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Gestures within Human-Technology Choreographies for Interaction Design

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Abstract

In the traditional use-oriented approach, only a fraction of gestures are taken as relevant to interaction. In this paper we argue that gestures should not be handled only as isolated objects of application use, but they should rather be understood as dynamic moments of embodied presence belonging to an experiential chain of different movements which has its own significance as a whole. In the current study, we call the embodied, experiential continuum of human action choreography. We assume that choreography is a fruitful theoretical concept in understanding interaction design because by choreography we can understand gestures as building up a chain of a bigger whole. The dynamic formulation of this chain of embodied gestures is what ultimately makes users' experience of digital devices meaningful in their everyday life.

Keywords: choreography; interaction design; methodology; gestures; kinaesthesia; user experience

Introduction

Our everyday experience is embodied in a continuous flow of different activities and movements that are manifested as a choreography of our life. As computerised devices enter into our lives in an increasingly pervasive manner, we need new ways to figure out how the designs of the new interactive commodities collide with these flowing patterns of human movement. Interaction designers have previously dealt with these issues, for example, by utilising methods that depict different use cases of a device or user interface in the form of narrative stories (e.g., use scenarios, see Carroll, 2000). However, what is not fully understood in the field of Human-Computer Interaction (HCI) is the dynamic, embodied nature of human experience. The inability to get a grip on the continuum of human actions *as an experiential whole* makes it challenging to define and thoroughly understand concepts such as user experience (UX).

In the traditional use-oriented approach, only a fraction of gestures are taken as relevant to interaction. In other words, only the gestures that are directly related to the use of a given application, are of interest. In this paper we argue that gestures should not be handled only as isolated objects of application use (e.g., for giving input) but, although often being easily conceivable as discrete actions, they should rather be understood as dynamic moments of embodied presence belonging to an experiential chain of different movements (both actual and imagined), which has its own significance as a whole. In the current study, we call the embodied, experiential continuum of human action choreography. In terms of interaction design, we are particularly interested in how the design of artefacts guides our everyday choreographies.

For conceiving human movement as an experiential continuum and consequently for getting a hold on this 'bigger picture' of gestures as a part of that kinaesthetic continuum, we propose a novel choreography-based methodology for interaction design. In this methodology, the very starting point of design focuses on the movement and actions performed and experienced within an environment and its objects. In other words, the design of isolated technological objects and features has a position secondary to the choreographies they are involved with.

Bodily movements in interactive systems

In interaction design, digital devices have constantly become more ubiquitous in terms of their size and weight. They have also acquired features that evoke more sensitive tactile-kinaesthetic experiences such as the Nintendo Wii Boxing game or the Apple iPad. Thus, in interaction design this movement-based input has raised new questions about the moving, sensing body in human-computer interaction. The recognition that human cognition is embodied action, has become fundamental to recent trends in interaction design. So one of the crucial questions is on what kind of theoretical frameworks movement interaction designers base their notion of interactivity with interfaces. To understand more profoundly embodied, kinaesthetically oriented interaction with digital devices, we need a more coherent theoretical foundation that can develop meaningful understanding of complex kinaesthetic and affective aspects as they appear through bodily movements.

Recently, the study of movement, motion, motility, and mobility has begun to take on a more central role in the humanities (e.g., Godøy, 2011), social sciences as the mobilities paradigm (e.g., Cresswell, 2006; Sheller & Urry, 2006), brain research and its studies of mirror neurons (Gallese, 2003; Longcamp, Tanskanen, & Hari, 2006) and also computer sciences (e.g., Dourish, 2001). Researchers in phenomenological philosophy (e.g., Husserl, 1997; Sheets-Johnstone, 1999; Parviainen, 2006), ecological psychology (Gibson, 1962) and philosophically oriented cognitive sciences (e.g., Gibbs, 2005; Noë, 2004) have argued that movement should be a key clue to understanding human cognitive systems and perception modalities. As Sheets-Johnstone (1999, p. 132) argues '...movement is the generative source of our primal sense of aliveness and our primal capacity for sense-making...'.

Sheets-Johnstone (1999) has criticised the mechanisation of the body and the materialists' trivialisation of movement (e.g., Dennett, 1991), which approach the *qualia* of movement as mere sensorimotor feedback. For Sheets-Johnstone, 'thinking in movement' involves neither linguistic related embodied metaphors nor mechanistic input-output modelling but is tied to an on-going qualitatively experienced dynamic in which movement possibilities arise and dissolve. By kinaesthesia, she means the sense of movement, i.e., a bodily felt sense of the direction of our movement, its speed, its range, its tension and so on (see also Husserl, 1997). In this way kinaesthesia provides information about changes of locations and motility as social interaction.

This *qualia* of movement is not a novel idea. In traditional movement theories, the centre of movement has been the human body, whose specific movement patterns and qualities indicate psychological orientation and features of the mover's inner life. The most well-known movement analysis, Rudolf Laban's methodology (Laban Movement Analysis LMA), is for documenting, visualising, describing, and interpreting all varieties of human movement, traditionally used in fields such as physical education, dance, theatre and physical therapy (e.g., Laban, 1980; Bradley, 2009). This method can be used in gestural recognition and modelling qualitative movement characteristics, such as describing motor intentionality, interest, motivation, attention, affection and bodily states. It has also been applied in industrial production, ergonomics, music (e.g., Broughton & Stevens, 2012) and more recently in interaction design (e.g., Loke, Larssen, Robertson, & Edwards, 2007; Robertson, Mansfield, & Loke, 2006).

We consider, however, that Laban's theory of movement is not necessarily useful for entirely capturing Sheets-Johnstone's notion of kinaesthesia and dynamics of movement constellations which the moving body has with actual or virtual objects. The purpose of our project is to develop a theoretical framework which does not focus on single gestures and postures but on affective connections or disconnections, patterns or routines people create with digital devices or physical objects in their environments on micro, local and macro levels.

Choreography as a theoretical concept

Choreography is usually related to dancing and bodily movement patterns, performed by professional dancers at theatres. Recently, however, choreography has been admitted as a theoretical concept in different disciplines. For instance, Baker and his colleagues (2009) have replaced the term orchestration with choreography in studying web services, by arguing that 'Choreography is an unambiguous way of describing the relationships between services in a global peer-to-peer collaboration, without requiring orchestration at all.'

By choreography we mean all bodily movements and activities in which movements appear to form meaningful interactions and relations between different animate or inanimate agents. It includes both a plan for the action, the action itself and all the agents it draws together. In terms of interaction design choreography refers to acknowledging how design choices affect movements and actions while also taking into account the pre-existing choreographies of the given situations. The approach does not make a difference between artefacts of different technological nature; table, tablet-computer and walls of the room can be conceptualised through choreography. However, our sense of movement varies depending on how we move our bodies in handling these objects and how their materiality responds to our movements. Thus, kinaesthesia has a central role in what kind of interactions with digital devices we consider meaningful and immersive.

We assume that choreography is a fruitful theoretical concept in understanding interaction design because choreography allows us to capture all levels of movement from micro movements, such as touch on an iPad, to macro level movements, such as the system of manufacturing and transporting these iPads. By micro movements such as kinaesthetic subtleties we mean improvised or automatic and habitual movement patterns which people make in their ordinary way of life by touching other people, in using their computers or making coffee. These movements take place in *kinesphere* which is one of Laban's key concepts. Kinesphere is the sphere around the body whose periphery can be reached by easily extended limbs without stepping away from the 'stance', which is the point of support when standing on one foot.

As Schiller (2008) and Parviainen (2010) point out, Laban's definition of the kinesphere does not elaborate upon the spatiotemporal condition of the environments within its physical space, architecture, socio-cultural events or political tensions. His definition of the kinesphere focuses primarily on the individual's dynamic shaping of bodily movements and its spatial expressions. Most movements we make, are, in fact, *pre-choreographed* by the physical, cultural, social, political and technical environment in which we are embedded. The architectural solutions of buildings as well as the whole infrastructure pre-choreograph our bodily movements, providing or suppressing opportunities for social interaction with other people. Thus, kinesphere does not capture those movements which we call 'local movements'.

By local-level movements we mean how, for instance, the

usage of a device is connected to our other activities or what kind of social relations we create by using devices. By focusing on the dynamics of these connections and relations, i.e., local choreographies, we can analyse from the new perspective how actively playing computer games transforms one's relations to other activities, such as eating or doing physical exercise, or relations to family members.

By macro-level movements we mean more specific connections and relations in which we exceed our own physical limits. For instance, in handling ordinary items, such as a vacuum cleaner and a cell phone, we are, in fact, one actor of a complex choreography of global manufacturing and trade which produces different items for us. For instance, thinking about the coffee-making process at home, we can notice that the coffee beans are produced in Columbia and our coffee-maker is made in China, thus this everyday action produces a kind of global choreography amongst different agents and their role as producers or consumers in the global market.

Gestures within human-technology choreographies

With respect to the three levels of examination within the choreography approach (macro, local and micro), the most relevant for studying gestures in HCI are local and micro levels. While the local level emphasises the kinaesthetic flow that embodies our everyday life, the emphasis in micro level choreographies is more on situated moments of movement. We suggest that gestures can be understood in a potentially mediating role of interconnecting these levels.

Using gesture as a concept for outlining discrete moments of embodied presence

The choreography approach does not specify gestures as movements with any predefined physical form or motivation. Therefore gestures are not exclusively seen, for example, as communicative objects. Rather, gestures may be identified more generally as 'signs of life' that are easily identifiable as discrete actions, but also inevitably belong in the experiential dynamic flow of our everyday activity. In other words, choreographies are constituted of discrete moments of presence that make the continuum analysable. Gestures may be utilised as a concept for denoting those situated moments in bodily terms of experienced movement (including imagined experiences of movement) that allow dividing the experiential continuum into recognisable and analysable 'chunks' in a way that is natural to us. This stance allows taking into account not only the actions one performs but also the mentally conceived actions one perceives or anticipates.

The above approach is closely related to the one applied in studies concerning sensations of movement in involvement with music. In such music research (Godøy, 2011), gestures have been proposed as gestalts which form an action-relevant basis for experiencing musical structures (in terms of bodily affordances). The same kind of approach could be applied in interaction design; how single gestural contours as identifiable chunks make up a continuous flow of significant experience. As action-relevant moments of embodied presence, gestures build up a chain of a bigger whole. The dynamic formulation of this chain of everyday activity is the thing that ultimately makes one's experience of life meaningful. And this is exactly where the choreography-based design methodology aims to tap into.

Towards formulating new grounds for evaluating user experience

A crucial part of interaction design is evaluation. When gestural interaction is considered, one of the key factors is subjective evaluation and user experience in particular, although objective measures should be taken into account as well. Subjective measures usually relate to gestures as part of a certain activity, such as reading a newspaper using a tablet device. This kind of action typically consists of interaction patterns which contain multiple gestures and the transitions between them. As such, traditional user experience evaluation methods can be applied, if the activity itself is addressed. In this case, the main challenge is to define the relevant, domain and context specific, UX targets for the action in question.

Considering the embodied nature of interaction, i.e., when the activity is evaluated as a whole, one can basically assess whether the interaction is successful according to certain criteria. However, we cannot identify which parts of the interaction (i.e., single or multiple gestures) are successful and which need more attention. Therefore, we need methodology that captures as atomic interaction patterns as possible. For example, in the design of a novel embodied interface for reading e-books, it might be that all other gestures except a page flipping gesture have been well designed, but since this specific gesture is crucial for the activity in question, it can destroy the overall user experience of the interaction design. The challenge here is how to measure these fragments of movements efficiently, since there can be a huge amount of individual gestures embedded in complex actions. And further, how can we assess the impact of these fragments on the overall user experience? In addition to subjective evaluation, objective assessment can be used to support subjective feedback. We can, for example, try to detect unwanted or obviously negative gestures, such as a gesture which forces one's hand into an uncomfortable angle, and further try to understand the possible reasons behind the subjective experiences.

The choreography approach offers a framework for taking into account how the single actions of an application use are ultimately fused into user experience through the continuous procedures of bodily engagement. This process can be seen through the relationships between three key levels of examination: (1) separable actions of use on a device, (2) embodied, experiential continuity of doing/acting and, (3) life in its entirety. The relationship between (1) and (2) concern how the experience related to the pinpointed actions of a user on a certain device connects to choreographies as a continuous, experiential flow, and between (2) and (3) it concerns how the same flow of embodied activity connects to the overall experi-

ence. Gesture may become a central concept in understanding the embodied engagement involved in these connections.

Conclusions

The concept proposed in this paper is analogous to figure-skating, in which a performance consists of a set of identifiable units, such as individual jumps or pirouettes. However, the overall artistic impression is a major criterion; how the athlete manages to create a coherent whole, and the interplay between skating performance and the chosen music. Contrary to the skater's choreography, which is prepared for formal execution with little or no variance, choreographies of HCI are prepared in terms of possibilities of human action, i.e., as pre-choreographies or affordances attributed to the HCI design. It could be said that some of the traditional theoretical models of HCI (e.g., GOMS model, Card, Moran, & Newell, 1983) strive to define a kind of optimal choreography for the user. The proposed choreography-approach for interaction design differs from these models in some crucial aspects. We do not see that choreographies should necessarily formulate the execution routes for any specific tasks or ways of reaching any specific goals. We rather see choreographies as a utility for understanding the activity of a user, and outlining how the intended use of technology collides with the flow of daily activities of a person. In our proposal, the starting point of design is not the technology or even an assumed need for it, but the embodiment of choreographies, consisting of an experiential continuum of identifiable gestures.

The ultimately corporeal nature of ourselves makes it natural to take observable and imaginary movements as a framework for conceptualising our everyday life. A choreography approach is applicable whether we ponder the user interface of single product or daily life at home as a whole. We can analyse devices not as material objects as such, but in terms of what kind of micro, local and macro movements are generated when we are using them. Many of the established practices of interaction design still remain fully applicable. The change takes place in the perspective: what we are trying to find is a 'bigger picture' in analysing the use of digital devices without losing the understanding of situated grass-roots level actions (and their subtleties) that essentially make up our daily flowing choreographies. We conclude that gestures offer an important, natural way to outline and analyse how these choreographies and their meanings are constituted.

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