Will Social Computers Dream?

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Did you dream last night? Chances are you did, but you don't remember it and that dream included either people you knew or people known to you by their social role – a president, a teacher, a colleague. If you remembered that dream and in it you or others acted different than you expected given the social role, when you awoke you probably felt those actions to be odd and most likely responded emotionally. The computers of 2065 will need social cognition to emulate human behavior, to understand, interpret and respond to humans in a social and emotional fashion, and to understand the response to dreams. The crux is that computers that reason in only a numerical-statistical fashion are unlikely to have this capability; but, those who can also reason in a socio-cognitive-emotional fashion are likely to have this capability.

Many futurists contend that the computers of tomorrow will be faster, smaller, ubiquitous, with smarter and simpler interfaces and woven into everyday objects leading to a greater influx of more accurate data, and the need for faster, more scalable, and smarter algorithms. This is a logical extension of current technologies and the use of the computer as a large numerical engine, with good search, storage, and statistical procedures. Along these lines, the computer of 2065 should be able to wake you in dream state, ask questions to help you recall your dreams, correlate your dreams with your physiological state, and give you a probabilistic breakdown of your future likely dreams based on your personal history. Such computers should be in use identifying trends in human behavior, providing short term general predictions, identifying rare DNA-based diseases, and forensically identifying likely areas of criminal activity or even suspects. Such computers, however, are unlikely to be able to adapt to new situations, understand why you dream, create new language or engage in emotional negotiations. Such computers may be seen as remote and unable to respond with dissonance to human behavior that is odd for a social role. For that, the computers of the future will need social cognition.

Social cognition refers to the set of procedures and behaviors followed by humans to reason about and respond to the world from a "social collective" and "individual affective" vantage point. Social cognition encompasses, but is far beyond, simple bounded rationality. Bounded rationality (Simon, 1957) had two precepts regarding human decision making: 1) humans are cognitively limited such that even if they had all information they could not process it, and 2) humans are socially limited such that even if they had unlimited cognitive capabilities they are socially restricted from accessing all information. On the one hand, the actor (human or computer) with true social cognition is even more cognitively limited than the boundedly rational actor. This is due to physiological and emotional constraints that impact what information the actor can learn, store, retrieve, and interpret below the knowledge level and at faster speeds than possible at the knowledge level (Carley & Newell, 1994). On the other hand, social cognition is in part a learned phenomenon. It requires the actor to be in a rich socio-cultural environment engaging in real interactions with multi-level actors with multi-level and competing goals, histories, and culture.

Social cognition involves a number of social reasoning processes. Among these are the following: People reason about others by considering the generalized other (Mead, 1934); i.e. people have a mental image of "others" such as "everyone thinks …" that is consistent with their perception of the norms, actions and beliefs of a group. When people have no information they infer that others will, act like themselves if the others are in the same group, or like the generalized other associated with the "other group." People tend to over-generalize from the actions of a few and assume that they are representative of their group; i.e., stereotype. People evaluate their behavior by determining that as they are in a group they should consider acting according to perceived group norms. People employ their transactive memory (i.e., their knowledge of who knows who, who knows what, and who is doing what) to make decisions (Wegner, 1987). People selectively lose skills and forget information if their transactive memory tells them they can get it from others. People rely more on other's opinions when information is scarce or uncertain. Adoption of new communication technologies is a function of network externalities; i.e., most people wait to adopt a new technology until a critical mass of people who are in different groups they interact with adopt. People's social networks and their knowledge co-evolve; so who one knows and what they know change synergistically. People are more likely to develop positive social relations while in a positive emotional state. People try to maintain an emotional balance and so will change their perceptions of others, their understanding of a role (e.g., police), and their interpretation of the generalized other when under emotional stress. And so on.

While not a complete inventory of the features of social cognition, these features do have a certain commonality with respect to reasoning. First, many of these are procedures, heuristic based algorithms, which enable reasoning, learning and decision making to proceed in an uncertain world. Second, these procedures make it possible for the human to reduce cognitive load and storage costs through inference and generalization. Third, the affective or emotional state is a mediator impacting both position in social networks and memory through the learning-interaction process.

Why should computers have social cognition? Social cognition is a source of errors such as the biases that invade most human decision making processes, with often strong negative social consequences such as racial hatred and social conflict. These cognitive limitations mean that humans are not at their best for numerical calculations. There are many tasks, e.g., monitoring blood sugar level or optimizing the exact mixture used to produce gas to minimize costs, for which a socially cognitive computer might be counter-productive. See Figure 1 – lower left. Computers without socio-cognitive reasoning can assess that you dream and the features of those dreams, and their relation to your medical and social condition. However, there are a large number of activities where social cognition is critical and a numerical approach alone is unlikely to suffice. See Figure 1 – upper right. Such activities are those where there is value in acting against the norm, in combining disparate information, in making errors in inference and so on. Among such activities are adaptation, the development of new linguistic terms, the creation of new social roles, institutional change, and negotiation. Computers with socio-cognitive reasoning can understand what we dream and help interpret those dreams.

Giving computers social-cognition is complicated, and unlikely to be completed by 2065. Brain-net, the direct linking of the brain to the computer, is potentially a way to enable the computer with social cognition. However, if the computer does not also have socio-cognitive reasoning then such interactions are likely to be limited to using the computer to augment physical capability and as external data storage. Whereas, humans may be more comfortable interacting with a socio-cognitive computer, and such a computer would open the way to a symbiotic social relation where the computer shares in adaptation, enables norms to be developed in a data-rich and less-myopic fashion, and supports social sense-making.

The key challenge that is not likely to be solved by 2065 is understanding human social cognition and having a model social agent. Advances are being made in understanding socio-cognitive reasoning and developing computational equivalents. Some of these are embodied in leading models like ACT-R (Anderson et al., 2004), Soar (Laird et al, 1987), and Construct (Carley 1990, Carley et al, 2009). We find that as social cognition is added to an agent-based model the results show more similarity to human activity, i.e., they better pass the social Turing test. The models better predict social behavior, and the computational speed and scalability increases, while storage costs decrease (Joseph et al, 2013). Social cognition, can be a win for human-social theorizing and for computational thinking.

Enabling social cognition in software tools and computers is increasingly important. Clearly the amount of data available digitally is growing, and new big-data analysis techniques will be critical in many domains such as medicine, improved and focused marketing, and optimized scheduling. The conceit that this digital revolution will empower all those who are disenfranchised, encourage democracy, and prevent tyranny is a fanciful myth. In contrast, what is happening is an increased digital divide, and the creation of a social media environment in which human security is threatened by the actions of the malcontent or vigilantes like *Anonymous* engaging in the dissemination of false information, or mis-direction with the support of smart bots making it look like "everybody" knows … People are still socio-cognitive reasoners, limited in their ability to process and access information, who generally cannot discriminate the true generalized other from the computer generated one. Pure numerical-statistical approaches are failing as they only identify outliers and not those hiding in plain sight. However tools that employ a modicum of social cognition are starting to appear that enable such discrimination.

By 2065, technologies that are somewhat socio-cognitively smart may be quite common. We should expect that as socio-cognitive intelligence improves within computers, on the whole the results should be positive. In part, this is because there are many areas where computers can support humans where socio-cognitive intelligence will enable more individually tuned and better support – health care, sports training, tutoring, cultural awareness trainers and support robots that anticipate needs are examples. And in part, this is because it is easier to detect that something is not human, than it is to be human – the many ways to fail syndrome. This will lead to better bots and phishing schemes, but even better bot detection tools, privacy enhancing tools, lie detectors, anomaly detectors, and protocol trainers.

With profound social consequence, creating computers that have true social cognition will open up many new avenues of scientific and philosophical enquiry. Not the least of which is: Can the Socio-Cognitive computer dream?

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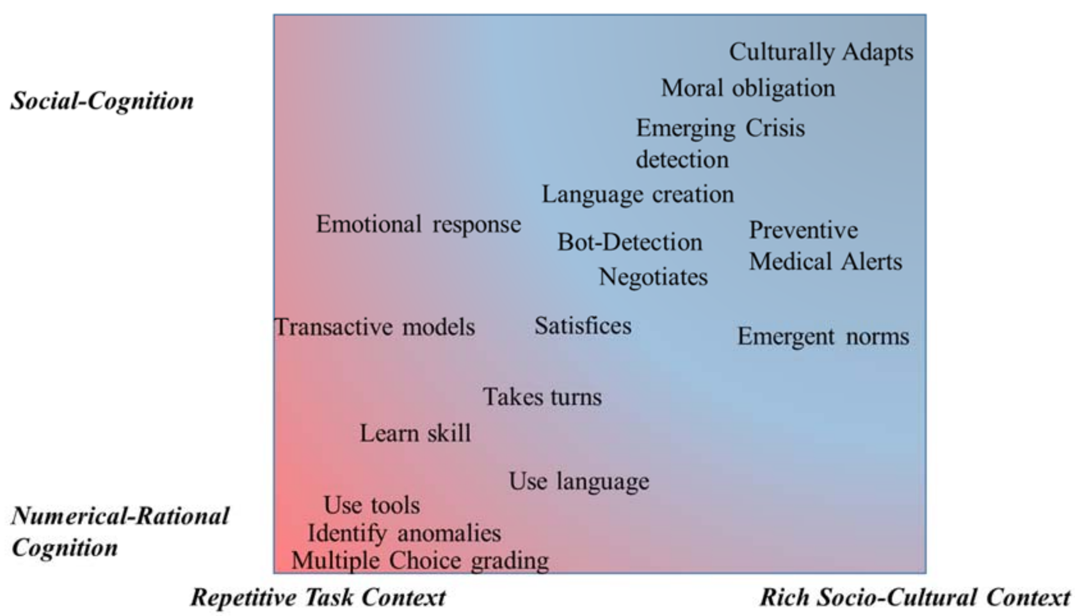

Figure 1. Different types of reasoning and context effect what behaviors are possible.