Artificial Intelligence and Interface Design for Everyday Products

Abstract

Imbedding artificial intelligence into designed technologies is not new, yet recently there has been a rapid increase in the number of domestic products that claim to be “smart”. The reasons for this are varied but a major contributing factor is the prevalence of smartphones and computational devices that we now carry with us. These devices constantly gather personal data and, in turn, use this information to tailor how they interact with us to predict our behaviours. This paper investigates how artificial intelligence can be designed into everyday domestic products in order to enhance the relationships that humans have with these objects. Considering not just the representation of intelligence as mental arithmetic capacitance but also as behavioural intelligence or, the manner in which the designed object represents its intelligence through physiological action and reaction. The primary focus of our interactions with everyday objects resides on their designed interfaces. The principles of technology interface design have changed very little since the first electronic domestic products of the early nineteen hundreds. Products have historically been designed to fulfil utility needs so our interactions with products have been designed to trigger them to perform their designated tasks. This practice can no longer be considered appropriate when the interactions that we have with everyday products are increasingly as social as much as they are utilitarian. In this paper we discuss the design of AI domestic products under three perspectives: being intelligent; being human; being machine. From these viewpoints will emerge a framework for the reconsideration of tangible interface design.

Keywords

Artificial Intelligence, Domestic Products, Interface, Interaction Design, User Experience.

The human, the object, the interface

Normally when a human interacts with the physical world they expect a physical reaction from it or to a lesser part a sonic one. This principle relates as far back as Isaac Newton's third law of motion. We see this evidenced when a child begins to crawl and then to move things in their immediate environment. Or when a child comprehends that the sound of their own crying results in the reward of devoted attention from their parent. It is very primitive and intuitive to us. Infants and toddlers derive implicit theories to explain the actions of objects and the behaviour of people; these theories form the foundation for causal learning and more sophisticated understanding of the physical and social worlds (Transforming the workforce for children birth through Age 8, 2015).

For an artificially intelligent object this awareness, that their expressions on to the world act as cues for other entities, is not present. For an artificially intelligent object the processes of revelation and discovery are inherently limited due to its inability to develop an understanding of self. Predominantly, artificially intelligent objects are still designed to be attentive and responsive rather that self acting. The concept of Self (i.e. the id, the ego, etc.) was first presented by Sigmund Freud in his seminal work, *The Interpretation of Dreams* (1899), but to this day the topic is still actively queried. Doherty (2009) stated that from a young age one understands that other people are looking at and judging them the same way that they are looking at and judging others. This is called the *Self-Concept*. This contemplation of societal position does not only refer to the deliberation of one's dominance over another, as one might relate to social stratification (Saunders, 1990), but also to the emotional relationships between two beings. It is through this lens, the emotion of things, that artificially intelligent products may prosper and through which this paper will be explored.

The universality of basic emotions argues strongly for their biological nature (Evans, 2004). From this position we can posit that for a designed product to be considered a kin to a higher intelligent being, it must be capable of expressions beyond the functional and which are not just responsive. This is not to say that it must act as human but, it must possess the capacity to act not just in utile ways.

In 2004, Donald Norman introduced the connection between the design of technological systems and the design of biological systems. Discussing the distinction between humans and other animals Norman states, the advantage human beings have over other animals is our powerful reflective level.

Computational electronic technologies, such as our smartphones and cars, operate through simple logic systems. They repeat pre-determined acts. They do not reflect on the outcome of the action in terms of satisfaction. These types of products, and indeed all domestic electronic products, are currently designed to present themselves as typically responsive utility objects. Their interface design reenforces this. It invites human activation through pushing buttons, rotating knobs, and moving sliders. The product will lie dormant until that moment of invitation to animate. And on completion of the expected task the product will return to its dormant state. If we are to change the capacity for these objects to possess the potential for higher level thinking through AI, then we must also change the way they physically present themselves for interaction, namely their interfaces. Otherwise it will be like designing a toaster with a radio, Figure 1. A novel addition, imbuing ability beyond the scope of expectation, that is ultimately mundane and forgettable.

Fig 1. Toaster radio

Being Intelligent

In any interaction there are at least two parties. There is no stipulation for any of the parties to be conscious. From the human perceptive interactions may occur intentionally or unintentionally positing that there is an actor and a respondent. Furthermore, any of these parties may be an object or an environment. When an interaction occurs between two or more parties it may be experienced personally or through third party observation. This event, when internally analysed as an observer, an actor, or the recipient of action, can be said to contribute to that objects intelligence. This form of intelligence is called learned intelligence (Marzano, 2003). “Besides this form of intelligence… there is also a belief that humans possess born intelligence, or innate intelligence, proposed in an infant’s ability of facial tracking and emotional cognition" (Dupoux, 2018).

When an actor acts upon environment, or other entity, it often does so in an exploratory or meaningful manner. To act with meaningfulness is to suggest that the actor is aware of the resultant potentials of the interaction. We shall refer to this top level of interaction as *intent*. Even in a first time interaction human actors make associations with minute relatable features. We refer to these features as *affordances* (Gibson, 1977) or *semiotics* (Locke, 1690). Based on these affordances to have intent from a human perspective is to have an intelligence that is capable of prediction. It also proposes that an actor, acting with intent, has an association to the subject of the interaction. Association is a faculty of the human brain that emerges through experience with environment and entities in the environment.

This ability to predict the potentials of environments and entities is one defining characteristic of living creatures that exhibit high level intelligence. According to LeCun (2017) the essence of intelligence is the ability to predict. By the combination of these intelligences humans are capable of developing complex predictive modelling very early in infancy (Marcus, 2017). From these observations and appraisals we create complex maps of the world around us. This prediction mapping process allows us to manipulate the material things in our environments, and often the environments themselves, with intent. Even if we do not have personal previous experience of every environment or entity we can still imagine the consequences of an interaction through exposure to third party experiences (e.g. spoken narratives, illustration, film, etc.). This phenomena may also be referred to as third party apperception.

Understanding how humans experience the world around them is crucial in the consideration of how electronic technologies should be designed so that their existence is considered more living than manufactured. According to Wilhelm Wundt (1894), there are two aspects of human sensory

experiences, the *physical* and the *mental*. This may also be referred to as the *actual* and the *interpreted*. Both of these experiential modes have essentially the same content, suggesting that it [is] merely the viewpoint from which this content [is] studied that distinguish[es] the two realms of knowledge (Kusch, 1995,129). The viewpoint is in turn influenced by the human users' Apperceptive Mass (Phillips, 2010).

Being Human

The consideration for what makes us aware that we are human, as opposed to another living entity, is something that is infrequently discussed in relation to robotics or artificial intelligent objects. Predominantly, AI is referenced to as relating to or attempting to be human but not relating to or attempting to be animal. The distinction between these to existences is what Descartes first wrote as being the awareness of the self. The ability to think of oneself as an entity that resides around and amongst other entities is an abstract one. Gary Marcus (2016) discusses the difference between data and abstract understanding, referring to the process of situational evaluation, for example a situation where a child attempts to make sense of an event through relational considerations of their current situation. The comprehension of an event in which one finds themselves is heavily influenced by the individual's awareness of self. This is referred to as the *Self-Concept*. From an external perspective this is known as *Social Identity*, the sense of our self that involves our memberships in social groups (Jhangiani and Tarry, 2014). If acting upon other entities or the environment with intent being aware of their own self[1] in order to adjudge the potentials of their actions is deemed a quality of high level intelligence. And one may infer upon the intention of others by evaluating the actions upon them by another, in relation to their current existent state. Furthermore, it is possible to evaluate the intelligence of other entities by their actions. This is to say, evaluate if the actions of other entities are independent, intentional, or mimicry. Genschow et al. (2018) determined that social information processing as part of social intelligence is linked to mimicry and anticipated action. Through these parameters we may reconsider the design for artificially intelligent domestic products so that they represent themselves as being intelligent by their awareness of self within prescribed environments; through intelligent actions rather than human level cognition; and through

[1] Self-knowledge cannot be achieved through mere introspection into my own (I take this to be the significance of the 'single self'), feelings, foibles, habits, likes and dislikes, capacities and so on. I cannot examine the single self and reach any important conclusions because I do not exist in isolation from other selves, and my introspection must of necessity be based on an examination of my relationships with others. (Berenson, Hegel, 1982)

the redesign of their physical interfaces so that our visceral interactions with them are less related to mid-nineteen century design methodologies.

Being Machine

Traditionally, designed things are slaves to the human users' needs and desires. The designed thing should not be animate prior to interaction unless it is to inform the human user that it is with power, alert, and ready to receive interaction; or it is already in the process of fulfilling its assigned duty (e.g. a kettle, a traffic light pedestrian crossing, an elevator. In order to proceed past this current status of existence designed things may be required to become enhanced with the ability to detect activity in their present environment. Yet the current era of personal electronic technology design is focussed on the integration of enhanced sensorial awareness of both environment and other entities in environment. The reason for this has been to enable them to interact with their environment beyond traditional utilitarian specifics. The issue which has arisen is a conflict between how products are expected to look and feel, and the potential of products nowadays when these sensory systems are designed into them. Or in short something that has always been dumb, suddenly becoming smart.

The interest in creating intelligent products has existed for generations. A robot capable of impersonating so well that it is indistinguishable from a true human (e.g. the Maschinenmensch or Brigitte Helm in Metropolis (1927)). In contrast to this, human nature inherently rejects anything non-human that is deemed to be attempting to be human. This was first theorised by Masahiro Mori in 1970 and is known as the *Uncanny Valley* theory. Mori discusses the distinction between machines that attempt to replicate humans, or parts of a human, and machines that are presented as theatrics or art. The discourse that emerges proposes intention. If a machine is deemed to have attempted to be human, and is discovered not to be, the human self will reflect on the primary intention of the machine. This projection of self on to the machine denotes its role in the present environment. The machine's character is only subjective, since this character depends on the standpoint of the experiencing individual and the moment in which, on the part of the subject, the experience of a thing happens to be made (Heidegger, 1962, 27).

Since the industrial revolution and the rise of the engine powered machine, society has progressively affirmed the characteristics that define a machine as such. In line with this society has also affirmed the evolutionary potential of the machine as one towards human replication. In order

to optimise the value these machines have we must consider the current role of the machine in our society in contrast to the role of the first self powered machines of the industrial revolution. Machines nowadays fulfil social human needs. The journey from utility robot to co-human entity is imprisoned by these initial boundaries of the role of the machine that live on it its innate being today.

Conclusion

Society is now in the era of everyday products being designed to be smart. Current dominant practices in the pursuit of Artificially Intelligent Products focus entirely on representing intelligence through mental competence. There is, however, an emerging philosophy which posits that AI requires designed objects to possess both mental and physiological intelligence. Intelligence may be assessed when considering the intelligences of non-human biologies. We consider the physiological commonalities between humans and other living things in order to evaluate the parameters for Intelligence. The designed interfaces of everyday products are both the point of inlet and the visceral outlet for our interactions with them. It is through the redesign of a product's interface (e.g. the screen or arrangement of buttons in order to trigger expected outcomes). that we may enable smart products to demonstrate intelligence. Not by the their cognition but through the manner which they act or present themselves for interaction. By extension, we must consider, how Self Concept and apperception play pivotal roles in the human evaluation of the potentials of other entities, organic and synthetic, in our physical and digital environments. The actions of other entities in our environment and our evaluation of the intention of those actions play a significant role in how we denote intelligence on all things we encounter. For designed objects to be perceived as intelligent they must address this parameter of intelligence evaluation. From the AI service robot to the AI companion, for the human relationship with these devices to be beneficial we must consider physiology as much as mental ability to communicate with us and act around us.

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