# Ontological and Anthropological Dimensions of Social Robotics

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**Abstract**

From a philosophical viewpoint ontological and anthropological dimensions of concepts of sociality and social intelligence in robotics are discussed. Diverse ontological options of social interaction as static or dynamic are analysed with regard to different theoretical approaches in sociology and the socio-behavioural sciences.

## 1 Introduction

Recent research on social robots is focussing on the creation of interactive systems that are able to recognise others, interpret gestures and verbal expressions, which recognize and express emotions and that are capable of social learning. A central question concerning social robotics is how "building such technologies shapes our self-understanding, and how these technologies impact society" (Breazeal 2002).
To understand the implications of these developments it is important to analyse central concepts of social robotics like the social, sociality, human nature and human-style interactions. Main questions are: What concepts of sociality are translated into action by social robotics? How is social behaviour conceptualised, shaped, or instantiated in software implementation processes? And what kind of social behaviours do we want to shape and implement into artefacts?

## 2 Some Clarification: 'Ontology' and 'Anthropology'

In the following I will use the term ontology in a philosophically but not in the sense of a branch of metaphysics which defines the nature of existence or the categorical structure of reality. The term ‘ontology’ here refers to the meta-theoretical core of a theory. Contemporary philosophy of science agrees that there is no theory without meta-theoretical principles or orienting strategies. These principles or strategies contain syntactical structures as well as ontological options. Ontological options lay down what set of things, entities, events or systems are regarded as existing (Lowe 1995). Central semantics are also regarded as part of the ontological options of a theory (Ritsert 2003). Following this understanding of ontology, 'anthropology' can be regarded as part of the ontological options of a theory and not as an essentialist and pregiven definition of human nature. Anthropology is defined in the sense of a set of human properties and behaviour which is taken for granted in the frame of a theory.

## 3 Sociality, Social Intelligence, and Social Relations

The growing interest in the social factor in robotics is related to the idea of a biologically-grounded, evolutionary origin of intelligence. The Social Intelligence Hypothesis - also called Machiavellian intelligence hypothesis - states that primate intelligence evolved to handle social problems (Jolly 1966; for discussion see Kummer et al. 1997). Social behaviour is said, not only to be grounded in the reflection of mental states and their usage in social interaction, but as necessary to predict the behaviour of others and change one´s own behaviour in relation to these predictions.
Kerstin Dautenhahn and Thomas Christaller describe the function of social interaction in the sense of double contingency as that which "enables one to establish and effectively handle highly complex social relationships and, at the same time, this kind of 'inner eye' […] allows a cognitive feedback, which is necessary for all sorts of abstract problem

solving" (Dautenhahn and Christaller 1997) According to this argument intelligent behaviour has a social off-spring and an embodied basis (ibid.; see also Duffy 2003) and helps humans - and it shall help robots - to survive in a complex and unpredictable world (Breazeal 2003).
This definition of social interaction developed in the sense of reflection of one´s own and anticipation of the behaviour of others, which was developed mainly in behavioural sciences like primatology, ethology and psychology, is quite similar to that of 'double contingency' in sociological approaches of system theory (Luhmann 1984; Parsons 1968) or interactionism. (Mead 1938, for critical discussion see Lindemann 2002).
The socio-behaviourist and these sociological concept of sociality share a quite formal understanding of the social, while other theories like critical theory, ethnomethodology, or Marxism developed a more contextual and material understanding of the social. As there is no generally acknowledged understanding of the social in social theory the decision for a more formal concept of the social can be regarded as part of the ontological option of a theory.

# 4 Dynamic Social Knowledge and Social Mechanisms

The sociological theorem of double contingency in system theory (Parsons, Luhmann) or interactionism is (implicitly) build on an anthropology that understands the relation of humans and their environment as open and flexible (Lindemann 2002), as a product of culture and it is grounded in a constructivist epistemology (Weber 1999).
The argument of the Machiavellian intelligence hypothesis is based on an anthropology that understands human nature as the product of a biological and contingent process: evolution. The epistemological frame stands in the tradition of naturalism (Danto 1967).
Both approaches share a formal understanding of social interaction which leaves plenty of room for different or maybe diverse kinds of interpretation of the 'nature' of social interaction.
In some approaches of social robotics human nature is regarded as flexible and open as it is embedded in time and space. For example, Dautenhahn and Christaller (1997) "do not regard 'social expertise' as a set of special social rules (propositions), which are stored, retrieved and applied to the social world. Instead, social knowledge is dynamically reconstructed while remembering past events and adapting knowledge about old situations to new ones (and vice versa). (…) we hypothesize that social intelligence might also be a general principle in the evolution of artificial intelligence, not necessarily restricted to a biological substrate." (Dautenhahn / Christaller 1997)
Here we find an anthropological option of an open and flexible human nature and the understanding of social knowledge as a very complex and dynamic product embedded into a historical frame, which is regarded as the product of evolution but can emerge (because of its dynamic nature?) also under different conditions.
While this interpretation of social knowledge stresses the dynamic and flexible process of social interaction, we also find more static and behaviourist interpretations of social behaviours - especially in the discussion on emotional intelligence which interpret social action more in terms of social mechanisms.

# 5 Emotional Intelligence

Social interaction in the sense of double contingency affords the understanding of the emotions of the alter ego (Duffy 2004). Emotional intelligence is understood as an important part of social intelligence (Canamero 1997) and is defined by Daniel Goleman (1997) as "the ability to monitor one´s own and others´ emotions, to discriminate among them, and to use the information to guide one´s thinking and actions".
In discussions on emotional intelligence - mostly with regard to psychology and ethology - social interaction is interpreted in terms of pregiven social mechanisms, like for example a few (fixed) basic emotions (see Breazeal 2003), 'moral sentiments' or social norms (Petta / Staller 2001). The latter are said to fulfil very particular functions to improve the adaptability of the individual towards the demands of his or her social life (Ekman 1992).
The understanding of sociality is reframed and made operational (for computational modelling) by defining the function of emotion in social interaction in terms of costs and benefits of the individual: "? there must be a material gain from having these emotions, otherwise they would not have evolved. (?) emotional predispositions have long-term material advantages: An honest partner with the predisposition to feel guilt will be sought as a partner in future interactions. The predisposition to get outraged will deter others from cheating." (Staller / Petta 2001) This interpretation of emotional predispositions is due to a less dynamic and more functional understanding of social interaction.

# 6 Sociality and Individualism

While most approaches in social robotics agree that social intelligence was developed out of the necessity to survive in a dynamic, unpredictable environment, some stress the dynamics of social knowledge, while others draw on the importance of fixed sets of rules and social norms for social interaction. These diverse interpretations are made possible by the formal character of the interpretation of social interaction in the sense of 'double contingeny', of the ability to predict the behaviour of others and change one´s own behaviour in relation to these predictions.
On the one side we find more functional approaches which understand society as the accumulation of individuals and social interaction as the negotiation of personal values: "Most behavioural and social sciences assume human sociality is a by-product of individualism. Briefly put, individuals are fundamentally self-interested; 'social' refers to the exchange of costs and benefits in the pursuit of outcomes of purely personal value, and "society" is the aggregate of individuals in pursuit of their respective self-interests." (Carporeal 1995)
Sociological approaches in system theory (Luhmann) or interactionism (Mead) more often defines sociality as something that is realized in the behaviour of the alter ego and as the outcome of a contingent and historical process of interpretation. According to this society is understood as a relation of socialized individuals that is regulated through culture and societal institutions (Lindemann 2002).
While many socio-behaviourist approaches take for granted that social behaviour is a general achievement of primates (and it is only abstract problem solving, which is a human-only property), system theory and interactionism regard humans as the only social actors (Lindemann 2002).
Only in recent time there are new approaches - especially in the field of science and technology studies - that make a claim for a "symmetrical anthropology" (Latour 1993; see also Haraway 1989) in which humans, animals as well as machines are regarded as social actors. (for discussion see Albertsen and Diken 2003)

# 7 Socio-Behaviourist Sciences and the Computational Modelling of Social Intelligence

There are historical reasons for the dominance of socio-behaviourist approaches (mostly in the anglo-american tradition) in artificial intelligence (see Chrisley / Ziemke 2002), but there might be also pragmatic ones.
One reason is the dominance of psychology, ethology and primatology which fits especially to approaches of Artificial Life and biologically-inspired robotics, while Luhmannïs system theory or Mead´s interactionism is oriented primarily towards sociology. The socio-behaviourist tradition regards not only humans, but also organisms in general as capable of social intelligence which is much more attractive for social robotics that wants to model social interaction in artificial systems.
While both 'traditions' share a more formal understanding of social interaction that enables naturalist, biological ontological groundings as well as constructivist, cultural ones with an dynamic understanding of the social, we nevertheless find many socio-behaviourist conceptions which offer a quite functional and less dynamic understanding of social interaction that makes the implementation of concrete social behaviours into artefacts much easier.
Social interaction is understood in these approaches in the sense of social mechanisms and norms thereby using quite static models of social behaviours: For example, "(s)tereotypical communication cues provide obvious mechanisms for communication between robots and people." (Duffy 2003, 188) Other relevant standardizations used in social robotics are stereotypical models of 'basic' emotions, distinct personality traits (see also Fong et al. 155), gender and class stereotypes (Moldt / von Scheve 2002) etc. These norms, stereotypes and standardizations make social intelligence (easier) operational for the computational modelling of social intelligence (Salovey and Meyer 1990).

# 8 On the Compatability of Ontological Options

On the one hand the formal description of social interaction as 'double contingency', as the prediction of the behaviour of others and adaption of one´s own behaviour leaves plenty of room for dynamic as well as static understandings of social interaction with divergent epistemological framings. On the other hand it is an open question how an embodied and situated understanding of social intelligence which regards organisms in general as social actors, can be used coherently with functional psychological concepts of emotion, personality and social mechanisms. If social intelligence is regarded as the outcome of situated, embodied social interaction one would expect to regard robots as an own kind (Duffy 2004) developing their own way of sociality. This would leave it open whether artificial systems will be able to develop the potential for abstract problem solving. Therefore imitating the social interaction of humans might neither be helpful for the development of human-robot interaction and probably also not very desirable (Billard 2004).
In any case, the analysis of ontological options of concepts of sociality might be helpful to think of the compatibility of diverse approaches and design

methods and the outcome of their combination. As there is no agreement on a concept of 'the' social neither in sociology or psychology (similar to the discussion on the concept of life in Artificial Life) - it would be interesting to take more sociological approaches in general into account, which were mostly neglected up to now. It could be helpful to compare not only the different effects of the implementation of dynamic and static concepts of sociality but also of formal and contextual ones.

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