Designing For Intelligence: Intelligence For Designing

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Abstract
Intelligent technology is increasingly entangled in every aspect of our lives. As the designers/builders of these technologies, we wield considerable power, as is rightly being publicly scrutinized in recent debates around biased algorithms and (mis)use of social media data. Designing for intelligence is not just designing technology per se but designing ways of being human and negotiating complex choices. To do this well, engineering and design skills are not enough. We need better social, emotional, and existential intelligences to be critically reflective and empathic practitioners, able to negotiate contended values, engage with diverse user groups and stakeholders, and bring a values-based ethical lens to the choices we make.

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H.5.m. Information interfaces and presentation (HCI): Miscellaneous;

Introduction
"*New computer technologies and the transformations they are bringing about raise issues with much broader societal, moral, and ethical implications than HCI has had to deal with in the past.*" [11:65]

The above quote arose from discussions at a 2007 summit of key researchers exploring the implications of new technology trends for human computer interaction (HCI). If concerns existed then about the implications of technology, how much more critical is this 11 years on in the era of smart phones, smart [everything], social media, big data, algorithms, artificial intelligence, ubiquitous devices, the 'Internet of Things', automation etc. Such intelligent systems are becoming increasingly entangled with every aspect of our lives and fundamentally impacting not just what it means to be human [8] but are shaping the society we live in.

Further, these concerns are no longer just a matter for discussion among researcher but are entering into public discourse, as evidenced by significant media coverage of problematic impacts of these new technologies, from issues around self-driving cars (e.g., [9]) to bias in algorithms (e.g., [2] [10]) to interference in national elections (e.g., [3]).

There are also much more subtle ways that intelligent technologies are influencing aspects of everyday lives. A particular example is work on smart homes/devices to assist in care for older people. Experiences, as provocatively illustrated in a Superflux film [14], however raise questions about who are we designing for and whose values our technologies embody.

Collectively these examples point to the significant power that we as software designers and developers wield in shaping what it means to be human and in shaping the society we live in. In response to this professional computing/engineering bodies are revising their ethics guidelines for professional practice [15] [16]. But is this enough? It is one thing having guidelines around practice and saying *what* we should do. But *how* do we practically apply these, and using what skills, especially in light of the increasingly complex issues that are entailed in designing for intelligence: the complex socio-technical undertakings where consequences and impacts are often difficult to anticipate let alone mitigate; the increasingly diverse set of stakeholders, participants etc. involved, often with competing concerns, agendas and values; and the increasingly diverse disciplinary collaborations needed to deliver any undertaking.

Intelligences to design for intelligence

In designing for intelligence, we need excellent technical and design skills, i.e., STEM skills that we can label as part of Rational/Intellectual Intelligence. But these are only a necessary but not sufficient prerequisite for designing good intelligent technology.

The proposal in 2008 that "HCI researchers need a larger assembly of skills and know-how if they are to succeed, which has implications for the concepts, frameworks and theories of HCI." [8:77] still holds true but we also need to bring a broader range of human intelligences [7], not just theories, to designing for intelligence and good technology outcomes.

First, there is a need to engage much more deeply with issues around values, purpose and meaning. This is about *existential* (also called spiritual) intelligence, moving beyond ethics per se to engage more deeply and critically with the values that underpin the ethics being captured in the professional guidelines previously mentioned. Values are important because they motivate the rules of conduct and norms encapsulated in ethics and point to the bigger picture 'meaning'

questions that are critical for responsible decision making. As we argue in [6:224]: "HCI has no longer any excuse to not be concerned about the values that are embedded in its processes and artifacts, and how they interact with society.". There are practical implications still to be worked out about how to move beyond values rhetoric to practical action in software engineering [4,5], complementing other values-sensitive work in HCI.

Second, there is a need for developing strong *social and emotional (SE)* intelligences and competencies [12]. This can be considered from both self and other perspectives, and concerning both awareness and management skills.

From the 'self' perspective is the need to develop self-awareness for example around the values that we as developers/designers implicitly bring to our work, and honestly assessing our strengths and limitations, what we can and can't do. The 'self' perspective also includes the ability to engage in critical thinking and reflection to ask hard questions early and often about our work and the technologies we are designing, and the ability to manage complex and often stressful work contexts.

From the 'other' perspective, awareness skills relate to empathy and being open to understanding the perspectives of diverse others, whether these are collaborators, stakeholders or potential users of our technologies. The 'other' perspective also includes relationship skills around effective social interaction, being able to communicate and collaborate effectively with diverse others, to work in a team, and being able to negotiate among competing perspectives and values.

The importance of bringing diverse intelligences to the design of intelligent technologies is illustrated in a report on the seven top characteristics of success at Google: coaching; communicating, listening well; having insights into others; having empathy; being a critical thinker/problem solver; and making connections across ideas [13]. STEM skills were listed after these.

Implications

If we take this seriously, the implications are wide ranging. Firstly, as professionals we have personal and institutional responsibility for prioritizing the development of our own existential, social and emotional intelligences, and becoming much more critically reflective and responsible practitioners.

Secondly, as educators, we need to re-think what constitutes core skills for the cohorts of computer science/engineering students who will be 'designing for intelligence' in the future and wielding the power to shape being human and society at large. Towards this, Peter Purgathofer and Christopher Frauenberger at TU Wien have started teaching first year students a new course on diverse thinking skills. There is also considerable evidence-based work on teaching SE skills in schools [12] that could be adapted for tertiary settings. As a specific example, a recent study reported that teaching mindfulness to software engineering students significantly improved the efficiency of their conceptual modelling work [1].

In summary, engineering and design skills are not enough. We need stronger social, emotional, and existential intelligences to be critically reflective and effective practitioners, wielding our power responsibly.

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