Transduction as a paradigm for a re-integration of human technology into culture.

Catherine Letondal
ENAC, Interactive Computing Laboratory
7, av Edouard Belin, Toulouse, France
catherine.letondal@enac.fr

ABSTRACT

This position paper presents the search for a philosophical approach to Human-Computer Interaction based on the hypothesis of a strong genetic relationship between humans and interactive systems, taking into account the origin of technology, and based on an account of interaction and design through the concept of transduction.

*Produces the permission block, and copyright information. See the specific order to use the table cells to include the authors in the order you want yourself and your co-authors to be listed. Use footnotes sparingly, avoid using them. There is a **white text** number 1 after the ABSTRACT heading to maintain this ACM copyright block space.

CHI'19 Extended Abstracts, May 4-9, 2019, Glasgow, Scotland, UK.

ACM ISBN 978-1-4503-5971-9/19/05.
DOI: https://doi.org/10.1145/3290607.XXXXXXX

KEYWORDS

Human-Computer Interaction ; Philosophy of technology

INTRODUCTION

This position paper presents the search for a philosophical approach to Human-Computer Interaction based on the hypothesis of a strong "genetic" relationship between humans and systems, taking into account the origin of technology, and thus potentially going beyond the principle of a co-evolution in socio-technical designs.

A known example of this strong relationship may be found in the relationship between gesture and technique. The relationship between gestures and technique has been the subject of important work, particularly in anthropology. Indeed, following the example of Leroi-Gourhan [14], we can analyse the technical gesture as first resulting from the evolution of interactions between gesture and speech, where hand-tool and facial organs-language pairs began with an equal commitment to the construction of communication symbols, but where the role of the hand was gradually transferred from manipulation to the simple trigger or even to a pure symbolic signal [14], resulting in a simple control gesture, as depicted by Jean Baudrillard in his book on the system of objects [1]. Karam et al [13] thus notes the predominance of gestures of a semiotic style in the literature, whereas relatively few human gestural interactions are of this type. In an article on the "desire for the tangible", sociologist Dubey [9] analyses this general development of the natural and physical in current interaction techniques such as the search for a presence, a proximity to the virtual, but where gestures remain gestures of control, even improved, of a system that has already decided everything in advance. In reality, the "gesture" seems to have moved, since this story has led to a progressive transfer of the gesture out of the body, first in the tool, then in the machine, and, as Simondon, a philosopher of technology, puts it: "The machine is a human gesture deposited, fixed, become stereotypical and power to start over" [19],[20]. This story leads today to a strange situation where it is nevertheless something physical that comes back with the digital gesture, sometimes even in a rather complex way, but according to operating modalities that no longer have anything to do with the initial interaction between gesture and symbol, since the real technical gesture and the symbolic components are actually transferred into the machine. Thus, whereas the gesture/symbol articulation, which has always participated in technical development, could be understood with Leroi-Gourhan as the open implementation of operating chains leaving room for confrontation and indeterminacy, this articulation is now more or less a choice of possibilities of "semaphore pantomimes" not available to the user, but anticipated in a machine.

Taking into account this anthropological observation of a strong relationship between human and technology questions the account of technology as produced by humans and resulting in technology becoming beyond human control. In this perspective, technology is recognized above all as human, and even more precisely, as defining the essence of beings producing it (i.e. humans or any other being capable of prosthetic extension). This implies at least a non-dualistic attitude towards technology, i.e. neither technophilic nor technophobic. In this stance, it is not the human dimension

that must be re-incorporated into the technique, but the technique that must be re-incorporated into the humanities [19]. In HCI, indeed, the human dimension, the development of meaning - what we can call "culture" - has often more or less been built through a struggle to repair a purely technical approach. This is for instance the position of ergonomics, which aims to improve the adaptation of technology to humans, "through the interface". We propose to discuss whether rediscovering the human dimension of technology itself could provide another fruitful direction, using a phenomeno-technical approach. This approach consists in particular in understanding interaction and interactive digital objects within a framework analyzing the mode of existence of technical objects [19], where we aim to investigate human-machine interaction as a set of phenomena at various scales, producing various types of individuations [21], from simple coupling to design.

RELATED WORK

Several work investigates the concept of interaction taking a philosophical approach. Hornbaek & Oulasvirta [12] propose an effort to gather a consensual definition of interaction from the academic literature by looking for dimensioning questions: from a list of views on the definition of interaction (dialogue, transmission of information, tool use, optimal behavior, embodiment, experience, control), they identified some key phenomena associated with each of the views, but also to identify the associated values (quality of interaction and what it would correspond to in terms of design and evaluation). Magnaudet & Chatty [16] recall a number of criticisms that have been addressed to the computational paradigm from several disciplines to highlight its limitations and the need for its replacement by a new characterization of the science of the HCI based on an epistemology of interaction and illustrated through a new structuring framework based on a process-oriented ontology. Next, the artifactual paradigm strongly structures the ecological approach to interactions between humans and objects, a modeling that is becoming increasingly necessary to understand and explore the multi-dimensional phenomena that we face as designers with the advent of tangible or organic interaction or ubiquitous computing - phenomena for which virtual/physical duality is no longer sufficient to account for the reality being built [5][22]. This problem is also articulated in a fairly natural way with approaches to activity theory that propose structures that account for interactions between humans and artifacts [5][18].

TRANSDUCTION

What we suggest in this position paper, is first that the concept of *individuation* as developed in Simondon theory [19][20][21] may provide a sound account of design activity [[10] as a never ending process built on the principle of production always leaving a "pre-individual" left-over, itself making possible future individuations. This account provides a basis to address the issue raised

above of a human-technology strong genetic relationship, based on ontological processes giving rise to the production of technical objects as a mediation with the world either in a prosthetic way [[19]]. Next, individuation occurs in Simondon's ontology through *transduction*: this term names the process that occurs as an entity individuates and precipitates in a field of relations and potentials. In this view, transduction refers to the shaping operation explaining the genesis of the individual, and as such, it describes interactions in physics, biology, psychology and sociology. As argued by MacKenzie [17], it is a process whereby a disparity or difference is topologically and temporally restructured across some interface. For a process of transduction to occur, there must be some disparity, discontinuity, or mismatch within a domain. "Hence transduction designates both a process that lies at the heart of technicity and a mode of thought adapted to thinking how collectives are involved, as Deleuze puts it, 'in the establishing of communication between disparates' [7]". What we suggest is that the concept of transduction makes it possible to think interaction and design together as two modalities of individuation, that differ essentially in e.g. intensity, situation, phase of life, level of necessity or speed.

As a first modality, Simondon describes the techno-esthetic relationship as an original and transductive relationship between the human and the world, as not only a strong link between human and technique, but also conveying the idea of a "continuous spectrum" that links technique and aesthetics, the operative and the sensitive. This principle is reminiscent of Gibson's concept of affordances [10] since it is a primary dynamic relationship of orientation between human and environment strongly associated with both an environmental capacity and a human capacity, even if Simondon favoured the notion of *milieu* over that of environment. In an article analyzing Simondon's theory of information as borrowing both from cybernetics and ecology with the idea of information either as redundancy or as resonance, Auray indeed compares information in Simondon to Gibson's information as a "tuning": "In this approach, information thus has as its content a tuning operation or, in Gibson's words, of unison" [1]. This is not the cybernetic idea of the human-machine from which Simondon is very far away, and which he strongly criticized, but an idea of modes of functioning originally common between psycho-physiological schemes and schemes of functioning of technical objects. A known manifestation can be found in the phenomenon of pregnation [22], not related to an inductive or conceptual knowledge, and manifested for example in the child's play: "The young child, in the pregnation situation, does not see and hear only an automobile: he is a car or truck, he makes himself the noise of the engine, and by participation, he is the engine".

Another modality of transduction can be found in the design and innovation process. The innovative design of interactive systems is indeed unique, given the co-emerging nature of the needs and functions to be designed, in that it involves a number of iterations during which it is through the use of progressive drafts of the system, and their context with users, that specifications can be obtained. The cyclical "task/artifact" model highlighted by [7] expresses this duality between what could be called two levels of specifications: the more or less formal one of the task model and the one of the software artifact that implicitly contains the specifications, and provides another level of formalization. The potential specification role of usage instances explains the pivotal role of the scenario in the design of interactive systems, scenarios whose function (observation scenario, design scenario, etc.) and format (free text, formatted text, storyboard, video, etc.) allow both contextualization, variations, contradictions, tensions, normalizations, etc. [1] of problems and design solutions, through processes where complex causalities are at work. Hence, according to Hatchuel [11], the need for a "language that allows technical criticism through models and general schemes that allow a reflective relationship to objects", and that consists in considering technical objects as "objects of the mind". Beaubois describes the transductive dimension of images and schemes at work during design: "Imagination is transductive in so far as it is first of all a "particular sensitivity": it is from things, or rather from the "regimes" of operations carried out by things, that imagination takes shape." He emphasizes their operational dimension: "It is neither a simple intellectual knowledge, nor a sensitive knowledge, nor a practical knowledge, but all three at the same time. To know a technical scheme consists in making this scheme work on the cognitive level, as it has an affective resonance and acts at the same time as an action scheme, i.e. as a sensory-motor commitment in an inventive practice. » [4].

CONCLUSION

As a preliminary conclusion to this brief overview, I would like to stress the importance of an integrated understanding of the human and technology as the terms of interactions that can be described through the concept of transduction. Re-integrating the technique into the culture, as opposed to re-integrating the culture into the technique as the HCI tends to do, thus requires this genetic account of individuated human and technological processes.

REFERENCES

[1] Alexander, I. and Maiden, N. 2005. Scenarios, Stories, Use Cases: Through the Systems Development Life-Cycle. Wiley.

[2] Auray, N. 2002. Ethos technicien et information. Simondon reconfiguré par les hackers. In Gilbert Simondon, Une pensée opérative, 2002, Jacques Roux (éd.), Publications de l'Université de Saint Etienne.

[3] Baudrillard, J. 1978. Le système des objets. Collection Tel (n° 33), Gallimard.

[4] Beaubois, V. 2016. Ressources simondoniennes pour une pensée du design. In Gilbert Simondon ou l'invention du futur, Klincksieck, 2016.

[5] Bødker, S. and Nylandsted Klokmose, C. 2011. The Human-Artifact Model: An Activity Theoretical Approach to Artifact Ecologies. Human–Computer Interaction 26 (4), 315-371.

[6] Bødker S. and Iversen, O.S. 2002. Staging a professional participatory design practice: moving PD beyond the initial fascination of user involvement. In Proceedings of the second Nordic conference on Human-computer interaction (NordiCHI '02). ACM, New York, NY, USA, 11-18.

[7] Carroll J.M and Rosson, M.B. 1992. Getting around the task-artifact cycle: how to make claims and design by scenario. ACM Trans. Inf. Syst. 10, 2 (April 1992)

[8] Deleuze, G. 1968. Différence et répétition. Presses Universitaires de France.

[9] Dubey, G. (2013). Toucher le virtuel: une nouvelle anthropologie. Sur quelques enjeux anthropologiques du phénomène de tangibilité dans les environnements numériques. SociologieS.http://sociologies.revues.org/4294

[10] Gibson, J. J., 1986, The Ecological Approach to Visual Perception, Lawrence Erlbaum Associates, London, 332p.

[11] Hatchuel, A. 2016. Objets techniques, objets d'esprit : de Simondon à la théorie de la conception. in Proc. of Gilbert Simondon et l'invention du futur. Colloque de Cerisy. Klincksieck.

[12] Hornbæk, K. and Oulasvirta, A. 2017. What Is Interaction?. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17). ACM, New York, NY, USA, 5040-5052.

[13] Karam, M. and schraefel, m. c. A Taxonomy of Gestures in Human Computer Interactions. 2005.

[14] Leroi-Gourhan, A. 1964-65. Le geste et la parole. 2 volumes. Albin-Michel.

[15] Catherine Letondal, Jean-Luc Vinot, Sylvain Pauchet, Caroline Boussiron, Stéphanie Rey et al. Being in the Sky: Framing Tangible and Embodied Interaction for Future Airliner Cockpits. TEI 2018 12th International Conference on Tangible, Embedded and Embodied Interactions, Mar 2018, Stockholm, Sweden.

[16] Magnaudet M. and Chatty, S. 2015. What epistemological framework for a science of human-machine interaction?. In Proceedings of the 27th Conference on l'Interaction Homme-Machine (IHM '15). ACM, New York, NY, USA, Article 9, 10 pages.

[17] MacKenzie, A. 2006. Transductions. Bodies and Machines at Speed. Bloomsbury Collections.

[18] Nardi, B. A., O'Day, V. L.: Information Ecologies: Using Technology with Heart. MIT Press (2000).

[19] Simondon, G. 1958. Du mode d'existence des objets techniques, Paris, Aubier, 1958.

[20] Simondon, G. 2016. On the Mode of Existence of Technical Objects. Univocal Publishing, vol. 39.

[21] Simondon, G. 2005. L'individuation à la lumière des notions de forme et d'information. Collection Krisis. Millon.

[22] Simondon, G. 2014. Psycho-sociologie de la technicité, in Sur la technique (1953-1983), Paris, PUF, 2014.

[23] Janlert, L.E and Stolterman E. 2017. Things that keep us busy. The elements of interaction. MIT Press.