist approaches. Health settings are promising for applying [e.g., 8] and advancing [e.g., 21] HCI theories, due to Health settings':

- increased dynamic (ad hoc teams, emergencies, frequent changes of team members and varying hierarchies),
- variety of user roles (patients, relatives, physicians, nurses, non-medical staff),
- variety of user goals regarding their quality of live (such as health, career, social security), emotions (fear, stress, relieve, pride, ...),
- as well as varying degrees of expertise, communication abilities and technology affinity.

The briefly outlined diversity in healthcare settings offers an ideal model domain to apply and advance HCI theory in studying social technology interaction in teams. To illustrate our argument we will provide concrete examples of human encounters with technology taking a social role. Examples are based on insights from our research group in residential care settings as well as acute care. Focusing on the social role of technology we excluded research where technology is used as a mere tool without social implications.

1.1 Technology that requires moderation

In a project towards strengthening people with dementia's identity through reminiscence activities, we developed tangible reminiscence artifacts [10]. While some of the artifacts we introduced into living groups were designed to be used by residents on their own, they worked best when moderated by care givers or researchers (Figure 1). This was not due to people with dementia requiring instructions (the interactions were simple enough) but because the targeted reminiscence was facilitated best through skillful moderation by empathetic caregivers. This unforeseen caregiver involvement, on top of mere reminiscence additionally satisfied the residents' need for social engagement [10].

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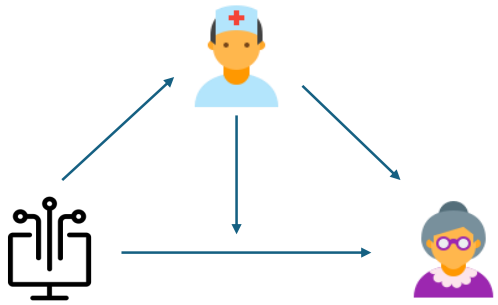

Figure 1: Technology socially moderated by care personnel.

In our case, sensitive moderation improved the reminiscence effect evoked through the amalgam of technology and content. Other researchers created technology supporting the moderation, for instance to sustain the communication [19] or evoke more positive topics in a shared communication [7]. Outside of the dementia context, curating personal health data could highlight patients' agency and reshape their communication with medical consultants [2]. A challenge for research projects of even simple multi-user systems is to include all stakeholders with typically very different skill sets and motivations.

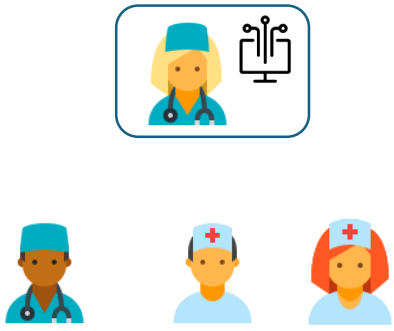

Figure 2: Teamleader role highlighted through technology use.

1.2 Technology that gives authority

In an acute care scenario of in-hospital emergencies, we provided team leaders with a tablet app to document interventions and keep track of the resuscitation process [8]. We found that teamwork was rated higher in teams where the team leader frequently used the tablet. A plausible explanation through the lens of embodied cognition [4] is that holding onto the tablet kept team leaders from participating in hands-on care on the patient. Instead, team leaders maintained oversight and had resources for higher level activities such as the coordination of the team (Figure 2).

However, limiting authority over a documentation aid to the team leader can also result in incomplete documentation in cases where the leader does not update tasks completed by the team [16]. Giving the last word in documentation to the team member executing the task (read back) makes documentation quality dependent on their motivation as long as the team leader remains officially responsible for documentation [11]. To cater for complete and successful interaction paths, future research needs to consider existing team hierarchies and assigned responsibilities.

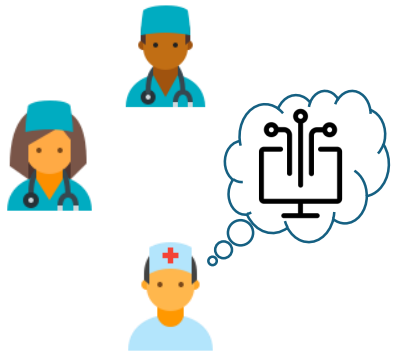

Figure 3: Users assigning technology a social role.

1.3 Technology that is assigned a social role by users

Technology not only supports social interactions but are assigned social roles or even treated as a team member [18]. For example, anesthesiologists' perception of their equipment includes roles such as a second patient requiring care or a fellow team member that is treated with respect, given a nickname, or is being verbally calmed when it emits alarms (Figure 3, [9]) This means, social roles are currently assigned to technology on an individual and situational basis. However, clarity about team roles – best communicated explicitly – is crucial to team effectiveness in healthcare [5, 20]. Therefore, all team members should share a uniform model of role distribution, which is better achieved when roles are explicitly introduced instead of assigned individually.

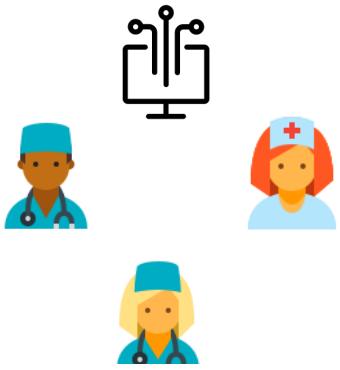

Figure 4: Technology designed to take a social role.

1.4 Technology that is designed to express a social role

The advances of AI technology along with the ever louder call for Human-AI Teams, HCI & Health has the great opportunity of contributing an agenda on (1) how AI systems affect team work and (2) how we can design AI systems to complement human-human interactions in healthcare. We plead for embedding the team role an artifact should take already in the design process. For instance, CASSANDRA, a rule based teamwork support system that moderated joint decision making processes in anesthesia teams was conceptualized as an *advocatus diaboli*, always aiming to falsify diagnosis statements [13]. To ensure fluent team work, instead of suppressing competences or undermining existing team roles, interactions and communications between human and non-human team members need to be carefully designed (Figure 4). Designing adaptive, social AI systems to maintain a good team fit while fulfilling one or multiple roles in dynamically changing teams and situations requires interdisciplinary approaches [12] and offers challenges for decades of research in HCI & Health. In their current state, AI systems are capable to mirror human emotional reactions but cannot interpret and respond to the underlying issue [3] – rendering them inapt for safety critical situations or direct contact with patients, particularly patients with mental health challenges. While technical advances in development and training of AI systems may reduce this issue, skillful prompting and transparent framing of AI systems capabilities are required to avoid human frustration within Human-AI Teams.

2 Opportunities to Understanding and Designing Social Interaction

In HCI & Health research, developed artifacts are usually based on thorough requirement analyses and designed to directly improve patient outcome, well-being or quality of life. On top of the direct health benefits for patients through advancing this safety-critical domain, we argue that the intersection of HCI & Health offers a model field for contributions in:

- Describing the social role of already deployed technology
- Designing the team interaction with and through novel technology
- Advancing and applying HCI theory

Developments of AI extend the scope of system abilities experienced as social and foster the complexity of observable or designable team interactions. However, we want to emphasize that plenty of social Health technology exists that does not carry the label of "AI" – all four social roles exemplarily described above include citations of non-AI work. For future research in HCI & Health, we question what other roles technology (be it AI or not) is already executing in teams today and which roles AI should be taking in the future. We propose Health as an ideal field for understanding and designing social encounters between humans and future technology.

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