De-computing the Pigeon Sensorium

John Fass
Royal College of Art
Kensington Gore
London SW7 2EU
john.fass@network.rca.ac.uk

Kevin Walker
Royal College of Art
Kensington Gore
London SW7 2EU
kevin.walker@rca.ac.uk

ACM 978-1-4503-4758-7/16/11.
http://dx.doi.org/10.1145/2995257.3012022

Abstract
This paper positions experimental design practice as a way of exploring the creative possibilities of animal-computer interaction (ACI), specifically using the 'de-computation' methodology we have developed. Taking the senses of pigeons as an example of non-human awareness, we draw on existing strategies of experience design and immersive design to illuminate various aspects of how animals see, touch, hear, and move in their interactions with humans. Through an initial design project focusing on urban pigeons, we suggest that open-ended experimentation generates unexpected opportunities for the development of ACI interfaces and systems.

Author Keywords
Animal computer interaction; design methods; decomputation; pigeon senses, experimental design.

ACM Classification Keywords
H.5.m. Information interfaces and presentation, J.3 Life and Medical Sciences, J.5 Arts and Humanities.

Introduction
Using design as an open-ended method of generating creative outcomes means considering what designers do and what processes are productive of new ideas. Cross [4] calls this a ‘designerly’ way of knowing things, making things, thinking about problems, and developing new design outputs. He proposes that

Previous De-computation projects

Figure 1. Echoing sound object (2016).
By Rose Leahy, Amanda Olesen, and Jolien van Schagen.

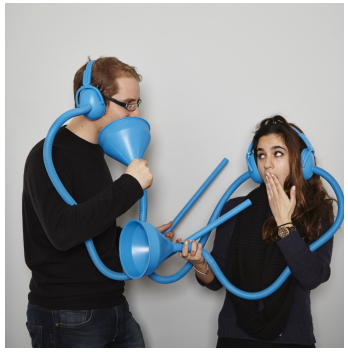

Figure 2. 'Ear-dar' (2015) a low-tech private communication system for noisy places.
By Alistar Magrini, Toni Sokura, Keren Hu, and Yasmeen Sabri,

Further examples at decomputation.rca.ac.uk

design process and *design products* are the twin strands of designerly knowing. Design processes, according to Cross, involve an act of conscious conjecture. As opposed to science, which he considers analytic, design is constructive—designers make connections 'between domains which are unlike each other,' in this case, between the domains of animal computer interaction (ACI) and sensory-driven experience design. Turning to design products, they are naturally the outcome of design processes. Cross maintains that objects 'are a form of knowledge about how to satisfy certain requirements' and 'how to perform certain tasks.' One important effect of the attention designers pay to objects (digital or physical) is that design activity involves being what Cross calls being 'immersed in material culture'. Objects are made of materials, and designers manipulate materials into various configurations. In Cross' analysis, designers are also fluent in the language of their respective media, 'and draw upon it as the primary source of their thinking.' The methodology we use to structure design processes and guide our use of materials is called De-Computation.

De-Computation

In the Information Experience Design (IED) programme at the Royal College of Art (RCA), we have developed an approach we call 'de-computation' to help designers understand the ways computers and algorithms shape behaviour and influence our understanding of the world. We propose that de-computation can help in the process of humanising technology, harnessing its speed and capacity for social and creative benefit, and showing ways of resisting its inexorable logic. De-computation poses an alternative to 'design thinking' by providing a framework for two-way exchange between design and technology for example through sensory experiences (Figure 1) and augmented human perception (Figure 2). More specifically, de-computation combines design making with computational thinking, thereby integrating digital data and technology with analog materials and processes in a systematic, structured way. It thus acts as a means for designers to approach technology, and conversely to view design through a computational lens. Designers, researchers and technologists may each recognise some of the processes we describe, and our aim is to synthesise these into a cohesive methodology for both research and practice. De-computation involves some steps familiar from computational thinking which we apply to design including; deconstruction, pattern recognition, abstraction and construction. The de-computation methodology is described in greater detail in [19].

Experience design

Dewey [6] suggests that having *an* experience is different from experiencing things in general. An experience is 'integrated within and demarcated in the general stream of experience from other experiences… it has its own individualising quality and self sufficiency'. Experience design then involves integrating multiple elements and materials into a coherent gestalt, deliberately structuring design outcomes into the form of experiences. Coxon [3] emphasises the importance of embodiment in experience design, saying, 'embodied experience might be applied as a research tool' by allowing the primacy of personal experience to shape an understating of the world. Designing for embodied experience also involves what Svabo and Shanks [16] call 'beyond cognitivism'. They use this phrase to describe an approach to design that focuses on thinking, sensing and feeling: 'thinking of the user-

The Pigeon Sensorium

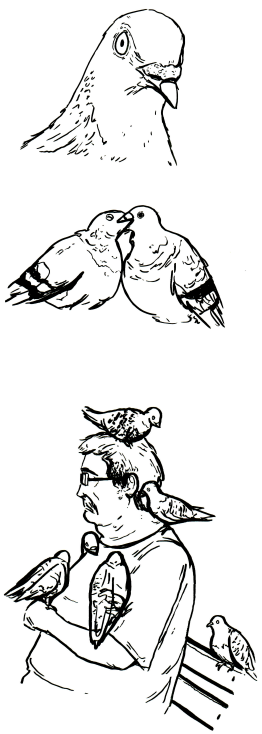

Figure 3. Pigeon communication, movement, intelligence, interaction with the human world.
Illustrations by RCA IED MA student Olivia Sullivan.

product relationship also as an emotional relationship'. We suggest that experiencing the world through the senses and physical abilities of, in this instance, pigeons, and by thereby designing experiences that place people inside the pigeon sensorium, will produce of ideas and concepts useful for ACI specifically, and HCI more broadly.

Animal experience design

In the world of creative design, Harrison [9] has illustrated animal senses, and Ebidzuka's Animal Masks [7] place the viewer inside the senses of various different animals. Design agency Marshmallow Laser Feast's Virtual Reality project [17] allows users to see through the eyes of the animal inhabitants of a forest. Woebken and Okada's Animal Superpowers [5] explores animal senses in a more embodied and performative way. We draw on these previous examples of experience design to inform our work.

The pigeon sensorium

Pigeons have a long history as noble birds, dating back to Roman times [10]. They are taxonomically identical to doves in the family *Columbidae*, collectively with over 300 species, yet are regarded as polar opposites: doves are associated with purity and religious deities, while pigeons have come to be regarded as disease-ridden urban pests. This perception is not unfounded, as urban pigeons do indeed commonly suffer from maladies affecting their vision, locomotion and immunity; however, in all cases these are the result of their integration into the human world [10], as pigeons have been domesticated into human society to the point of overpopulation. From bearers of vital messages during wartime to favourites of breeders for racing and show, pigeons are now commonly regarded as 'rats with wings' and elaborate interventions are designed to keep them away from places and people worldwide.

Pigeons have been the object of numerous studies, not least for their extraordinary visual abilities. Bowmaker, *et al* [2] demonstrate the unusual spectral range of pigeons and conclude that pigeons see many more colours, including well into the UV spectrum, than most other birds and all mammals. Pigeons also have exceptional navigational abilities. It was thought that this was due to magnetoreception, but recent research [8] suggests that pigeons construct an olfactory map of their surroundings. Pigeons share our ability to place everyday things in categories [20] and can recognise human faces and expressions [14]. As far as pigeon-computer interaction is concerned, pigeons have been shown to distinguish between complex on-screen patterns [12]. Waitzman [18] demonstrated the Carrier Pigeon Internet Protocol (CPIP). In this creative experiment, packets of network data were printed on paper then attached to pigeons' legs. Upon their arrival at a destination, the data was transferred to the computer using optical character recognition (OCR) software [13]. Other ACI applications relating to pigeons are few.

Therefore our de-computation project will engage with the pigeon sensorium as it relates to human interactions. We will design objects and installations, which will be documented through video, to illustrate key aspects of pigeon-human interactions as well as the application of the de-computation methodology to addressing ACI-related questions. The resulting work may involve a combination of (non-invasive) pigeon instrumentation, pigeon emulation, and other forms of human-pigeon interactions.

References

1. Bhatt, R. S., Wasserman, E. A., Reynolds, W. F. and Knauss, K. S. Conceptual behavior in pigeons: Categorization of both familiar and novel examples from four classes of natural and artificial stimuli, *Journal of Experimental Psychology: Animal Behavior Processes*, 14(3) (Jul 1988), 219-234. http://dx.doi.org/10.1037/0097-7403.14.3.219
2. Bowmaker, J. K., Heath, L.A., Wilkie, S. E. and Hunt, D. M. Visual pigments and oil droplets from six classes of photoreceptor in the retinas of birds, *Vision Research* 37(16) (Aug 1997), 2183–2194.
3. Coxon, G. Fundamental Aspects of Human Experience: A Phemono(logical) Explanation, in *Experience Design*, Ed, Benz and P. Bloomsbury, 2015.
4. Cross, N. *Designerly Ways of Knowing*. Springer, 2006.
5. Debatty, R. Animal Superpowers, 26 Feb 2008. http://tinyurl.com/zfwddnp (Accessed 18/09/16)
6. Dewey, J. *Art as Experience*. Penguin, 2005
7. Ebidzuka, K. Animal Masks, 2015. http://tinyurl.com/gu4clrt
8. Gagliardo, A., Pollonara, E. and Wikelski, M. Pigeon navigation: exposure to environmental odours prior release is sufficient for homeward orientation, but not for homing, *Journal of Experimental Biology* 2016: doi:10.1242/jeb.140889
9. Harrison, E. *Animal Senses*. Victory Press, 2015.
10. Johnson, N. *Unseen City*. Rodale Books, 2016.
11. Lenskjold, T.U. Design interventions and "alien ethnographies": Experimenting with speculative prototypes as prompts for relations beyond the human. *Interventionist Speculation*, Aug 14-15, 2014, Copenhagen, The Research Network for Design Anthropology.
12. Nakagawa, K., Kobayashi, H. and Sezaki, K. Carrier pigeon-like sensing system: animal-computer interface design for opportunistic data exchange interaction for a wildlife monitoring application. In *Proceedings of the 5th Augmented Human International Conference* (AH 2014). ACM, New York, NY, USA, Article 27. DOI=http://dx.doi.org/10.1145/2582051.2582078
13. Shankland, S. Pigeon-powered Internet takes flight, *CNet News*, 3 Jan 2002. http://tinyurl.com/z2md3ls (Accessed 16/09/2016)
14. Soto, F. A. and Wasserman, E. A. Asymmetrical interactions in the perception of face identity and emotional expression are not unique to the primate visual system. *Journal of Vision* 11(3) (2011) DOI: 10.1167/11.3.24
15. Steel, B, McNicholas, R. In The Eyes of The Animals, 2015. http://tinyurl.com/p7hp9th (Accessed 18/09/16)
16. Svabo, C. and Shanks, M. Experience as Excursion: A Note Towards a Metaphysics of Design Thinking, in *Experience Design* Ed, Benz P. Bloomsbury, 2015.
17. Tucker, E. Virtual reality helmets present a forest from an animal's perspective. Dezeen 2 Nov 2015. http://tinyurl.com/hn6jceg
18. Waitzman, D., A Standard for the Transmission of IP Datagrams on Avian Carriers, *RFC 1149*, 1 April 1990.
19. Walker, K. and Fass, J. (2015) De-Computation: Programming the world through design. *NORDES*, June 2015, Stockholm, SE.
20. Wasserman, E.A., Nagasaka, Y., Castro, L. et al. Pigeons learn virtual patterned-string problems in a computerized touch screen environment *Anim Cogn* 16:737 (2013). doi10.1007s10071-013-0608-0