

# Relationship configurations for hybrid networks of humans and social AI-agents

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## 1. Introduction

The Dutch healthcare system suffers from the 'care gap': its inadequacies to deliver healthcare services for growing numbers of clients. AI-systems are designed to remedy these problems, but for social acceptance these innovations must be realized with a human-centric approach (Bosse, 2019).

The research (fig.1) focuses on the impact of introducing social AI-agents in a healthcare social network (le Comte, in progress).

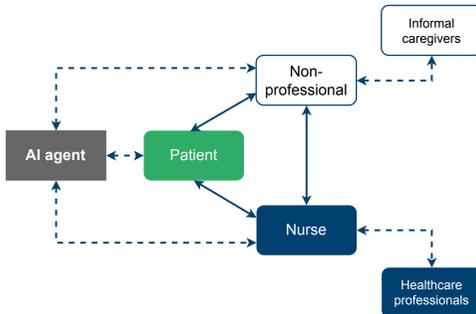


Fig. 1 The research problem

In the design science research approach, theory from the social sciences (par. 3) is applied to gain insight in the behavior of actors and the dynamics of the relationships influenced by a participating AI-agent.

## 2. Case

A patient is hospitalized for a certain illness and treated by professional medical personnel. During discharge from the hospital, a nurse invites her to a conversation, (fig. 2) in which the patient receives instruction for self-care. The nurse hands over an information brochure to be consulted during self-care.

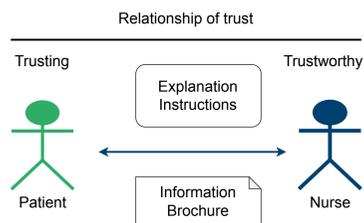


Fig. 2 Hospital discharge conversation

The patient and the nurse have developed a relationship of trust regarding the medical professionalism of the nurse. Therefore she will accept the instructions that are given by the nurse.

But now an AI-agent is deployed for patient instructions:

- Will the patient trust this agent?
- Should the agent mimic the behavior of the nurse to appear trustworthy?

## 3. Theory

### Social AI

Social AI emphasizes the social engagement of AI with humans. Social AI systems are designed to amplify, augment, empower and enhance human performance and control in systems that employ AI (Shneiderman, 2022).

### Group Dynamics

A group is two or more individuals who are connected by social relationships. Group dynamics are the interpersonal processes that occur in groups over time (Forsyth, 2019).

- Composition, interaction and interdependence are important group characteristics.
- Formation, influence and performance are crucial group processes.

### Social cognition

Social cognition is the study how people make sense of other people and themselves in their social world (Fiske & Taylor, 2021, Chen et al. 2011).

- The self-concept is our collected beliefs about ourselves and relations with significant others.
- A relational self embodies the cognitive, emotional, motivational, and behavioral tendencies exhibited in relation to a significant other.
- Transference is the phenomenon whereby elements of a relational-self resurface in new social interactions.

## Acknowledgements

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## 4. Approach

The social science disciplines of social network analysis, group dynamics and social cognition offer important insights in the interactions of humans in social situations. This is illustrated in the analysis of relationship configurations that occur in hybrid social networks. We study the relationship of trust between a patient, a nurse and an AI-agent (par. 2) and apply the theoretical concepts of 'relational self' and 'transference'.

### Relationship configurations

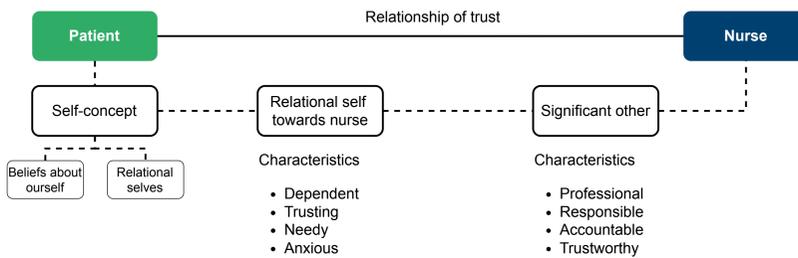
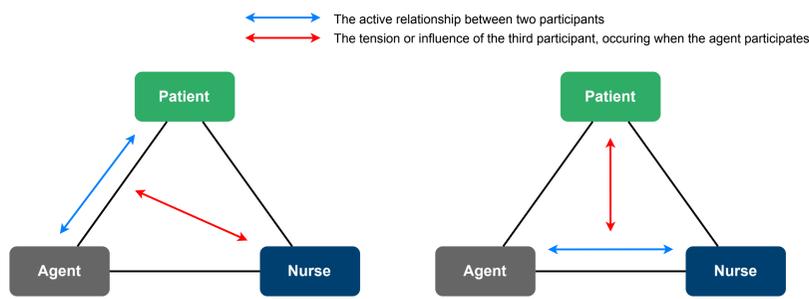


Fig 3: Patient and nurse in a dyadic relationship of trust

The original relationship (fig. 3) is characterized by trust, dependency and empathy. The participants in the relationship experience certain feelings depending on the role they fulfill and the expectations regarding the interaction. We assume that the nurse is considered by the patient to be a significant other, with whom a strong relationship has developed. During their interactions the mental representation of the relational self (patient) with the other (nurse) is evoked, influencing attitude, motivation, behavior and emotions (Chen et al., 2013).



Case: agent provides medical information to patient (par. 2)

Case: agent supports nurse in intervention

Fig 4: Triadic relationships between patient, nurse and agent

### Relational self and the transfer of trust

In the new relationship configuration the agent takes over certain responsibilities from the nurse towards the patient (fig. 4). That change will impact the actors, the roles they play and the dynamics of interaction. Trust is one of the aspects that is affected by the change. We hypothesize the following process (fig. 5):

1. The agent mimics the appearance and behavior of the nurse when taking over her responsibility.
2. The patient transfers his significant-other representation and the associated relational-self of the nurse towards a new significant-other representation and associated relational-self aimed at the agent.
3. The patient and the agent establish a new relationship.
4. In that relationship trust is transferred and developed.
5. The patient evaluates the agent's behavior as if it was the nurse, resulting in a higher acceptance of the agent's advice.

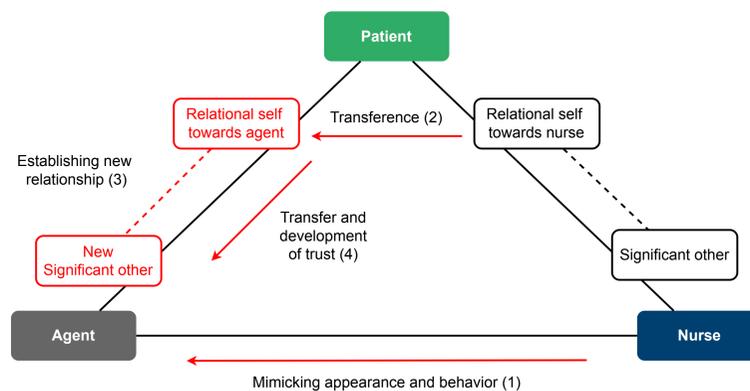


Fig. 5: The transference process in developing relationships

The key issues regarding transference are the individual behavior and appearance of the agent, but also the social identity and social role that the agent assumes. These aspects are considered activation cues for the transference process (Chen et al, 2013).

## 5. Discussion

- Modeling and analyzing relationships in (hybrid) social networks is a relevant instrument to gain insight in the structure and dynamics of relationships.
- The transference process is triggered by activation cues. The possibilities of artificial mimicking of human activation cues within a social role are not yet known. Personal and relational characteristics, and identity and agency seem relevant.
- The application of the transference concept to social AI-agents is important for the development of AI-human interactions that are richer than a simple exchange of information (Holohan & Fiske, 2021).

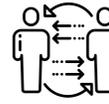
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## 6. Conclusions



Adding an AI-agent to a healthcare social network triggers social cognition and group dynamics processes related to trustworthiness and professionalism.



Social concepts such as social identity, relational self, transference and social roles are important for development of social AI-agents.



A multi-disciplinary approach integrating AI research and social psychology research is required to develop AI-agents that are capable of fluent social interaction with humans.



The analysis instrument of relationship configurations in social networks aids in the development of computational models for artificial social cognition and group dynamics capabilities for an AI-agent.

## 7. Challenges



Patients and clients in healthcare are vulnerable and anxious. To study them in their interactions with professionals requires a value-sensitive design approach.



The development and assessment of relationships between humans and AI-agents will take a significant period of time. A longitudinal study of these interactions must be performed in a consistent manner.



The domains of social cognition and group dynamics are complex. To what extent can theories from these domains, such as relational selves and transference, be operationalized into computational models?



For good interaction with the human the agent will have to learn about its social role and behavior. What learning mechanisms and datasets are needed to develop an AI-agent with such learning capabilities?

## 8. Further research

- Analysis of advanced relationship configurations and group identities based on group dynamics, in healthcare situations and the impact of social agents (fig. 6).
- Application of social cognition concepts to social agent development, in particular the relational self, transference, social inference, and social influencing.
- Development of healthcare use-cases focusing on specific attitudes and behaviors, like treatment adherence.
- Studying and understanding the effects of long-term engagement of humans and AI-agents.

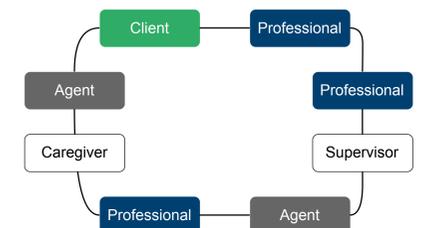


Fig. 6: Roles and relationships in healthcare

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