UX story #1: Bixi rental bicycles

Since Spring 2009, the city of Montreal offers a public bike service. Citizens and visitors have access to batches of bicycles located on different street corners all over the city. They can rent a Bixi (the name of the bicycle) for their short trips and leave it in one of the numerous parking lots set up in the city. Evaluating the UX of the cyclists goes beyond usability evaluation. Of course, the bike is expected to be reliable, easily usable and comfortable and the support organization should help one find a bike, pay, and contact help in case of problems, etc. But there is more: the pleasure of going cycling, the satisfaction of doing an activity that helps keep in shape, that is in harmony with one's values (healthy living, prevent pollution), that reinforces self-image (as active and strong), and that makes one participates to large societal movements (closer to our bodies and the environment).

Figure 1 A Montrealer about to pull away on a Bixi

UX story #2: the Wii console

Older people are using the Nintendo Wii console to exercise. This console uses a haptic control called Wiimote, which can detect movements and rotations in three dimensions. These movements...
done in coordination with dynamic scenes of a game environment showed on a screen allow one to virtually play tennis, bowling, golf, etc. Here, evaluating the usability of the product is far from being sufficient if one is interested in the experience with it. The UX of people using this system includes the fun of playing, the satisfaction of being physically active, the development of abilities for coordination and concentration, the pleasure of interacting with other people who observe, encourage, keep score, and comment on the performance, and the improvement of the self-image (being active, dynamic, and cool).

Figure 2 Older couple playing with a Wii

UX story #3: Air travellers

The travellers’ experience is negatively affected by national security requirements and airlines financial stress. The enchantment of air travel has nowadays given way to a laborious and compromised experience: there are luggage issues, long security procedures and tight economy class seating. Interestingly, some airlines have opted to equip each seat with a monitor allowing the traveller to watch movies or programs of his/her choosing at his/her own pace. This basic interactive technology gives the traveller a small measure of empowerment in the travelling experience. Watching a movie with a headset creates a strong immersive experience that alters the traveller’s sense of time and space, offering an escape from the physical discomfort and making the journey appear shorter. Although technology here does not address the root causes (some of which are out of the airlines control), it doctors up a situation to the point where most travellers feel ok about their trip, partly reversing what is an otherwise mitigated experience. Here again, the usability of the system does not capture the essence of the interaction with it. The system is an efficient mean to make us forget about discomfort and even have some enjoyable moments.
Figure 3   Passengers plugged into their monitor during flight

1. Introduction: A rapid start

These stories illustrate different facets of User eXperience (UX). They show how the concept looks rich, inclusive, holistic, applicable to different systems, and in a better position than usability to capture the global experience of system use. UX has received a rapid acceptance in the fields of HCI (Human Computer Interaction) and interaction design. The concept appeared in the literature in the second half of the 1990s (Alben 1996) and since then, researchers and practitioners of different disciplines involved in the analysis, design, and evaluation of interactive systems have readily adopted it.

Yet, although well received, UX is still theoretically incoherent and methodologically immature (Law et al. 2007). The serious reader of UX research may feel that the field is like a construction site with many interesting beginnings and little in the way of a general view. This article is the first of two addressing fundamental issues of UX. Its goal is to present the state of knowledge on the nature, characteristics, and process of UX. It is structured as follows: in section 1, we go back over some historical pointers of UX; in section 2, we define the scope of UX; in section 3, we present definitions and several characteristics of UX; in section 4, we describe the role of emotions in UX; and in the conclusion, we propose some promising research avenues about UX.

Historical pointers

The precursors of UX: 1970s-1980s    Paying attention to the user is not a new idea. As far back as 1971, Hansen proposed engineering principles for the design of interactive systems. His first principle was: Know the user. He was not referring to a UX, but UX is tributary of this early orientation. Several other authors from the HCI community in the 1970s, 1980s and 1990s underlined the importance of paying attention to the user to design good systems.
They focused on the anthropometric, motor, perceptual, cognitive, cultural, social, and attitudinal characteristics of the user.

Also in the 1970s, in Japan, Nagamachi (see later publication 2002) and others (e.g., Yamamoto 1986) developed the field of Kansei Engineering. Although this had little impact on western HCI until the last decade (e.g., Grimsaeth 2005), this field shares exactly the same concerns as UX. It is a method for translating feelings and impressions into system properties, and to deliver predictable emotions.

The 1980s have seen a growing appreciation for Csikszentmihalyi’s (1975) notion of Flow as a framework to understand positive user interactions. Flow is a complex psychological state that describes a perceived optimal experience characterized by engagement in an activity with high involvement, concentration, enjoyment and intrinsic motivation.

New games and new toys  Parallel to the development of the personal computer and the new concerns about the user, the 1970s saw the beginning of computer games (e.g., Pong, 1972) and of new toys, like Sony’s portable audio cassette player, the Walkman (1979). The Walkman followed in the steps of the portable transistor radio of the 1960s, and was a revolution that eventually led to the iPod. These leisurely tools questioned the work-related approach to interface design.

In our opinion, nothing questioned the work-related approach more than games. Video and computer games’ popularity and the strong involvement of the players drew the attention of various HCI researchers and interaction designers. In 1983, Thomas Malone completes a doctoral thesis titled: “Heuristics for designing enjoyable user interfaces: Lessons from computer games.” He points to surprise, challenge and difficulty levels as important factors to keep the user’s interest. He meant to transpose these factors to workplace interactive systems, so that users would be more incline to adopt them. Game design has developed into a field of its own. Salen and Zimmerman (2004), reviewing the theoretical and practical literature on games since the mid-thirties, identified the corner stone concept of meaningful play.

Beyond usability  When computers migrated from the office to the home and on to different interactive systems, our interactions with them diversified. In an article on quality of experience, Alben (1996) asks: How does effective interaction design provide people with a successful and satisfying experience? With this new wave of technological products, it became apparent that the parameters of usability were not enough to help fashion interactions that offered fulfilling experiences outside of work-related activities.
**Hygiene vs. motivator factors**  “Usability is one of those things that is first understood in the negative. By that I mean it is often easier to know when something isn't usable than when it is” [a]. This assertion with which we agree is closely akin to a major critique about usability concerning the absence of positive. During decades, the HCI community acted as if it had equated system quality to the absence of problems (e.g., errors, user frustration) instead of striving for the presence of positive elements in the system (e.g., self-development, fun) (Robert 2008). Interestingly, this critique can be put in relation with a well known model of job satisfaction: the American psychologist Frederick Hertzberg’s two factor model which is sometimes called the Motivator-Hygiene model (Hackman and Oldham 1976). Herzberg investigated the factors that were responsible for the satisfaction at work of employees from different organizations. He discovered that they could be classified in two categories: hygiene factors and motivators. The former, which includes working conditions, company policies and administration, supervision (technical), relations with peers, and relations with superiors do not cause any encouragement or satisfaction, but instead they cause dissatisfaction when they are not met. The latter, motivators which include achievement, recognition, work itself, responsibility, and advancement, encourages people’s performance and satisfaction. So by transposing the two-factor model of Herzberg to HCI, it is tempting as Schaffer (2009) does to see usability as a hygiene factor rather than a motivator. Motivators have the real power to create positive UX.

**Emotions**  By the end of the 1990s, in reaction to the limits of usability and in search for positively motivating factors, a large field of research has developed to better understand the impact of non-instrumental qualities of systems and personal factors that affect the UX. The research looked at three general topics: beauty, pleasure, and emotions. Clearly no single aesthetic appreciation or emotional response can explain UX as a whole, but the great variety of specific emotional responses does point to the importance of understanding the user’s emotions as the key to understanding the UX.

2. The scope of UX

When we think of UX, images of video games, new technology, and intense experiences come to mind. But really UX does not refer to new human activities, it is a new lens through which interactive system designers see and understand human activity, and from which they can conceive better relationship between the user and the interactive systems. To understand the concept of UX, it is necessary at first to define the concept of experience and examine different types of human experiences.
Human experience

The Merriam Webster (2002) dictionary defines experience as the fact of having been affected by or gained knowledge through direct observation or participation. To experience is to learn by experience. This general definition makes a distinction between the psychological effect (‘having been affected by’) and the cognitive effect of experience (‘gained knowledge’), and between two types of people’s engagements (‘direct observation or participation’).

Categories of systems

We can have an experience with or without a system, and if it is with a system, our relation with it will be different depending on how we engage with it and on the type of system at hand. We propose the following classification (see Table 1).

<table>
<thead>
<tr>
<th>Engagement of the person having the experience</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active users</strong> (possible modes of engagement)</td>
</tr>
<tr>
<td>Pro-active</td>
</tr>
<tr>
<td>No system is used</td>
</tr>
<tr>
<td>System is slightly or not adjustable, not interactive</td>
</tr>
<tr>
<td>System is adjustable</td>
</tr>
<tr>
<td>System is interactive</td>
</tr>
</tbody>
</table>

Table 1  Examples of experiences according to the system and the type of engagement

Experience without a system  We can live experiences without using a system. For instance, watching the sunset, visiting Paris, brainstorming, helping someone cross the road, walking on the Great Wall of China, or being in love, are all real life experiences where no system is involved; the person having the experience is not a “user,” so it is inappropriate to talk of UX.

Experience with non-interactive systems  Some often fairly high-tech systems are designed to offer a user experience where there is no interactivity: for instance, a city bus or the chairlift at a ski resort. People use these, but have no control on the operation of the systems, which is not say that there is no UX; the interaction scenario is just simpler.
**Experience with adjustable systems** Some mechanical and digital systems (e.g., office chair, mountain bike, radio, Blue-Ray player) are to be adjusted in the course of their use. These adjustments vary in frequency (sometimes, it is only once at the very beginning, and sometimes it is continuous during the usage) and range from simple adjustments (e.g., on the office chair) to more complex ones (e.g., on the mountain bike).

**Experience with interactive systems** To be called interactive, a system must enter an action dialog with the user that goes beyond the kind of exchange one has with adjustable systems. According to Rafaeli (1988) to be considered “interactive”, an exchange between a system and a user must sustain three or more exchanges, responding to each other, and referring to previous exchanges (e.g., searching for information on the Web). The level of interactivity varies widely from one system to another. Interactivity can be seen on a continuum going from low interactivity (e.g., on a bank teller) to high interactivity (e.g., on a video game).

**Categories of engagement of the person having the experience**

**Active users** Active users are the people for whom a system was created, the primary users or target users. It appears that there are different modes of user engagement within the active user category. There are differences in engagement between the user of commercial exchange applications (e.g., from online banking to e-Bay), the visitor of an interactive museum exhibit, and the designer using software to design the interactive exhibit. In the first, the user travels along interactive scripted paths; we see this user as proactive. The museumgoer paces the rate at which s/he receives the exhibit’s information, which makes him/her something of an interactive spectator in an actively receptive mode. Whereas the designer is a creative user, producing open-ended results, using interactive tools. There are perhaps other modes of engagements such as the social-networker, the collaborators, and so on. The user engagement applies to all three types of systems: non-interactive, adjustable, and interactive.

**Passive users** We can have experiences vicariously through observing others around us. Even though we do not use the system, we get a second hand or passive UX. These experiences involve the same types of systems we use ourselves. At least two categories of experiences fall in this category depending on the way we relate to the system:

- Systems we experience through the media: through publicity, critical journalism or set in the narrative frame of a movie, for example. All these will shape how we perceive a system. Efficient publicity positively influences our perception and our actions. Experiential marketing (Schmitt 1999) makes sure we get a sense of the
product experience ahead of time. Critical reporting also modulates our mental pictures and thus our expectations. Through repetitive media exposure, we end up getting a UX by proxy even though we do not use the device ourselves. For instance, think of young people dancing on the music of an iPod. Through the media, the potential user is receiving information.

- Systems used in our close environment may positively or negatively affect us. For instance, the bad experience of having to endure people continuously talking on their cellphone in our close environment may influence our opinions about this product. Another example is the Bixi, Montreal’s rental bike mentioned in the opening story. The city of Montreal operates a park of 3000 bikes. The citizens of Montreal are affected by the users of these bikes because they see them, hear them, and deal with them in traffic on a daily basis. If these bikes were ugly, rusty, noisy, often broken, and parked everywhere the passive UX would be strongly negative. Passive users experiencing through direct observation are, in our opinion, in witness mode.

In this article we will concentrate on experiences involving system use, whether active or passive (in grey in Table 1). The active experience is regarded as the core of UX, the actual interaction, while the passive experience usually folds into the UX as part of the expected UX.

### 3. Defining UX

In the expression “this was quite an experience”, there is an underlying sense that something is new or different, special, exciting, surprising, or outstanding. This colloquial reference to experience reveals that the user is aware that something is going on. The experience may be due to some external event occurring in the world the person is aware of, or to a particular state of mind of this person. Without this awareness there is no experience, there would be only automatic behaviour.

There is a need for a commonly agreed and shared UX definition; this would be beneficial for teaching, doing research, and managing UX (Roto 2007). A definition reflects a common understanding of the nature and scope of the concept, and it provides a solid basis for evaluation. In 2004, Forlizzi and Battarbee asserted that the term UX was associated with a wide variety of meanings. It is still true today. Here are several definitions of UX:

> “All the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they’re using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it” (Alben 1996).
"User experience" encompasses all aspects of the end-user's interaction with the company, its services, and its products" (Nielsen-Norman Group 2009).

"The overall experience, in general or specifics, a user, customer, or audience member has with a product, service, or event. In the Usability field, this experience is usually defined in terms of ease-of-use. However, the experience encompasses more than merely function and flow, but the understanding compiled through all of the senses" (Shedroff, 2001).

Shedroff goes on to define what is an experience:

"The sensation of interaction with a product, system, service, or event, through all of our senses, over time, and on both physical and cognitive levels. The boundaries of an experience can be expansive and include the sensorial, the symbolic, the temporal, and the meaningful" (Ibid.).

"Every aspect of the user's interaction with a product, service, or company that makes up the user's perceptions of the whole. User experience design as a discipline is concerned with all the elements that together make up that interface, including layout, visual design, text, brand, sound, and interaction. UE works to coordinate these elements to allow for the best possible interaction by users" (UPA 2006).

"The term user experience, most often abbreviated UX, but sometimes UE, describes the overarching experience a person has as a result of his/her interactions with a particular product or service, its delivery, and related artefacts, according to their design" (Wikipedia, online October 2009).

"A consequence of a user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g., complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g., organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.)" (Hassenzahl and Tractinsky 2006).

We agree with the these definitions which identify several characteristics of UX:

- UX is concerned with every aspect of the interaction with a system, related artefacts, the services, and the company;
- UX is an overall effect over time on the person;
- UX depends on four elements: the user (what s/he brings to the interaction, and how s/he interacts), the context, the quality of the system, and the activity done with the system;
- UX has several levels or dimensions (the text in quotes in this paragraph comes from the definitions above): functional (“how well it serves their purposes”), physical (“the way it feels in their hands”; on both physical … levels”), sensorial (“through all of the senses”), cognitive (“on both … and cognitive levels”), and psychological (“how they feel about it”).
Our definition and explanations

We propose a new definition in light of the ones above because it seems essential to mention that UX is a construct and is multidimensional. Here is the new definition:

**UX is a multidimensional construct that defines the overall effect over time on the user of interacting with a system and service in a specific context.**

UX is a construct, meaning that it is a theoretical object corresponding to some reality. Different constructs are necessary in several disciplines: for example, workload in human factors engineering or social classes in sociology. In each discipline, the definition of a construct is a challenge. UX is no exception.

UX is multidimensional since it is the combination of different types of experiences (hence the dimensions) such as they are perceived by the user. The dimensions are: functional, physical, perceptual, cognitive, psychological, and social. There are two meta levels which relate to each dimension: sense making and aesthetic. Note that we added the functional and social dimensions to the ones already mentioned by the authors. Because of space constraints, the dimensions are defined in Robert and Lesage (2010) (this book).

A single interaction may serve two different and concurrent sets of goals and needs: extrinsic and intrinsic, delivering two different and concurrent sets of results, all of which participate to the user's perception of the whole.

UX depends of four basic elements, centring on the User as s/he interacts with a System for doing an Activity in a specific Context (USAC).

Here are brief explanations about how each of the following terms relates to UX: user, system, activity, context, granularity, expected UX, in-progress UX, overall UX, extrinsic and intrinsic goals, instrumental and non-instrumental qualities.

**The user** "UX happens inside the person" (Roto 2007), it is a subjective feeling about the system. A UX is ultimately personal because each user will have a unique experience according to his/her background. The UX is strongly affected by what users bring to the interaction in terms of mood, interests, goals, values, previous experience, needs and expectations. Consequently a positive UX for a first user could be neutral for a second user and negative for a third one. This being said, the design team cannot design for 100% of the experience. Designers can only set the stage for an ideal UX for a specific type of users, based on their profile. Although UX is personal, it makes sense to think of "team UX" when users collaborate together to achieve some activities, when a part of the experience comes from interactions, competition, or comparison with others, and when people have fun together. So far little work has been done on team UX.
**The system** As in any good design, the interactive system is expected to have several basic qualities: appropriate functionality, reliability, usability, etc. To use Herzberg's word, in all cases there is a basic “hygiene” level that needs to be achieved to access a good UX. Indeed it would be hard to imagine that poor functionality would attract and keep the users, that a non-reliable system would lead to a positive UX, and that poor usability would satisfy the users. Each system has instrumental qualities (e.g., appropriate functionality, security, efficiency, usability, good design) that allow one to do activities (e.g., register to a conference through Internet) and reach some external goal (be registered on time). Some systems also have non-instrumental qualities (e.g. beauty, pleasant look and feel, smoothness of the interaction, novelty, values they represent) which bring pleasure, satisfaction, pride, sense of belonging to a community, etc. Note that some qualities (e.g., pleasant ‘look and feel’, smoothness of the interaction) may also be instrumental when they are used to increase user performance and satisfaction. The innovation with UX is to consider that both instrumental and non-instrumental qualities of the system contribute to the UX.

**The activity** At the centre of a UX, there is a user interaction with a system, implying that there is an activity. In a UX perspective, we prefer to step back from the “task” and talk of activity, be it related to work, leisure, transport, or daily chores. It is essential to take into account the specifics of the activity in terms of location, time pressure, social interaction, security issues, quality requirements, inputs and outputs, etc. If an activity is misunderstood or looked at out of context, the designed system however efficient will not be appropriate to deliver a positive UX.

UX should cover the related activities as well. These are essential or normal behaviour with good use of the system. These should also be done safely, easily, and efficiently. The frontier may be fuzzy between the central activity and related activities. For example, the central activity with a camera is to take pictures; the related activities are to be transported, transfer photos to a computer, connect to a TV, change batteries, share the pictures with friends and relatives, make prints, archive the pictures, and so on. This example shows how some related activities potentially have a thread of intrinsic experience running through them, e.g. the satisfaction of manipulating personal material that makes sense and creates emotions, and of connecting with relatives and friends.

**The Context** We refer here to the wider human and environmental factors that end up colouring the UX, such as social, cultural, political, linguistic, economic, or environmental factors. These influence all three other elements of the USAC group, i.e., the User, the System and the Activity. For example digital devices require high compatibility with other
digital devices of their specific technological ecosystem. Likewise, it is now a sign of good environmental stewardship to design systems with their full life cycle in mind, including the disposal of their parts after the life of the system no matter what purpose the system actually serves.

Granularity of the UX As mentioned by Roto (2007), UX can be analyzed at different levels of granularity. The analysis conducted at each level will provide useful information to different groups of shareholders (e.g., the management, the designers). These levels are not rigid, they are defined in relation to one another.

At a high level, the UX rests upon the interaction of the user with the whole infrastructure or organization that supports the system or the service. For example, the overall UX of the traveller with the airport will include his/her interactions with a multitude of systems and services, such as parking services, transport between terminals, registration service, security checks, duty free shops, money exchange, etc. The overall UX will result from an accumulation of smaller UX with each of the systems or services that the user interacted with.

At a mid-level, the UX rests upon the interaction of the user with the specific system or service that supports a significant activity. For instance, the interaction with the registration desk of the carrier, the security check, or the airport service to handicapped people each corresponds to a UX.

At a low level, the UX rests upon the interaction of the user with specific components of a system that partly supports an activity; for instance, the use of visual displays for information on arrival and departure flights, and the use of various icons and symbols used in an airport fall into this level.

Expected UX There are important differences between the three UX periods, Expected, In-progress and Overall UX (Roto 2007). Each period brings a significant and different input to our mental construction of UX. Figure 4 shows the relations between them and various inputs of information.

![Figure 4 Relations between Expected UX, In-progress UX and Overall UX](image-url)
An expected UX may exist before the initial use of a system and is renewed by each period of use. It rests on expectations built from different sources of information, such as:

- our past experience with a similar or previous version of the system, systems of the same family or same company, etc.;
- comments from different people around us;
- observations from direct encounters, seeing people around us use the system;
- messages from different media;
- our own analysis of the system.

After each session of use:

- our renewed personal experience with the system.

User's expectations are not static; they evolve continuously with each new input of information. Information cumulates in the user's mind with possibly points of convergence and/or divergence. The expected UX does not rely only on the system designers but also on those involved in creating the brand image of a system (marketing department and communication designers) and those who directly serve the users (sale and after-sale services).

The evaluation of UX should take into account what is brought by the users in terms of comparisons with other systems, past experience, product images, attitudes, goals, needs, interests and values. It is not enough to make sure through strong brand appreciation that the expected UX is positive, designers and researchers still need to know the specifics of what the users are expecting and why. Such an evaluation will be based on the usual interviews, questionnaires, focus groups, and communication analysis.

**In-progress UX** This UX happens during interaction. Because the system may allow the user to achieve extrinsic goals as well as intrinsic goals, the actual interaction may be both a means toward an external end as well as an end in itself.

Evaluating the UX while it is in-progress is unavoidable. It could be based on verbal and non-verbal behaviour observations, physiological measures (this is the only period where their use makes sense), and subjective evaluations. However the user may not have sufficient distance to evaluate the entire UX, especially if the last session was problematic.

**Overall UX** This UX happens as a result of having interacted with the system. Here the user steps back from the system, reflects on it, and judges the overall UX in light of his/her own experience and of all the information received. S/he is likely to have a holistic impression of the experience even though it is multidimensional.
The evaluation of the UX at this period of time is appropriate because it covers all. It will be based on data collected during the interaction and afterwards through interviews, questionnaires, focus groups, and verbalizations.

**Extrinsic and intrinsic goals and needs, instrumental and non-instrumental qualities of the device**

Hassenzahl (2007) has researched and written extensively on the concurrent strands of experience, which he refers to as pragmatic and hedonic dimensions. In his research, he has found that people perceive interactive products along these two dimensions, and that they perceive them as distinct from one another. The pragmatic dimension focuses on the product’s instrumental quality, its utility and usability in relation to the primary activity and extrinsic goals, and the hedonic dimension focuses on the product’s non-instrumental quality and how they support intrinsic goals.

Many authors have identified different intrinsic needs and goals, such as self-actualisation, esteem and relatedness (Maslow 1943), or the need for novelty and change, personal growth and/or self-expression (e.g., Ryan and Deci 2000, see Sheldon et al. 2001 for general lists of human needs). Hassenzahl (2003) distinguishes three kinds of needs: Stimulation (novelty and change, personal growth), identification (communication of identity to relevant others, relatedness) and evocation (provoking memories, symbolizing). This list is by no means exhaustive, and we agree with Hassenzahl that there is no set hierarchy of needs but rather a variable situation-dependent set of goals, some situations leaning heavily towards the intrinsic (like playing games) and some towards the extrinsic (like flying an airplane).

**4. The emotions**

Figure 5 shows the process of UX over the three periods of time described above and how the intrinsic and extrinsic goals weave through the experience. These dynamic aspects of the experience do not explain what fuels the experience. Numerous authors have looked at different emotions such as pleasure (e.g., Jordan 2000), appreciation of beauty (e.g., Tractinsky et al. 2000), play (e.g., Gaver et al. 2000), fun (e.g., Blythe et al. 2003) or at the emotions in general to find the motivational factor at the heart of the UX.
Desmet and Hekkert (2007) propose that the emotions act as a subjective motor driving people to action. They base their model on experimental psychology (Bradley and Lang 1994). Emotions are stimulated by perceptual information from the senses and by cognitive processes. Some percepts will evolve into aesthetic experience, while the cognitive processes will deliver sense making, and both will provoke an appraisal and emotional response. For instance, as we come across the latest model of a favourite car, we might appraise it as novel and revolutionary, and the corresponding emotional response might be surprise and enchantment.

Smith and Kirby (2001) see emotions as coherent systems, organised and functional. Their purpose is to establish our position in our environment by attracting to us some things and pushing away others. In the UX story #2 about older people playing with a Wii, the social networking they get by exercising with a Wii is valued enough to keep them playing, or have them come back another day.

**User’s levels of processing**

The user appraises devices at several levels. Norman (2004) proposes three levels of processing: visceral, behavioural, and reflective. At the visceral level we make rapid judgments (such as good or bad, safe or dangerous) and a signal is sent to the motor system and to the brain. These judgments could be enhanced or inhibited by the reflective level. The visceral level is seen as the start of affective processing.

The behavioural level controls the different user's actions: use the device, try new functionalities, upgrade it, connect it to other devices, show to friends and colleagues, etc.
The reflective level watches over, reflects upon, aiming at influencing the behavioural level. Based on information coming from the other levels and on one's knowledge, experience, culture, values, etc. the reflections about the product will be positive, neutral, or negative. The reflective assessment may happen during or after the interaction, and it will bring different kinds of emotional responses. For instance, after a major effort, one might feel proud or shaken, or feel more competent.

5. Summary of what makes UX
In light of the literature and our own work (Lesage and Dorta 2008; Robert 2008; Robert and Lesage 2010), we can extract the following highlights of UX:

- UX is multidimensional and holistic; its six dimensions are: functional, physical, perceptual, cognitive, social, and psychological; two meta-levels are related to each of them: sense making and aesthetics. Each experience has as unique and coherent set of dimensions meeting together according to variable ratios.
- UX is subjective: it partly depends on what the user brings to the interaction with the system in terms of moods, sensitivity, attitudes, prejudice, interests, knowledge, motivation, etc. This is the basis for sense making and for attributing weight to each dimension of UX. It also partly depends on the subjective emotional response to the interaction with the system. All this sets the stage for having an aesthetic experience.
- UX is an overall effect on the user (hence the overall UX): it cumulates the effects (in terms of knowledge and emotions) experienced at each point of contact with the system, the services and related artefacts. Furthermore it cumulates the (perceived) results of activities which are made of two concurrent strands, one answering to extrinsic needs and goals, the other to intrinsic needs and goals.
- UX spans in and over time (so it is not static): it covers the expected UX that built up to the actual use of system and the in-progress UX; these two cumulate in an overall UX.
- UX depends on four basic elements: the User interacting with a System for doing an Activity in a specific Context;
- UX is situated in a specific context (or is context-dependent): it depends on the characteristics of the context in terms of location, time, people, opportunities and constraints, technology, incidents, stakes, etc.
UX applies to an individual or a team.
- UX can be considered at different granularity levels.
6. Conclusion

Usefulness, efficiency, and usability of interactive systems, although essential, are insufficient for capturing the essence of our interaction with systems. The UX movement in the HCI and interaction design communities is an invitation to go beyond instrumental qualities of interactive systems and the achievement of extrinsic goals. Designers are encouraged to strive for the integration of non-instrumental qualities of system as well as the achievement of users' intrinsic goals. Both types of system qualities and goals make sense for users and contribute to the UX.

We need to better understand the relations between design elements, sense making, emotions, and UX. To go beyond the definition and the model of UX process presented in this article, our next step will be to carry out empirical research on how the UX builds up for different people, doing different work and non-work activities, with different types of systems, in different contexts, and for different periods of time.

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