Seeking the human in human-like computing

Alan Dix[1,2]

Talis, Birmingham, UK
University of Birmingham, UK

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Abstract. There are clear connections between the long-term study of human–computer interaction (HCI) and the emerging area of human-like computing (HLC). A recent report on HLC to the HCI community identified four main topics: (i) improving interaction with people through human–like computation; (ii) developing new interaction paradigms for interacting with HLC agents; (iii) emulating human capabilities as a good model for general AI and robotics; (iv) learning more about human cognition and embodiment through HLC. This paper explores these topics focusing on the potential input of HCI knowledge and methods and using past and current HCI research as examples,

Keywords. Human–computer interaction · Human–like computing · Intelligent interfaces · Low-intention interaction · Cognitive models · Regret · Consciousness of self · Spreading activation · Web-scale reasoning

1 Introduction

EPSRC offers a tentative definition of Human–Like Computing (HLC):

> *"offering the prospect of computation which is akin to that of humans, where learning and making sense of information about the world around us can match our human performance."* [9]

The call for this workshop describes HLC research as aiming to:

> *"endow machines with human-like perceptual, reasoning and learning abilities which support collaboration and communication with human beings."*

The established discipline of human–computer interaction (HCI) studies the ways in which people engage with technology and the ways in which technology can be designed to work for and alongside people. Emerging in the 1980s in the wake of the personal computer revolution, the discipline has evolved to encompass technologies from the web to the internet of things, and has always included a strong strand on intelligent interactions. There are clearly connections with the emerging area of HLC both direct in terms of understanding the way HLC systems should be designed in order to better work alongside people, and also more methodological as HCI has developed means to investigate rich real world situations where social, physical and digital effects interplay as well as more controlled lab-based studies of basic cognition. The rest of this paper unpacks some of these connections.

2 Four Themes

A report on the 2016 EPSRC HLC workshop to the HCI community [6], identifies four main goals for the area:

(i) improving interaction with people through human–like computation
(ii) developing new interaction paradigms for interacting with HLC agents
(iii) emulating human capabilities as a good model for general AI and robotics
(iv) learning more about human cognition and embodiment through HLC

The first of these is the key focus of the MI20-HLC call; however, this goal by necessity implies the second, as more human-like capabilities change the nature of interaction design, which, for the past thirty years, focused on the control of the computer as a relatively passive partner.

The third and fourth goals will be important secondary outcomes for those working on AI/robotics and cognitive science/HCI respectively and are likely to be mutually reinforcing. As an example of this, a computational model of regret was developed based on an initial informal cognitive model; this was found to improve the rate of machine learning, helping to validate the initial cognitive model of regret [4], however it also highlighted the importance of 'positive regret' (grass is greener effect) and hence expand the cognitive understanding.

An obvious application of (iii) is to help with (i). Work on web-scale inference on ontologies and linked open data [5,10] was inspired by spreading activation models of the brain and also the way humans seek additional knowledge through epistemic action [11]; this human-inspired algorithm (iii) was then applied to aiding human form-filling and task inference (i,ii). Paradoxically, the most human-like interactions may not depend on deep human-like computation; this was evident with Weizenbaum's *Eliza* in the 1960s [14] and also Ramanee Peiris's work on personal medical interviews in the 1990s in which relatively simple chatbot-style systems were able to elicit extensive patient case information [13]. However, this paradox might resolve itself. Preliminary work on the emergence of 'self' (iv), suggests that the best way to create systems that embody human-like internal dynamics, may be to focus on developing human-like external behavior [7].

From a HCI point of view (i) and (ii) are central. The core of HCI is to understand embodied interactions of people with computers and one another in real world situations, a crucial input into (i). As noted, most user interface design advice assumes a passive computational device, but there has been work on ambient intelligence, human-robot interactions and human-like avatars (e.g. [12]). This includes some formal modeling of 'low intention' interactions where the computer system is the more active participant [8]. However, substantial new research is still needed on (iv).

Discussion of the broader social and societal issues of IT and AI also has a long history. As far back as 1992, "*Human Issues in the use of Pattern Recognition Techniques*" [2] explored issues with black-box algorithms including the potential for gender and ethnic discrimination and corresponding legal and ethical implications. Twenty-five years later, these issues have come to the fore with celebrated cases, such as Google's 'racist' search results, and the EU General Data Protection Regulation, which will mean that, in some circumstances, algorithms will have to be able explain

their results [1]. Of course, this is a challenge, but not necessarily an obstacle, indeed the 1992 paper led directly to the development of more humanly comprehensible database interrogation algorithms [3].

3 References

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