Return of the Man-Machine Interface: Fighting Disen-man-chisement with HCI

Duncan Rowland

University of Lincoln,

Brayford Pool

LN67TS, UK

drowland@lincoln.ac.uk

Conor Linehan

University of Lincoln,

Brayford Pool

LN67TS, UK

clinehan@lincoln.ac.uk

Maureen Schoonheyt

Hague University of Applied Sciences,

Johanna Westerdijkplein 75,

The Hague, Netherlands

maureenschoonheyt@hhs.nl

Abstract

This paper presents the design and evaluation of "the man-machine interface" a punchable interface designed to explore and criticize the values inherent in modern systems that favour one type of user (linguistically and technically gifted) and alienate another (physically gifted). In the study, participants used the device to express their opinions and then engaged in a group discussion about the implications of strength-based interactions. We conclude by drawing parallels between our own work and that of evolutionary biologists whose recent findings indicate the shape of the human hand is likely to have been partly evolved for the purpose of punching.

Author Keywords

Man-machine interface; punch interface; critical design; values-sensitive design.

ACM Classification Keywords

H.5.m. Information interfaces and presentation; H.5.2 User Interfaces *Haptic I/O and Prototyping.*

General Terms

Design, Human Factors, Theory.

Introduction

Since the first proto-human picked up a bone club to cave in the skull of his oppressor [1], tools have often been used by the physically weak to subjugate the strong (the physically superior having no need of such tools to control the inferior). Just as David slew Goliath through his covert use of technology, modern computer systems disempower honest strength in favour of (wordy) obscurantism[1]. Moreover, society now functions through mechanisms put in place by successive generations of bureaucrats whose chief skills are in the manipulation of symbolic information. Those best able to engage with these semiotic mechanisms will naturally flourish and be promoted to positions whereby they can strengthen the same system by which they were valued in the first place. A runaway process of natural selection has occurred with systems of governance becoming ever more bloated, and the majority of the populace ever more distant from the policy makers [2].

In general, a system develops to benefit those who develop the system [3], but digital computers have the capacity to deploy any number of systems and are not physically bound to any particular one, and have no physical requirement to benefit any particular group. So, the values designed into a system - either deliberately, or by default - do not necessarily need to conform to any present set of agreed upon social norms. Indeed, the fallacy of technological determinism is that society is solely a product of its enabling

technology [4], instead, technology can, and should, react against the status quo and provoke the development of new values and morals. As feminism has provided a lens on the gender inequalities in society, and the often tacit discrimination that occurs through the unquestioning implementation of systems within a specific set of norms [5]; we draw inspiration from these ideas to develop work which can benefit those currently disenfranchised by the disempowerment of strength.

Although inspired by a feminist approach, imbuing the system with non-traditional values to offset a perceived inequality, it should be noted that the system is not designed to be inherently sexist. Even so, there will be those who will maintain that such a system is sexist by default, however, it is arguably not any more sexist than a system based on language use (which, whether by nature or nurture, tradition has it has a strong sexual favour towards women [6,7,8]; for example, democratic political debate). The goal, rather, is to level the playing field by valuing physical strength in the decision making process. Those whom have been gifted with strength, but whom are unable to operate effectively in a world of words are currently left unvoiced in many decision-making procedures.

This paper presents a project designed to explore, criticise and provoke deeper thought about values inherent in modern interface design. Specifically, we propose that modern interface styles, such as touch screens, mimetic interfaces, and gesture recognition have become increasingly advantageous to gentle, dainty-fingered users, requiring fine motor control, excellent linguistic and multi-tasking skills. We are concerned that such interfaces do not best serve those

---

1 'Written words destroy memory and weaken the mind, relieving it of work that makes it strong… They are an inhuman thing.' (Socrates)

users whose strengths lie more in gross motor movements and physical prowess. Indeed, due to the increasing technological mediation of so many aspects of modern life, from work, to education, health care, play, socializing, and governance, we are concerned over the potential disenfranchisement of these more physically talented people by those in positions of control whose own skills relate chiefly to symbolic information processing.

Background

This project should be considered an instance of critical design; a theoretical approach to design that is intended to provoke deeper thought about the values inherent, but not necessarily obvious, in the design of products. Dunne and Raby [9], in introducing the concept of critical design, suggest that all design is ideological and that the design process is informed by values consistent with a specific worldview. Critical design "rejects how things are now as being the only possibility, it provides a critique of the prevailing situation through designs that embody social, cultural, technical and economic values." (p.58) It is, "a way of looking at design and imagining its possibilities beyond the narrow definitions of what is presented through media and in the shops".

Critical design has recently been discussed in HCI research as a means for exploring and criticizing the values inherent in the design of interactive technology [10,11]. Examples of critical HCI include the work of Linsay Grace [12], whose critical gameplay project aims to subvert the dominant assumptions in contemporary video game experiences.

This project should be understood as a feminist-inspired critique. Our goals in this work mirror those of feminism, in that we are critically examining the status quo of interface design in order to provoke deeper thought about inequalities in how advantageous that technology is to different groups of people, based on their physical or socially constructed characteristics. The use of the phrase man-machine interface is intended to be humorous, provocative and confrontational, in the true spirit of critical design.

The work reported here could also be considered as a form of 'values-sensitive design' [13,14], which is a theoretically grounded approach to design that takes account of human values as a specific part of the design process. The concept was introduced by Friedman to illustrate how human values, whether intentional or not, are inherent in the design process and the outputs of that process. Indeed, the role of human values in the design of technology has recently been discussed at length [15].

Strength-based interfaces

There are few existing interfaces to computer systems based on brute physicality [16,17] with the traditional 'Test Your Strength' funfair attraction being the most common exception. Interestingly, these devices provide an opportunity for males to publicly display physical prowess in the context of a vanishing landscape of opportunities for such sexual display. Even though practical reasons for such strength are increasingly rare, exaggerated muscle mass is still seen as desirable, though now more likely grown for show, e.g. the 'ripped six-pack' or 'arm guns' commonly on display in a nightclubs).

Measuring Strength of Feeling

The man-machine interface provides a novel means for people to express not only their opinions and feelings, but also the strength of those opinions and feelings. The measurement of how strongly people feel (often referred to as valence and arousal measurements) towards a product, service, experience, or concept has a long history where many different approaches have been investigated [18]. The most commonly used measurement technique is the Likert scale type of questionnaire that allows for an expression of opinion or feelings verbally on a scale between "strongly disagree" and "strongly agree." The man machine interface is presented as an alternative to this linguistic form of measurement.

Design

Conceptual design
The design of the system highlights the inherent inequalities in existing methods of feedback and decision making. The system deliberately allows individuals able to punch more strongly to have a greater impact on the results. This is in contrast to traditional systems of voting in which each individual's vote is valued the same; however, the ability engage in verbal debate is not equitable and the feelings of the rhetorically weak are left underrepresented. The interface is designed to facilitate public display of physical prowess (with some targets able to be punched powerfully merely for show). This contrasts with the 'secret-ballot' in which individuals are forced to cloak their representations in the plebiscite veil of the voting booth.

Technology
The system has been adapted from a standard martial arts training aid (a Body Opponent Bag, or BOB). The device selected was the MATT (the Mixed Martial Arts Target Trainer[2]) and this was chosen as it was advertised as being the only home based fitness product capable of simulating the feeling "punching a man's head" (although there are now more products offering this feature of debatable benefit).

Three of the four targets were used (the left and right 'hands' and the 'head'), with the central ('body') target being replaced with a flat screen monitor to provide instruction and feedback to the participants.

USB (Singstar[tm]) microphones were loosely embedded on the back of each target and these were connected to a Raspberry Pi computer for processing.
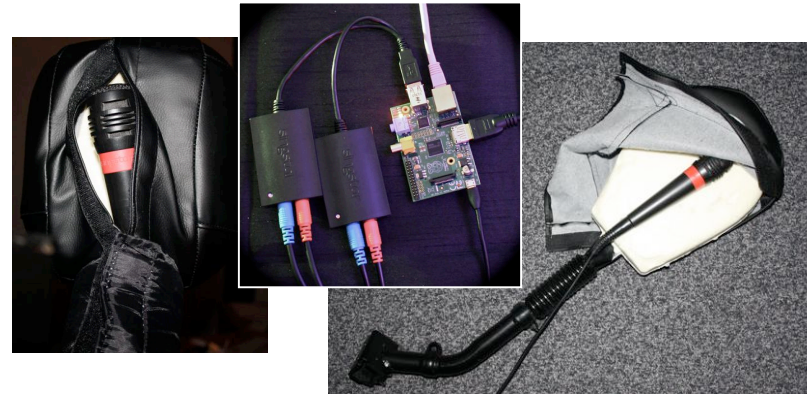

Figure 1: Main System Components (USB Mics and Pi).

[2] http://www.bayls.co.uk/products/fitness/mmatt-mixed-martial-arts-target-trainer/

Figure 2: User's View of the Punchable Interface

The Raspberry Pi ran a standard Raspbian version of the Linux operating system. A Python script was developed to detect punches (via the RMS of the microphone responses). Punches were recorded to a text file (with volume deemed to approximate the strength of each punch) and used to trigger sound effects (via an external USB speaker) and to start and pause a full screen HD video rendering of a cute character reading the following instructions.

Instruction Script

"[camera][pause][smile]Hi! Welcome to Lincoln University's experimental student feedback system. To begin, please enter your ID. [pause]Thanks. Please stand in front of the device and only hit the targets when asked to. OK! Question One. Do you consider this to have been a good module? Please [point]hit either [point]the: "yes" or "no" target now. [pause]Next please indicate the strength of your feelings[punch] about this by punching the central head target now. [smile][pause]Thanks. Question Two. Do you think that punching things [punch]is a good way to express your feelings? Please hit the appropriate yes or no target now. [pause]OK! Please indicate the strength [punch]of your feelings about this by punching the head.[smile][pause] Thankyou and have a nice day. [smile][pause]"

[pause] - Pause and await punch/input

[smile] - Joy facial expression (Smile)

[point] - Character points to left or right target

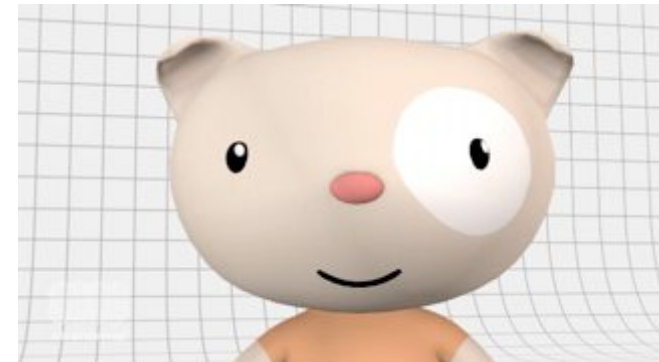[punch] - Character punches towards the central target

Figure 3: Interface Character © xtranormal.com 2012

Evaluation
Thirty potential participants - the entire (all male) undergraduate game design class - were asked at the end of the semester's final practical session if they would consider participating in a study relating to

interface design. Nine participants, aged 20-23, were recruited and were fully informed as to the purpose of the study and what was required from them. All those who volunteered initially gave written consent to participate and were then asked to fill in a paper-based module evaluation form. This form allows students to anonymously express opinions regarding the quality of that module and is a task routinely undertaken at the end of each module studied. Next, participants were asked to use the interface one at a time, following the instructions outlined above. Afterwards, two focus groups were conducted in a semi-structured manner, led by the authors. Discussion initially focused on the subjective experience of users engaging with the device, before exploring the concept of expressing "strength of feeling" through "physical strength" and the effects that such a means of expression may have on users, and use, of technology.

Results and Discussion

Before reporting the results of focus group discussions, it is important, due to the narrative of the paper, to acknowledge the particular characteristics of the participant sample from which data was gathered. All participants were young males. We may expect such a group to engage readily with competitive activities and opportunities to display physical prowess. Thus, we may find their responses more positive and enthusiastic than other groups that we could have sampled. However, participants are also third- and fourth-year computer science students. As such, they are people who have already benefitted from the shift in cultural values away from physical and towards linguistic and technological skills, and may expect to continue to do so in future. Due to these potentially conflicting

opinions, we believe that they are a particularly interesting group with which to discuss the concept of strength-based interfaces.

Two separate focus groups were convened to discuss the man-machine interface. Group one consisted of five participants and group two consisted of four. Both sessions were audio recorded and those recordings were transcribed for analysis. Group one's discussion lasted for approximately one hour, group two's lasted for 30 minutes.

Thematic Analysis
A thematic analysis was conducted on the data recorded from focus groups. Both transcripts were initially read closely by one researcher, who defined a set of eighteen codes. Two researchers then independently applied this coding scheme to the transcripts, before meeting to discuss the fit of the codes to the data. It was agreed that fourteen separate codes were necessary to explain the data gathered. These were collapsed into five overarching themes; *expressing strength of feeling via punching, performance, unfairness, politics* and *punching as an interaction technique*. Participants also demonstrated great interest in the novelty of the experience, but this was not deemed sufficiently interesting to discuss below. In addition, we have chosen to omit analysis of the discussion of politics due to space constraints, as there was a huge amount of discussion on this topic.

EXPRESSING STRENGTH OF FEELING THROUGH PUNCHING
Quite a lot of discussion focused on the opportunity that the device offered people to express the strength of their opinions or feelings via their physical strength.

This was seen as novel, and participants expressed both positive and negative reactions to the concept.

Positive

As described in the background section, this project proposes that expressing opinions and feelings via gross physical strength is an activity that may appeal to some people, and for those people may represent a valid means of expression. Participants largely agreed with this concept; *"there's definitely some sort of emotional attachment to something that you punch," "there was a lot of emotion behind the punch, so depending on like if you're really strongly for something, and then you punch definitely more power [...] behind it than if you're not for it," "If you're angry, you might try and use more force that you [...] normally would."* Indeed, one participant bemoaned the lack of existing opportunities to express them self physically; *"I wouldn't like physically hit a person, but if like I was given the action [...] I'd sort of punch something to show how strong I'd feel about something. That was pretty interesting," "Having that ability to express how strongly you feel about something is a good way of showing how you're thinking and feeling."*

Negative

Participants also expressed some reservations and concerns. Interestingly, most of these focused around the expectations placed on people by a culture that disapproves of aggression; *"Um, I just thought it was just a bit weird. Like, um, like, as a kid, you was taught not to hit anyone or anything. And like constantly, you're getting told that" "It was like, uh, going against the grain of what I would imagine what most people were told growing up. Like: "Show your emotions by hitting something" isn't usually our primal guidance sort of thing," "You could say having young kids punching something could send the wrong message as well as a moral thing, that it's okay to punch things to express yourselves, which isn't really what people go for nowadays?"* Two participants were very negative towards the concept; *"No, I don't like answering with punches," "I haven't really got really like a motivation to hit things. So it's like I'd rather just sulk, or something."*

PERFORMANCE

As the session wherein participants interacted with the device took place in public, and classmates were allowed to watch if they wished, there was an element of performance to the behaviour of participants. Participants discussed how they were very conscious of being watched while punching the device; *"It was a little bit weird getting in front of everybody while they was looking at you, punching something,"* and how being watched affected their subjective experience and their actions; *"I mean, you don't want to like, hit really slightly if everyone else is like, smacking it," "you don't want to be like the worst person," "How am I supposed to react to this properly … ?… in a way that won't make me look like an idiot," "You didn't want it to look like we were weak."* These comments are fascinating in the context of this paper as they underline the disruptive influence of the device. Specifically, this group of people rarely if ever interact with each other in a way that values physical strength. Rather, being an undergraduate computer science cohort, the social hierarchy of most influential or valued members of that group is determined more by their technical skills. The device provided a disruptive influence on the established pecking order and provided the opportunity for physicality-based sexual display.

Unfairness of the interface
Most participants expressed some concerns over "unfairness" inherent in a device that uses physical strength as an input technique. These concerns came in two forms; the first addressed reliability of measurement across individuals, the second focused on the potentially discriminatory effects of this type of input mechanism on those people who use it.

Reliability
The majority of participants expressed concerns over the reliability of measurements taken by the interface; *"each person is built differently, skill wise. One person might be able to, uh, strongly agree more than another," "Yeah, because if it was: "How strongly do you feel about this?" You circle "Seven" and someone else circles "Seven." If they both punch it […..] thinking about "Seven" […] the forces will be different," "The body type of everybody is completely different," "It's completely inaccurate."* These comments are interesting, since the interface was designed intentionally to advantage stronger people. Participants identified this inequality, but it did not provoke them, as intended, to think more critically about similar inequalities inherent in other types of input device.

Some participants pointed out problems with reliability of measurement by identifying factors that could affect the strength of punch recorded, but which are not related to strength of emotion or opinion. These include punching technique, *"a lot of people would do like a typical movie punch and just swing from the side, […] where as I do […] a straight sort of punch, which generally get's more power. So, […] I think from that I might feel strongly about something more so than someone else,"* or confidence, *"Not even the physical*

size, just like more confident in yourself. You get up and don't care if those people watch you, then you're going to do what you're going to do," "if you get people that aren't confident standing in front of other people, […] even if they are very strong, they're still going to be really, really reserved."

Participants also suggested means for remedying the unreliability of the interface. Specifically, they suggested taking baseline readings for every user, "*You'd have to look at baseline*," "*You have like a frame of reference. Everyone's working then on the same kind of relevant level*," "*Unless, of course, like, the second part was like I saw, a mini-baseline hits, because people are bound to hit either "Yes," and punch it really hard*," "*Or hit "X" amount of between zero and ten times.*" Indeed, the researchers had to repeatedly steer discussion away from baselines and how they could be implemented. This insistence on fairness across participants is very interesting.

Discrimination
Participants were asked to consider a situation where decisions would be made, whether at university, in national elections, or in government, based on the data gathered from a strength-based interface. They were asked to consider the consequences that this would have on the people that those decisions affected. Participants almost unanimously expressed outrage and sympathy on the part of less physically gifted people. *"It would put everybody else completely out. Everyone that's above a certain age that can't punch as hard as you is then completely cast aside," "You could ostracize everyone apart from a small portion of people," "If you're, for example, an elderly person, you might not be able to hit it as hard," "being rather short myself, it*

was … I had to kind of reach a bit further than I would have really liked to." Again, while participants identified and discussed the inherent discrimination in the punch interface system, there was little evidence of further thought around existing inequalities perpetuated by other types of systems, whether technological, political or social.

Punching as an interaction technique
Participants were prompted to discuss whether a punch-based interface would be interesting or useful as a means of controlling computing devices more generally. All participants expressed some interest in this concept, particularly in relation to the frustration commonly experienced by users of interactive technology. *"I mean everyone wants to punch on the computer sometime when it freezes over." "it would de-stress people. Because if they're getting real stressed at it, […] maybe if they hit a couple of hits that's it. And then, like a pretty picture of a dog just comes up and just goes, "Relax." "It's a stress reducing program. Basically, you're taking out on the system."* There were also suggestions for what types of functions the punch interface might be most suitable for controlling, the most common of which was to force quit programs that had crashed. However, there were also other suggestions, *"A super like on facebook," "It will fake smash the window, the desktop. If it's basically not working, you can beat the crap out of something until your like really, really relaxed again, and then you start to see more clear with it," "It's going to have to have just one outcome when you punch it in per program," "to open up a set program, you can assign it a set program like if you're on Skype, someone is following you, you could just punch something over ten, it would either turn on or turn off," "Definitely off."*

Conclusions

It is apparent that today's systems of symbolic manipulation have allowed a disconnect to develop between work and value, allowing the subjugation of the most physically able. Staggering sums of money (c.f. effort) can be manipulated by a few effortless clicks or the dismissive swipe over a tablet's surface.

Evolutionary biologist Prof David Carrier describes work with interesting parallels in a recent interview on whether fighting (use of the hand as a fist) has markedly shaped the hand's evolution [19,20].

"I think there is a lot of resistance, maybe more so among academics than people in general - resistance to the idea that, at some level humans are by nature aggressive animals. I actually think that attitude, and the people who have tried to make the case that we don't have a nature - those people have not served us well.

"I think we would be better off if we faced the reality that we have these strong emotions and sometimes they prime us to behave in violent ways. I think if we acknowledged that we'd be better able to prevent violence in future."

Relating this back to interaction design and the findings reported in this paper, it is clear that expression of physical force is a natural aspect of human behaviour and may provide a potentially valuable input mechanic (tapping into emotions and providing an outlet for pent up aggression). Though there are clear indications that social conditioning demonises these natural tendencies, we hope in the future to discern circumstances where they could become the preferred method of data entry.

References

[1] Kubrick, S. and Clarke, A. C., "2001: A Space Odyssey" (Screenplay), (1968)

[2] Garry, P., "The meaning of big government". Renew America. Retrieved 7 Jan 2013, http://www.renewamerica.com/analysis/garry/110614 (2011)

[3] Wallerstein, I., "The Capitalist World-Economy". Cambridge: Cambridge University Press., (1979)

[4] Levy, Steven, "Hackers: Heros of the Computer Revolution", Penguin, ISBN-13: 978-0141000510 (2002)

[5] Hooks, B., "Feminist Theory: From Margin to Center", Eds.2, Pluto Press, 2000

[6] Harrington G. S. and Farias S. T., "Sex differences in language processing: functional MRI methodological considerations", J Magn Reson Imaging. Jun;27(6):1221-8. doi: 10.1002/jmri.21374. (2008)

[7] Fine, C. "Delusions of Gender: How Our Minds, Society, and Neurosexism Create Difference" (1st ed.). W. W. Norton & Company. ISBN 978-0-393-06838-2, (2010)

[8] Jordan-Young, R., "Brain Storm: The Flaws in the Science of Sex Differences", Harvard University Press. ISBN 978-0-674-05730-2. (2010)

[9] Dunne, A. and Raby, F., " Design Noir: The secret life of electronic objects". Berlin: Berkhauser, (2001)

[10] Bardzell, J., "Interaction Criticism and Aesthetics", In Proceedings of ACM CHI, 2357-2366, (2009)

[11] Blythe, M.A. The digital music box: using cultural and critical theory to inform design. In Proceedings of ACM CHI Extended Abstracts, 2297-2302, (2007)

[12] Grace, L., "Creating Critical Gameplay Design". In Proceedings of ACE (2010)

[13] Cockton, G., "A development framework for value-centred design". In CHI '05 Extended Abstracts on Human Factors in Computing Systems (CHI EA '05). ACM, New York, NY, USA, 1292-1295. (2005)

[14] Friedman, B. "Value-sensitive design". Interactions 3, 6, 16-23, (1996)

[15] Sellen, A., Rogers, Y., Harper, R., and Rodden, T., "Reflecting human values in the digital age". Commun. ACM 52, 3, 58-66, (2009)

[16] Gross, S and Boess, S, "Love Hate Punch", Retrieved 7 Jan 2013, http://v2.nl/archive/works/love-hate-punch, (2010)

[17] Nexersys, Retrieved 7 Jan 2013, http://nexersys.com/ (2012)

[18] Hazlett, R. L., "Measuring emotional valence during interactive experiences: boys at video game play", In Proceedings of ACM CHI (2006), 1023-1026.

[19] BBC News, "Fighting may have shaped evolution of human hand", Retrieved 7 Jan 2013, "http://www.bbc.co.uk/news/science-environment-20790294, Dec. (2012)

[20] Morgan, M. H. and Carrier, D. R., "Protective buttressing of the human fist and the evolution of hominin hands", doi: 10.1242/jeb.075713, J Exp Biol 216, 236-244, January 15 (2013)