BODY, WORLD AND AFFORDANCE: TOWARDS ENGAGING TECHNOLOGICAL ARTEFACTS FOR OLDER INDIVIDUALS.

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This paper addresses the problems older individuals have been observed to encounter when engaging with technological artefacts and how such difficulties may relate to the designers understanding of the normal cognitive ageing process of human beings. This paper suggests that these problems may not be the result of limited cognitive abilities of certain older individuals but rather the manner in which designers understand the complex relationship between the mind and actions in the world. The paper speculates that an alternative perspective on interactions as affordances that occur between the embodied individual and their ecology may benefit design methodologies deployed in creating engaging technological artefacts for older individuals.

INTRODUCTION

There has been growing discussion within the design community regarding the response to the ageing populations of many Western European nations for a number of years. One subject within this area that has generated discussion is the effects cognitive changes have on an older individual's ability to perform certain technology-mediated acts, such as using personal computers, mobile phones and home audio/visual equipment. Although there appears to be no formal methodology that designers follow when developing cognitively inclusive technological artefacts for older individuals, there are cases of designers drawing upon knowledge within psychological disciplines that discuss cognitive change. This short paper notes that based upon this knowledge designers may be able to improve the usability of technological artefacts for certain tasks but the resulting interactions may not be considered as novel or engaging.

This paper will briefly overview some of the cognitive changes psychological disciplines associate with the normal ageing process of the human brain. These changes will then be unpacked in relation to the methods and techniques certain designers have used when developing new technological artefacts for older individuals. It will suggest that these methods reduce the mind to discrete processes for exploitation by the designer, which might not be productive in the development of engaging technological interactions for older individuals. The paper will introduce an alternative body of evidence based upon theories of cognition that suggest an individual's cognitive abilities are embodied within the capacities of their particular physiology and enacted within a certain ecology. The paper will argue that the model of interaction underpinning these theories determines that engagement with technological artefacts is a continuous moment-by-moment reassessment of affordances that couple together the sensorimotor capacities of an individual and the ecological environment. The paper speculates that design methodologies relating to the creation of engaging technological artefacts for older people may benefit from considering their changing capabilities in relation to this dynamic model of experience and interactions as affordances.

AGED COGNITIVE ABILITY AND DESIGN REDUCTIONALISM

Designers have often drawn from the disciplines of psychology and neuropsychology in order to understand the changes in the mind as people age, with the intention of relating such changes to the designed world. Neuropsychology traditionally studies and identifies how mental activity relates to certain behaviour, stimuli and pathologies. Francisco Varela and colleagues (Varela et al. 1991) argue that such a method is a result of a long standing notion that treats the mind as an information processing machine that can be reduced down to specific processes representing external phenomena, actions and behavioural traits. In the cases of older users of technologies, the processes most often attributed to restricted abilities to engage with emerging technologies are related to an individual's memory and intelligence. Specifically, the areas that relate to working memory and fluid intelligence are widely considered as causing the most difficulties (Stuart-Hamilton 2006, Birren and Warner Schaie 2001). These processes will be briefly explained below.

Working memory is considered the feature of the short term memory system that allows an individual to not only keep information in conscious thought for a short to medium length of time, but to dynamically manipulate such information. Psychologist Alan Baddeley claims this is of particular use in activities that require learning, reasoning and comprehension (Baddeley 1986). It is widely noted that working memory declines in older age (Salthouse 1994), along with the explicit recollection of long term memories (e.g. Smith 1996). However, certain abilities related to long term memory, such as implicit knowledge of previously gained skills and knowledge of words, are shown to be robust later in life (Smith and Earles 1996).

Raymond Cattell (1971) described fluid intelligence as the ability one has to decipher new information or situations without the need to draw upon any prior experience. This is often opposed to crystallized Intelligence, which is the coming together of past skills, experiences and knowledge that may be recalled to be used once again (Cattell 1971). Various lab studies have observed a lowering of fluid intelligence later in life and little change in the crystallized processes (such as Hayslip and Sterns 1979, Singer et al. 2003). Much as with the changes observed in studies of memory, this suggests older individuals are less able to develop the skills required for certain 'new' experiences, yet have a wealth of previous knowledge that is still accessible.

Some design researchers have noted that the research within psychological disciplines on ageing intelligence and memory may be of value to designers of new technological interfaces. Mary Zajicek identified how the changes observed in the cognitive abilities of older people could relate to problems that occur upon the use of screen-based computational interfaces, fitting *'precisely the type of exploratory learning required for computer use'* (Zajicek 2001, p.2). Zajicek recommended that certain measures should be taken by designers of interactive technologies in consideration of these reduced cognitive abilities, such as simplifying the functionality of a particular interface by reducing the amount of information that is required to be stored in short term memory. Similar conclusions have been made by a number of HCI and gerontology researchers over the past decade, often resulting as sets of guidelines for the usability of new technologies for aged cognitive ability (such as Schieber 2003).

Other practitioners have attempted to reduce the effects of the presumed cognitive change by avoiding the use of the restricted abilities and exploiting the 'healthy' processes of memory and intelligence. Milli Docampo Rama is one such practitioner, investigating the idea that each generation of certain age ranges belong to particular generations of technological interaction (Docampo Rama 2001). Docampo Rama's research was based upon a cross-validation between sociological, psychological and child development research that had suggested the experiences one has between the ages of 10 and 25 years most strongly shape personal values and skills used in the future (Sroufe and Cooper,1988, Glenn 1974). Docampo Rama integrated this argument with a historical study of technological interfaces through the 20th century to establish a series of technology generations that certain generations of people belong to. It was argued that the integration of previously gathered knowledge from this earlier period in an individual's life harnessed the healthy and able processes of his or her memory, whilst removing layers of complexity reduced load on the less able working memory processes. Tim Lewis (Lewis 2007) and colleagues have explored Docampo Rama's claims further through usability studies of older people using certain technological products – such as microwaves – with differing levels of interface generations, from mechanical-esque to digitised software-based interfaces.

In certain cases design methods derived from psychological studies of aged cognitive ability can provide heightened level of 'usability'. This paper questions, however, whether a reliance on the past, metaphor, analogy and a discrete understanding of memory constitutes the development of novel and engaging technological interactions for the older individual. In using the knowledge from the psychological disciplines the designer becomes a limiter of potential interactions as opposed to allowing an engaging reciprocation between an older individual and the technological artefacts they encounter.

These approaches take the world as a discrete set of properties that are symbolically stored across the mind for later retrieval. As such, this leads to designers adapting cognitive change through identifying which of these symbolic representations in the mind work still and those that do not, and designing technological artefacts accordingly. An alternative perspective on the relationship between the mind and actions in the world that does not observe the mind as an information processing machine is provided within the embodied and enactive cognitive sciences.

THE ROLE OF BODY AND WORLD

The perspectives outlined above rely heavily on the idea that the mind sysmbolically represents certain external phenomena and treats this as the central 'computational' processing device of human consciousness. Opposing this, embodied models of cognition argue that perception and cognition result from the physiology of the whole body (Lakoff and Johnson 1999, Gallagher 2005). An embodied perspective on cognition takes the experience of a particular individual occurring as a result of the combined sensorimotor capacities (sensory organs, muscles, bone and skeleton structure etc, and the actions these allow) that their body provides. Francisco Varela and colleagues determined that embodiment unifies the perceptual and action capabilities of an individual. Perception and action '*are fundamentally inseparable in lived cognition. Indeed, the two are not merely contingently linked in individuals, they have also evolved together'* (Varela et al. 1991, pp.172-173). The model of cognition outlined by this group of researchers suggests that it is no longer possible to separate the mental processes from actual, lived experience. Within this body of opinion the processes of the mind are not a collection of symbollic representations of an outside world that can be discretely exploited; the mind is dynamic and fully intergrated within the actions, interactions and world an individual finds themselves in (Maturana and Varela 1987).

This argument does not stop at the notion of the mind as embodied, as this body is situated in a particular world, or ecology, and is acted, or enacted, within it. Sensorimotor actions both inform and are informed by the wider ecological environment an individual is situated within and the action possibilities it provides (Abram 1996, Noë 2004, Gibson 1979). James Gibson's theory of ecological perception introduced the concept of affordance (Gibson 1979). Gibson claimed that the potentiality for interaction in the environment is one of a mutual conversation between an individual's physiology and the objects, surfaces and artefacts that are perceived at a moment in time (Gibson 1979). Gibson's affordances (not be confused with Donald Norman's adaptation of the concept (Norman 1999)) are invariant properties of the environment; an affordance either exists or it does not. A particular affordance may not be perceivable to a particular individual as a result of his or her embodied sensorimotor capabilities, however, that is not to say the affordance does not exist for others. As a result of this mutuality with the physiology of an individual, affordances can be discovered and lost. A branch that affords climbing up to and swinging on for a child one summer may not the next. This is a significant feature of the theory of affordances, as it suggests that the invariant potentials for interaction are been dynamically continuously reassessed.

Alva Noë expands upon Gibson's concept of affordance to include the ability for an individual to extend and master their sensorimotor skills, '*the possession of which enables a situation to afford an opportunity for action not otherwise available'* (Noë 2004, p.106). Noë uses the example of how a baseball bat may afford little to one individual, but to an individual whom has mastered the skill or is in the process of doing so, it may afford the hitting of an appropriate ball a long distance. This suggests that memory is a dynamic process of the sensorimotor activity that is in continual change; it does not merely act as a static store of information to be referred to but is in a constant fluxation based upon current and planned action in the world (Edelman 1992).

IMPLICATIONS

The current direction of the design of technological artefacts inclusive of cognitive change in older individuals draws heavily from Psychological studies of memory and intelligence. As a result of this, the designer relies upon a method of distinguishing how the design of a particular object relates to the reduced processes of the brain that are considered either healthy or unhealthy in old age. This creates a situation where designers have relied heavily on past experience and simplification of interaction possibilities in order to restrict the claimed affects of cognitive ageing. Theories of embodiment and enaction argue that such a reductionalistic method of understanding action and interaction in the world ignores the dynamic nature of the continual reassessment of mutual affordances between the human sensorimotor capacities and the environment. It is not as simple as reducing cognition, history and experience into discrete factors for investigation, but instead to understand how the individual is in a constant state of flux unified with the activity of the body and the broader environment.

For a designer this would require them moving away from a method that encourages the investigation of the discrete facets of long term memory and intelligence and explicitly introducing past meaning and experience into the technological artefacts they create. Rather, this alternative perspective may remove evidence of the designer, developing technological artefacts that allow for the engagement and interaction with any particular individual – be they young, old or non-human – based upon their particular sensorimotor capacity and the affordances and engagements it allows.

The brief discussion of embodied and enactive forms of cognition has not touched upon how this is affected by certain changes in an individual as they progress through lifetime. Firstly, this is a result of there being little to refer to regarding the intersection between the two subjects – studies of aged cognition, which itself is an ever growing area of investigation, are still based upon an information processing model of the mind. Secondly, it could be speculated that to a proponent of embodied and enactive cognition ageing as a concept may not exist; all that is observed is an alternative set of affordances and mutual couplings between an individual and the environment. Rather than considering a particular person as having 'aged cognitive ability' as they no longer reach the standards set by much younger members of the population, they are just seen as individuals with certain sensorimotor capacities that inform their activity in the world.

Some of the difficulties that theories of embodied and enactive cognition provide for designers is that the language used by either discipline is not coextensive with one another. Future research will have to reframe the terminologies of either field in a manner that is cohesive and induces collaboration and builds upon these synergies. This short paper takes a tentative step towards speculating the usefulness of these models to designers that are relying more frequently on psychological disciplines to provide insight into particular aspects of human behaviour.

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