The Multi-Disciplinary Case for Human Sciences in Technology Design

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Abstract
Connecting the dots between discoveries in neuroscience (neuroplasticity), psychoneuroimmunology (the brain-immune loop) and user experience (gadget rub-off) indicate the nature of our time spent with gadgets is a vector in human health - mentally, socially and physically. The positive design of our interactions with devices therefore can have a positive impact on economy, civilization and society. Likewise, the absence of design that encourages positive interaction may encourage undesirable behaviors. Much like the architecture of physical spaces and buildings, the consequences of the architecture of the 21st century conversation between man and machine may last generations. AI and the Internet of Things are primary vectors for positive and negative impacts of technology on our cells and our social relationships with each other and our environment. We outline the co-discoveries supporting the argument for human sciences in technology.

A Day In The Life of A Palo Alto Oblivitron
Let us define a new word: oblivitron. An oblivitron is someone who is oblivious to what is going on around them because they are engaging with a device. The following is an excerpt from a real day in the life of oblivitrons in present day Palo Alto. As I read the Palo Alto Daily, our local daily paper, I notice a small article about the teenage girl that was struck by a train while listening to music with earphones walking across a train track. At the Palo Alto Whole Foods grocery I see a mother talking to Siri and pushing buttons with one hand while absently pushing a stroller with the other as the baby looks up at her. In the next moment a driver zips through the white lines of a cross walk without seeing the older gentleman tottering into view because the driver is texting.

These daily life scenarios are possibly familiar to many of us by now. They represent but a few actual examples of our current daily interaction with gadgets happening across cities all over. Together they indicate an apparent absence of forethought on how humans might co-evolve with devices in every day life and society. Such obviously wrong scenarios will only increase and become more bizarre if we do not incorporate human sciences into technology. If we also consider co-discoveries of brain plasticity, gadget rub-off and the brain-immune loop there is a strong case for including explicit tools and training that are pro-human sciences in our software tool kits and primary vectors for positive and negative impacts of technology on our cells and our social relationships with each other and our environment.
technology courses and curricula. Presently few departments for human sciences exist. The brain, immune and other discoveries we describe will make clear why we need to do this not just for ourselves and our children but for the generations to come.

The remainder of the paper gives detailed discussion of the co-discoveries. The discussion centers on three things: robots and software agents, neuroplasticity and the brains of psychopathic killers and the Dalai Lama. The connection of these three concepts to our co-evolution with technology is neuroplasticity and the center of it is the design of the constant conversation developing between humans, our devices and each other.

Robots and Software Agents

Hybrid robot-human and robot-robot societies are approaching fast. Nordstrom Robotics has great plans for the introduction of vast numbers of robots into society in less than three years as evidenced by the project with Japan and Hungary. Fully automatic Google cars and drones are now being test driven between Berkeley and Mountain View, California. Software agents Siri and Watson are but a glimpse of what is coming down the pipe from IBM and other places. Cliff Nass and his team at Stanford have shown not only do we regard machines like people but that we then regard one another like our machines (Reeves and Nass 1996) (Nass and Moon 2000). The social mix of humans and robots, humans and software agents, or simply our devices and objects, takes this observation to a new level of play in the game because the way we treat one another adds up to the way we are as a society. Should our interaction with drones, google cars and software agents have compassion? These are issues we need to consider. We look to the field of neuroscience to see how these interactions can change our brains.

Neuroplasticity and Psychopathic Killers

Remarkable discoveries related to cognition in neuroscience have huge implications for the design of technology now in every day use. Centuries old questions that psychologists, philosophers and AI researchers could only debate in abstract terms can now be answered with real evidence from high density electrophysiology, functional magnetic resonance imaging (fMRI) structural MRI inducting diffusion tensor imaging (DTI), positron emission tomography (PET) and immune and endocrine measures. For instance, to Molyneux’s 300 year old question, “Is there a connection between touch and sight?” or more broadly, is there a common association of space among our senses, neuroscientists have provided us with “fossil records” – evidence based accounts that neurons in cortical regions devoted to one sensory modality in fact respond to two or more modalities (Falcier et al. 2002). The discovery of neuroplasticity means that no matter how old we become, repetitive exposure to objects, agents, thoughts and stimulants in our environment alters brain structure and function (Beagley 2007) (Davidson and Lutz 2007). If we repeatedly interact with places people or things that cultivate certain emotions, thoughts, attitudes and so forth, it increases those emotions and attitudes in ourselves and predisposes our brain structure and function towards those repetitive cues. Without an intent to create positive human experience involving empathy and positive relationships, we are repeatedly interacting with devices that are, for lack of a better word, psychopathic. According to the theory of neuroplasticity, with repeated interaction with psychopathic or indifferent devices, we are modifying our own minds and brains to lose that capacity and in effect are anesthetizing ourselves. Without this capacity for feeling and empathy, we ourselves risk increasing psychopathic tendencies.

To be clear about the importance of this aspect of device interaction and neuroplasticity, please consider the following MRI study involving the brains of convicted murders in a prison facility in Wisconsin (Motzkin et al. 2011). Researchers at the U. New Mexico created a portable MRI that was used to examine brains of convicted murders. In this study, MRI brain scans of convicted psychopathic murderers were compared to those of non-psychopathic murderers (those who have regret and guilt). The scans show marked differences in regions of the brain governing empathy and ability to feel (Motzkin et al. 2011).

Putting the two concepts of neuroplasticity and user interaction together, we immediately understand that the consequences of surrounding our human selves with objects, images or environments devoid of features that support and encourage positive mental capacities for feeling and empathy. In its absence, we will “enhance” ourselves towards that psychopathic brain. Less dramatically, it is simply the case that positive emotion has positive impact on our health (and vice versa).

The Dalai Lama

For a long time, the Dalai Lama has promoted the idea of compassion. Without it, he says, human kind will not survive. Although it may seem unscientific to hear such a statement, the value of ancient wisdom becomes scientifically validated when considering the following list of discoveries around human health and things like kindness, aggression, loving touch, happiness and so on.

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1 Human sciences is a collection of disciplines focused on common sense knowledge about being human.
The following is a partial of the growing body of relevant studies:

- Rate of wound healing is affected by domestic conflict/emotional happiness (DeVries et al. 2007).
- Lower cardiovascular reactivity is related to warm partner contact (Kiecolt-Glaser et al. 2008).
- Brain glucose metabolism is affected by psychosocial stressors (Kern et al. 2008).
- The creation of neural stem cells governing short term memory and the expression of genes regulating the stress response are positively affected by motherly affect (Meaney et al. 2001). Dr. Meaney’s work has received the Royal Order of Quebec, among many other awards and inspired the public health agencies in Canada to begin investigating more formally the role that motherly nurturing has on human health and the need to quash aggression in our families and trusted social circles.

This growing body of these discoveries relate to our interactions with one another, and the objects in our surroundings. It highlights how important our positive social interactions are for our selves, our fellow beings and for society as a whole. It affects not only our brains, our happiness, our health and ultimately our economy and social sustainability. It also changes our awareness of our environment. For a description on how to build a robot with compassion see (Masonb 2012) (Masone 2010).

**Summary and Discussion**

For reasons that may never be clear, emotions and affect were minimized or ignored in a variety of fields, most notably AI. It turns out affect is deeply intertwined with cognition, immune function, glucose metabolism and a host of other basic human functions. The fields of Artificial Intelligence and Intelligent User Interaction are definitely due for a radical revision in light of the multi-disciplinary collection of discoveries, but could this whole idea of creating machines with affect be a wrong turn? In John McCarthy’s story, “The Robot and the Baby,” a nanny saves a baby by staying calm but the mother panics (McCarthy 2003). The story successfully makes the point that it is not useful for all robots to have (all?) emotions. Disruptive emotions, negative emotions, also cause war, violence and hurt our families and society. Yet as the discoveries across many fields show the potential for positive technological influence on the state of human existence has huge potential. Together the interdisciplinary collection of discoveries provides a blueprint on how to move forward and maximize human potential.

There are three concepts that together can empower us: intentional positive design, neuroplasticity and technology. At this juncture, we have the choice how to design the objects in our world to be supportive of positive human traits. For example, we can create positive emotion in a web browsing experience using color, fonts, images, and content that is intentionally supportive of positive emotion and human sciences. These ideas have huge implications for design and our awareness of this connection could not come at a better time.

**References**


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