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A user-centred assessment of a new bicycle sharing system in Medellin

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ABSTRACT

A bicycle sharing system (BSS) offers multiple benefits to a city as well as numerous challenges for effective implementation, especially if the system is connected to other modes of transportation. User-centred assessments of BSSs have been recognised as a paramount factor in transportation research, although it has received relatively little attention. This ethnographic study implemented a user experiential approach for assessing EnCicla, which is a new BSS in the city of Medellin, Colombia. A deeper understanding of users was needed for identifying the perceived journey maps; including route stages, functional likes and dislikes, affective reactions, and motivations for using the system. Findings identified not only the functional but also the affective aspects of the user experience. The 40 participants were also classified into four user groups: Lover, Civic, Grateful, and Adapted. Managerial implications involved recommendations for improving the service design and the communication and promotion strategies of the system. Limitations have to do with the specific characteristics of the sample.

1. Introduction

The use of bicycles has increased popularity worldwide as an alternative means of transport. Since 1965, the shared use of bicycle fleets or bicycle sharing systems (BSSs) has expanded through the five continents (Shaheen & Guzman, 2011; Shaheen, Guzman, & Zhang, 2010). By 2010, Shaheen et al. (2010) estimated that more than 139,000 bicycles belonging to approximately 100 BSSs exist in around 125 cities. Europeans for decades have known the value of having bike systems in countless cities. Bicycle sharing can be found in countries like Spain, France, Sweden, Germany, England, and Italy, among others (Antoniades & Chrysanthou, 2009). Outside Europe, there are systems operating in Australia, Canada, Japan, New Zealand, and other countries, such as Brazil, Chile, China, India, Iran, and Mexico (Midgley, 2011). For example, in the United States, the city of Washington has created a BSS in order to reduce traffic congestion (Holtzman, 2008). Since 2013, Citi Bike also operates to provide New Yorkers with an additional transport option (About Citi Bike, 2013).

This sustainable mode of transport has become an important tool for urban mobility planning because it facilitates the effectiveness of mass transit systems. A prospective study on urban mobility by 2050 (Lerner, 2011) mentioned some strategies that should be adopted by cities in order to improve the mobility of its citizens. One of these strategies was to ensure full integration of the travel value chain especially if public transport is interconnected with systems of cars and bikes. Indeed,

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urban transport has influenced the achievement of social sustainability in urban regions (Boschmann & Kwan, 2008), and therefore, cities have begun to pay significant attention to finding opportunities for implementing programs that reduce short-motorised travel and increase active and sustainable transportation, like walking and cycling (Maibach, Steg, & Anable, 2009). In this regard, due to the "growing concerns over global motorisation and climate change" (Shaheen et al., 2010, p. 1), the use of bicycles as a transport system presents great benefits for the health of the planet and its citizens (DeMaio, 2009; Krizek & Stonebraker, 2010; Rabl & Nazelle, 2011). The frequent use of bicycles has also been perceived as a practice that combines independence and interdependence of citizens, and as an appropriate response to contemporary problems (Aldred, 2010). Shaheen et al. (2010) pointed out that, "several studies have documented bikesharing's social and environmental benefits including reduced auto use, increased bicycle use, and a growing awareness of bikesharing as a daily mobility option" (p. 1). On the contrary, Miralles-Guasch, Martínez-Melo, and Marquet-Sarda (2014) found that the use of private transport, especially cars, has been strongly related to time travel, convenience, and social status, but not as a way to improve the city conditions.

Despite the increasing number of BSSs and perceived benefits to cities, individuals, and the environment; obstacles remain to their effective implementation. Challenges mainly relate to the system's integration with other public transport systems, future demand, safety, business models, costs, and user convenience for the cyclist (e.g., weather conditions) (Shaheen et al., 2010). In particular, Shaheen et al. (2010) stated that little research has been made concerning BSSs from the point of view of the users. Most research has been focused on the instrumental motives for using BSSs; whereas the affective response of the user has received very little attention in the literature (Mann & Abraham, 2006), even though it may be a key factor in implementing BSSs. Yet, the integration of a new transport system, such as a BSS, additionally requires analysing the reasons behind its potential use as well as the perceptions of its users (Miralles-Guasch et al., 2014). Nevertheless, limited studies were found relating to the user experience in BSSs.

1.1. The EnCicla bicycle sharing system in Medellin

The city of Medellin in Colombia (South America), with approximately 3.4 million inhabitants in a metropolitan area of 173 km^2 (Municipio de Medellin, 2013), implemented a new BSS called EnCicla. Its main objective was to find solutions to some of the city's mobility challenges. It is no coincidence that Medellin was named the most innovative city in the world by the Wall Street Journal (City of the year, 2013) and was selected as a model for sustainable urban innovation by the international award Lee Kuan Yew World City Prize (Medellin wins the Lee Kuan Yew World City Prize, 2016).

There are several antecedents to EnCicla in Medellin. The city of Medellin has a complex and integrated transportation system with a variety of means of transport. The Metro is the city's main mass transit system since 1995. Nowadays, the Metro system includes not only elevated railways known as the Metro, but also aerial cable-car lines called Metro Cable. The bus system also includes a variety of options, such as public buses and MetroPlus, which is a bus rapid transit system. As for the Metro system, it is important to note that it has built an outstanding citizen culture called the "Metro culture." The Metro culture introduces the Metro not as a mere means of transportation, but as a lifestyle and meeting place (Metro culture, 2016). The Metro culture reinforces "correct" behaviour and messages concerning the good citizen and the values, attitudes, and everyday habits which it expects of users (Brand, 2013). This has produced positive changes in civic culture by presenting a public transport system as an instrument of civic transformation. The Metro culture has been recognised as a benchmark of good mass transit system use by its users, to the point that this Metro culture was selected to be replicated internationally by the Panama Metro system (Nuestro metro, 2014). The successful implementation of the Metro culture has contributed not only to the education of the users of the Metro, but also has become an ideal to follow by the whole integrated system of transport in Medellin.

Due to the complexity of the transport systems in Medellin, the city government has promoted urban mobility, including non-motorised mobility, as means to improve security, and the economic and social wellness of its citizens. The Área Metropolitana del Valle de Aburrá is an administrative entity of public law associated with the municipalities of the valley called Valle del Aburrá, where the city of Medellin is located. In a mobility master plan for the metropolitan region of Medellin, The Área Metropolitana del Valle de Aburrá expressed the importance of integrating the transportation systems by using non-motorised mobility (translation from Spanish): "Non-motorised mobility associated with pedestrians and bicycles is a cornerstone within the system of mobility for all citizens, because it ensures accessibility and connection within the inner areas and residential tissues. This should be achieved by a subsystem, that is structured, and physically and functionally articulated, within the vial subsystem" (Plan maestro de mobilidad, 2009, p. 15). Accordingly, among other initiatives, the city government invested in developing a system of permanently designed bikeways that were semi integrated with the Metro. However, these bikeways were presenting a very low utilisation rate.

Taking advantage of these circumstances, Universidad EAFIT (EAFIT) made a proposal to the Área Metropolitana del Valle de Aburrá. The idea was to develop and implement EnCicla as a public BSS in the city by using a bicycle product model that was qualified as appropriate for a BSS in Medellin. The model was designed by Lina Marcela López, José Agusto Ocampo, and Felipe Gutiérrez, students of Engineering Product Design at EAFIT. After the project was approved, EAFIT developed a quantitative market research to clarify the expectations of future bicycle system users. Afterwards, EAFIT designed and implemented a pilot program for the bicycle system that proved to be successful. The pilot program included a qualitative research, which was the ethnographic study presented in this manuscript. The general objective was to explore how the new EnCicla users assessed the system. EnCicla started fully operating in August 2012, and with only three months of oper-

ation, the system achieved 15,700 bicycle loans (Cardona, 2012). EAFIT finally promoted the local government to assume leadership of the BSS. Consequently, EnCicla was incorporated into the agenda of the city government and transportation policies for continuing its expansion.

EnCicla as a BSS is a mixture of separated in-roadway bikeways, such as bike lanes; and shared in-roadway bikeways, such as bike boulevards, shared lane markings, and advisory bike lanes. The bike routes of EnCicla were designed over the permanently designed bikeways that were already part of the access roads connecting the Metro with the campuses of three major universities in the city. The first university is Universidad Nacional de Colombia (NAL), located near the Metro station called Suramericana. The second university is Universidad Pontificia Bolivariana (UPB), which is located in the vicinity of the Metro station called Estadio. The third university is Universidad de Antioquia (UdeA) that is located near the Metro station called Universidad. The Metro stations connected to EnCicla are located in the Metro line called Line B that crosses the city from east to west centre. See Fig. 1 for a visualisation of a section of the EnCicla system in Medellin. For the sake of clarity, before EnCicla was implemented, Metro users visiting these universities had to use different means of transportation to move through the access roads in heavy car traffic. Commuters usually walked or used motorised means of transport such as taxis, or public buses and vans. EnCicla achieved integration of these educational institutions with the Metro stations, by offering an alternative, fast, safe, economic, environmental, and reliable form of non-motorised transport mainly for students.

1.2. Objectives of the study

Given the great benefits of BSSs as well as the numerous barriers to their effective implementation and often usage (Fishman, Washington, & Haworth, 2012; Shaheen et al., 2010), the overall purpose of this study is to explore how the EnCicla users assessed EnCicla as a new BSS in Medellin. Five objectives were developed to help achieve the purpose and were defined by the directives of EnCicla and EAFIT. The first objective is to identify the stages perceived by the users during the use of EnCicla. The second objective is to evaluate the perceived functional likes and dislikes. The third objective is to assess the affective reaction during the perceived stages. The fourth objective is to characterise and classify the various users of the system. The fifth and last objective is to identify the motivating factors for using EnCicla.

2. Literature review

2.1. Transportation systems literature

Transportation research has usually drawn on different disciplines, theories, and methods in order to understand the use of transportation systems. Marketing, psychology, ergonomics, and product and systems design, among others, are identified when reviewing the transportation literature. Furthermore, qualitative research methods applied in these disciplines are gaining importance in travel behaviour research (Clifton & Handy, 2001). A psychological-affective approach also offers conceptual foundations for transportation research while focusing in the main topics of psychology such as affect, behaviour, and cognition (Zimbardo, Johnson, & MacCann, 2009). Despite the importance granted to affective components in different services arenas, the transport sector has not placed much importance in them as much as the instrumental factors that are pervasive. However, a growing number of recent studies on transportation have focused on non-instrumental factors of psychological-affective nature. For example, Stradling, Anable, and Carreno (2007a) identified dozens of studies spanning from 1998 to 2004 that have focused on non-instrumental factors influencing transportation mode choice and car use. Anable and Gatersleben (2005) further highlighted the importance of increasing the attention to affective factors as a way to a better understanding of transportation mode choice. Affective factors as preference for walking or cycling, unwanted arousal (e.g., buses are too crowded), and discomfort, have been found in research about the ideal urban bus journey experience (Stradling, Carreno, Rye, & Noble, 2007b). Stradling et al. (2007a), as well as Steg (2005) and Bergstad et al. (2011), suggested that affective and social motives are determinants of choices of car use. Consequently, modes of transport seem to fulfil more than instrumental functions.

2.2. The Desmet and Hekkert's (2007) experiential framework

Even though transportation literature has considered multiple perspectives including the abovementioned ones, an experiential approach has been crucial for the planning and improvement of transportation (Nijkamp & Blaas, 1994). Therefore, this study decided to use a conceptual framework for the user-centred assessment of a transportation system based on the user experience framework posed by Desmet and Hekkert (2007). Schifferstein and Hekkert (2011) defined the field of *user experience* (*UX*) – the original term is "product experience" – as "the research area that develops an understanding of people's subjective experiences that result from interacting with products" (p. 1). Similarly, Hekkert and Schifferstein (2008) defined the UX as the awareness of the psychological effects elicited by interaction with the product (or service), which is a "quite broad" definition that encompasses the UX definitions of other authors (p. 2). UX is affective by definition. That is, a user may have a UX characterised by a particular subjective feeling with positive, negative, or neutral valence, and a level of arousal. This UX framework allowed researchers to accomplish the study objectives in a coherent (i.e., as a unified consistent whole)

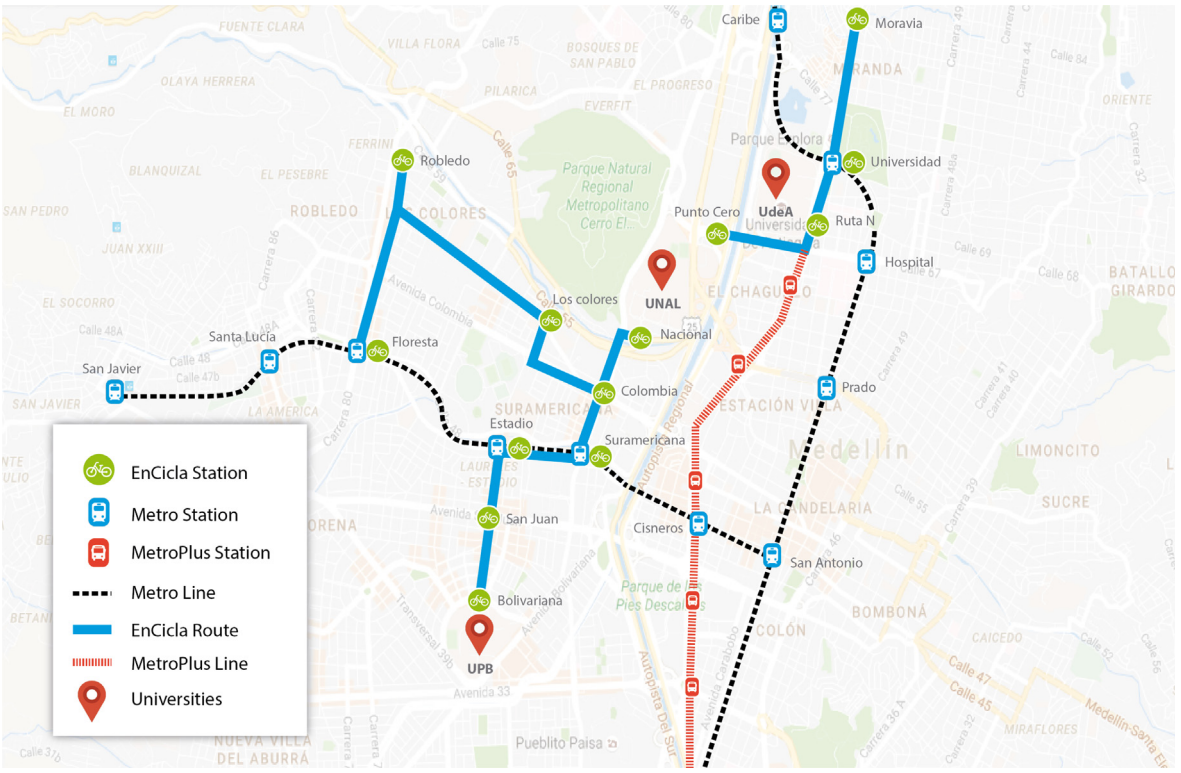

Fig. 1. A section of the EnCicla system map. Background map adapted from Google maps (2016), [search of Laureles – Estadio, Medellin – Antioquia], Retrieved on August 5, 2016 from: https://www.google.com/map.

and simple way (i.e., using fewer concepts as possible), while considering affective factors influencing preference for using a transportation system. Such an approach may be inscribed into the user-centred design philosophy because of its focus on the user's emotions, instead of focusing on the product, service, or the interaction context.

A UX focuses on *experiences*. The later tem is part of conscious beings and constitute their internal psychological subjective reality, in that experiences make up human's mental lives (Revonsuo, 2009). Experiences have been considered as situations and episodes during an interaction between the passenger and the transportation system, which include different tasks and activities (Kirk, 2013). Concerning the transportation domain, user or passenger experience is already an important topic for different transportation systems (Harrison, Popovic, Kraal, & Kleinschmidt, 2012; Kazda & Caves, 2007; Kirk, 2013). The disciplines of marketing (e.g., Meyer & Schwager, 2007), human computer-interaction (e.g., Hassenzahl, 2005), and product design (e.g., Desmet & Hekkert, 2007) have also been interested in UX since the 1990s. For instance, Meyer and Schwager (2007) defined the UX as the internal and subjective response that customers have to any direct or indirect contact with a company. Meyer and Schwager (2007) also highlighted that customer satisfaction "is essentially the culmination of a series of customer experiences" (p. 2) and that a company could understand how to satisfy its clients provided the company deconstructs the net customer satisfaction in its component experiences.

2.3. The affective nature of the user experience (UX)

The definition and components of the UX are sources of debate since consensual models or definitions of the UX are limited (Abbasi, Lew, Rafique, & Li, 2012; Law, Roto, Hassenzahl, Vermeeren, & Kort, 2009; Ortiz-Nicolás & Aurisicchio, 2011). Some of these debated definitions focus on just some aspects of the user (e.g., senses, motor skills); while other definitions are centred on social, technical, or aesthetic functions of the UX (Ortiz-Nicolás & Aurisicchio, 2011). Most UX models and definitions do agree upon its affective nature (Fridja & Scherer, 2009; Hekkert & Schifferstein, 2008; Russell, 2003), which is the basis of the generation of pleasantness or unpleasantness, positive or negative emotions and meanings, and agreeable or disagreeable sensations in the user. This is based on the notion of the *core affect* of Russell (2003, 2009). This core affect mechanism represents a two dimensional model, which opposes different emotions, called a circumplex model (Russell, 1980). Another point of agreement is the UX's focus on the non-utilitarian aspects of the interaction with the product or service (Desmet & Hekkert, 2007; Hassenzahl, 2005; Hassenzahl & Tractinsky, 2006). This last point enriches traditional quality models (Hassenzahl, 2005) with concepts such as pleasure (Jordan, 1999) and fun (Blythe, Overbeeke, Monk, & Wright, 2004).

For this study, researchers decided to observe the UX as a continuum; this makes UX particularly well adapted to analyse transportation experiences. For instance, concerning bus travel, Stradling et al. (2007b) found that passengers live their bus trip experiences in a continuum ranging from an ideal state of reverie to interruptions causing unwanted arousal, or from positive/pleasant to negative/unpleasant affect if using Russell's terminology (1980, 2003). As UX accompanies and guides the interaction with a system (Desmet & Hekkert, 2007; Schifferstein & Hekkert, 2011), it considers cognitive, affective and behavioural user's aspects, which are appropriate to fulfil the objectives of the present study. When considering the interaction of an individual with a product (e.g. bicycle), the interaction can be physical – the physical use of the product or system – or non-physical – thoughts or emotions derived from the product or system (Stappers, Lught, Hekkert, & Visser, 2007). Even though the Hekkert and Schifferstein's (2008) framework does not offer a definite definition of interaction (they talk rather of perspectives in the interaction), their idea is in line with Stappers and Visser's (2004) definition on the subject. Consequently, in this study, we adopted the definition of *human product-service interaction* "as the way people use, understand, and experience [the product or service as it contains] aspects of perceptual and motor skills, of emotion and affect, of cognition and performance" (Stappers & Visser, 2004, p. 4). The *user* then, is the person who interacts with the service along the different stages of the product or service lifecycle. On each of those stages, the UX accompanies and guides the interaction.

The Desmet and Hekkert's (2007) definition of UX distinguishes three major components, which is simpler than other definitions. In this way, although the UX is experienced as a whole, at least three components can be distinguished as part of a multicomponent phenomenon (Desmet & Hekkert, 2007). The first component, the *semantic* one, has expressive, symbolic, connotative meanings or values attributed to the object. The second component, the *perceptual*, is characterised by feelings of (dis)pleasure that are based on the sensory perception of the object, in other words, how the physical characteristics and attributes of a product or service generate pleasure or not in the user. The third component, the *emotional*, includes the feelings, emotions, and moods that are elicited (Hekkert & Schifferstein, 2008). Hence, a user may have a UX characterised by having a particular subjective feeling with positive, negative or neutral valence, and a level of arousal.

The model of product emotions (Desmet & Hekkert, 2007, p. 62) serves as the basis of the framework. For Desmet and Hekkert, *emotions* are reactions formed in an appraisal process consisting of a comparison process between a stimulus type (i.e., EnCicla) and a person's concern. *Concerns* are preferences for a particular state of things in the world (Ortony, Clore, & Collins, 1988). Concerns may be expressed in many ways: through the interests, values, motivations, attitudes, or others (Fridja & Scherer, 2009). However, it is in the appraisal between the concern and the stimulus that a particular emotion is generated. It is the ubiquitous presence of concerns along the five objectives of this study that is going to be highlighted as the common element that will provide coherence and simplicity to the study. Due to the affective nature of the UX definition adopted, and the prominence and relative simplicity of its three components; an experiential approach was an appropriate frame to develop the objectives of the present study.

In the following sections of this paper, researchers will present the used methodology by explaining the methods and tools applied to the study. Next, results will be presented and discussed. Emphasis will be placed on how the UX favours a coherent evaluation of a transportation system.

3. Methodology

Kirk (2013) argued that the most commonly used methods to investigate the UX's, "do not provide the information necessary for understanding the complete passenger experience" (p. 25). For this reason, an ethnographic study was selected as adequate for developing the study's objectives while achieving a deeper understanding of the UX. The research design included participant observation (Gans, 1999; Merriam, 1998) as the main data collection tool along with complementary tools (see Table 1) that supported the data collection process. This design permitted high levels of empathy and control during the escort of 40 EnCicla users in real conditions while guaranteeing the validity of answers. Twenty students we selected per university.

3.1. Selection of participants

For selecting the participants, researchers obtained from EnCicla a list of 200 students from two of the universities using EnCicla: UNAL and UPB. Selected students were actual EnCicla users that freely registered online as part of the EnCicla pilot program. Additionally, UNAL and UPB authorised researchers to contact students. Researchers contacted 52 randomly selected students by using an approved phone protocol. Forty appointments were arranged for meeting with participants at a specific Metro station that was connected to the EnCicla station. The goal was to use the bike system in real conditions. Participants signed a consent form and did not receive any financial compensation for participation.

3.2. Procedure

Prior to fieldwork, eight research assistants received eight-hour training. In the fieldwork, the EnCicla user was escorted by the research assistant or main researcher who also rode along by bicycle while doing the tour between the Metro Station and the UNAL or UPB (see Fig. 2). Bicycle tours were no more than eight kilometres. Each research assistant escorted at least

Table 1
Study design and data collection tools.

Research objective	Data collection tool	Analysis tool
(1) To identify the stages perceived in the use of EnCicla	Ethnography (including participant observation of users and open interviews[a]). Researchers used a map of the area of the city that included the bike path	Identification of stages from the journey maps
(2) To evaluate the perceived functional likes and dislikes	Open interview (complemented with laddering)	Thematic analysis (Braun & Clarke, 2006) and content analysis (Julien, 2008)
(3) To assess the affective reaction in the perceived stages during EnCicla's use	Plutchik wheel used during the open interview (complemented with laddering)	Circumplex theories of emotions (Ortony et al., 1988; Russell, 1980, 2003) and content analysis (Julien, 2008)
(4) Characterise and classify the different users of the system	Open interview	Thematic analysis (Braun & Clarke, 2006) and content analysis (Julien, 2008)
(5) To identify the motivators for using EnCicla	Open interview (complemented with laddering)	Appraisal model of emotions with products (Desmet, 2003b) and thematic analysis (Braun & Clarke, 2006)

[a] One interview was conducted per participant.

Fig. 2. EnCicla user escorted by a researcher during the fieldwork.

five EnCicla users and most of the tours where recorded by video and/or audio. The bike tours lasted around 15 min. The open interviews were made after the tour ended, lasted between 30 and 45 min, and were recorded and transcribed. They generated a total of approximately 1200 recorded minutes.

At the end of the tour, the open interview started with the question: *How was your trip?* User narratives helped researchers to identify the stages perceived by the users. For this purpose, the researcher presented a map of the area where the bike path was located. This map explicitly showed no cycle path. The participant was asked to indicate on the map how they would split the bike route in stages. This was based on what Law et al. (2009) pointed out when explaining that the UX occurs before, during, and after the use of the service. Next, a question about the perceived functional likes and dislikes was posed. After this, the user was asked to indicate their motivation for using the BSS. For this part, research assistants were trained in the laddering technique (Reynolds & Gutman, 1988). Laddering is more than a semi-structured technique for asking repeatedly "why" to the user.

During the interview, the assessment of the affective reaction of the user during the perceived stages started at this point. There are numerous methods of affective evaluation of products and services (Desmet, 2003b). Different measures could be obtained from those methods such as psychophysiological measures (e.g., electroencephalograms) and behavioural measures (quantifications of posture gestures) (Ekman, 1994). However, the option chosen was a self-assessment tool because it is easy to use and did not require specialised knowledge, training, or measuring equipment. Nevertheless, there are two problems with this self-assessment tool. Firstly, one of the major difficulties in directly asking a user about their emotions is to avoid stereotyped responses. Even though there are hundreds of emotions, people generally give answers such as happiness or joy (Desmet, 2003b). Second, self-reports could be biased due to bad recall (Detenber, 2001). Consequently, the open interview in our study design was performed right after the EnCicla tour was finalised and utilised a flower like-

representation of the Plutchik circumplex (Russell, 1980, 2003) to enquire about emotions. An emotion circumplex is a schematic representation of emotions diametrically arranged on a circle and forming poles of opposite emotions. Circumplexes of emotions are a very solid construct in psychology (Plutchik, 2003; Russell, 2003; Sander & Scherer, 2009).

There are more than 30 recognised theories concerning emotions from different disciplines (Strongman, 2003); however, the Plutchik's circumplex has the quality of being simple as well as allowing the measurement of the level of intensity of emotions. EnCicla users pointed out on the circumplex which of Plutchik's 32 emotions were felt during each stage of their EnCicla route. Another advantage of the circumplex is that is visual and stimulating to the respondents while allowing the identifications of mixed emotions, called *dyads*. Basic emotions are then combined to form primary, secondary, or tertiary dyads, depending on the frequency of the emotions (Plutchik, 2003). For example, the emotion of love is a primary dyad consisting of a mixture between the basic emotions of joy and trust. EnCicla users were also asked to differentiate between positive and negative emotions and give an explanation of the causes of the emotions that were felt. During this part of the open interview, laddering was used again to identify the motivators (i.e., concerns) behind each identified emotion. This would lead to an understanding of how an emotion was linked to a number of rational-cognitive motivators (Desmet, 2003a).

The last part of the interview was supported by the cognitive appraisal theory of emotions (Desmet, 2003a; Ortony et al., 1988) and the model posed by Desmet (2003b). The idea was to explore how an emotion is generated during the relationship with the service, while considering the concerns of the user. As an example, the concern of Paul was "being green," while the expressed emotion was of admiration. For other EnCicla user, the concern of Margarita was to get dutifully to her classes, while the emotion generated was of interest and optimism. Consequently, as shown in these examples, two EnCicla user had different concerns facing the same stimulus. Consequently, two different emotions were generated. It must be emphasised that the appraisal is at the base of the emotion and not the stimulus. To close the interview with the EnCicla user, researchers posed two specific questions in order to enquire about the whole EnCicla experience and additional motivations to participate in the study: *How was the enrolment process to use EnCicla? How was the service of the hosts (EnCicla employees)?*

3.3. Data analysis

After the fieldwork, each researcher wrote a report with the following items for each participant in the study: (a) basic demographic variables and selected verbatim that summarised their opinion about EnCicla; (b) likes and dislikes, identified stages of the bike route, as well as identified motivators; (c) table with description of stages, emotions, explanations, and concerns; (d) emotions per stage including valence and intensity (journey maps); and (e) overall conclusions.

Data collected consisted in audios, videos, transcriptions, pictures, route maps, and the reports of all participants. As shown in Table 1, data analysis and interpretations mainly utilised a thematic analysis variant (Braun & Clarke, 2006; Fishman et al., 2012), among other tools of analysis. Data was initially shared with all main researchers and research assistants so they could propose their own data categorisation and interpretations. Data analysis meetings were then scheduled and followed recommendations of Braun and Clarke (2006). In the first group meetings, each research assistant and main researcher presented their participant's reports. That is, initial analyses focused on the understanding of each of the participants. After the first group sessions, research assistants used content analysis (Julien, 2008) for summarising the main likes and dislikes, motivators, and emotions per participant. Next, several group sessions were performed among researchers for identifying data patterns across participants.

4. Results and discussion

This section will present the overall results in accordance to the five objectives of the study. In order to achieve objectives one, two, and three; the first part of this section will discuss the user experience of individual participants. Then, the second part of the section will develop objectives four and five for presenting the classification and characterisation of these individuals in user groups. Pseudonyms will be used when addressing participants and verbatim will be translated from Spanish to English.

4.1. EnCicla users and journey maps

For identifying the stages that were perceived by the EnCicla users (objective no. 1), journey map descriptions were initially created for each participant. Table 2 presents an example of the description of the journey map of one participant: Milena Rojas. The table presents Milena's stages and substages of the bike route, emotions, the correspondent explanations, as well as the concerns behind the emotions. For this case, Milena identified four substages: A-D. For substage A, the emotions were interest and confidence. The explanations she gave to those emotions are included in Table 2. Through the use of laddering, the researcher identified that the concern at the base of this emotion was to have a transportation vehicle. Identified concerns always belonged to one of the substages of the experience. For instance, substage A related to a semantic concern (having a transport vehicle), substage B to a perceptual concern (taste for sensations), and substage C to an emotional concern (feeling calm when reaching the destination). In general, there is variability in the number of stages perceived by the EnCicla users. In spite of this, the analysis of all participants revealed that three distinct stages of the experience of using

Table 2
Journey map description of an EnCicla user: identified stages, substages, emotions, the correspondent explanations, and the concerns behind the emotions.

Stage	Substage	Emotions	Explanation	Concern
1	A	Interest and confidence	"I come from the Metro Station Itagüí to the Metro Station Suramericana and I know what to use for transportation to go to the university."	Having a transport vehicle
2	B	Joy	"I take my bike and I like the feeling when using it."	Taste for sensations produced by a bicycle
	C	Calmness and serenity	"I go to the university following the bike path and I feel calm when I arrive."	Feeling calm when reaching the destination
3	D	Acceptance	"At the end of the student day, I return my bike at the Metro Station Suramericana in order to go home."	Returning home

EnCicla could be identified: Arrival at the EnCicla station, travel to the university, and return of the bicycle at the EnCicla station.

During the data analysis, the evaluation of the perceived functional likes and dislikes (objective no. 2) was based on the interview transcriptions. When participants were asked, *what do you like or dislike about EnCicla? Why did you like that? Why did you dislike that?* Participants used expressions such as: "very secure system," "the system is very technological," "there's a hole," "the traffic light is covered," and "no signal." For example, for the user Jose Restrepo, a functional like was identified when he said, "How easy it is to be transported, it is clean, it doesn't pollute and it doesn't deteriorate the city." A dislike was identified when he added, "they [the hosts] become entangled with the cell phone for the loan [of the bikes], they run out of battery, and then, I got wet." In general, the most frequent likes for EnCicla users were saving time and money, quality of life, ease, ecology, flexibility (at the semantic level and most of them are values), and comfort (at the perceptual level). The dislikes were mostly placed on the behaviour of other users, dangerous road intersections, insecurity (at the emotional level), limited coverage (at the semantic level), and getting wet from the rain (at the perceptual level). In general, data analysis revealed more likes than dislikes in relation to the stages of the UX.

Next, the data analysis focused on assessing the affective reaction during the perceived stages (objective no. 3). For further understanding the identified stages, a summary of visual results was created for each participant. Fig. 3 provides an example of the EnCicla user called Jose Restrepo. This participant identified five journey substages (A-E). The predominant emotion for substage A was optimism, for substage B was confidence, for substage C was surveillance, for substage D was fear; and for the last substage E, the emotion was acceptance. This visual profile allowed the display of emotions in accordance to its valence: positive emotions were placed in the upper part of the graph and negative emotions in the lower part.

The Plutchik circumplex was useful during the interviews as it allowed participants to describe the basic emotions, as well as mixed emotions, that were felt during the identified stages of the journey. For instance, when describing her journey, Gloria Livandi manifested joy and anticipation as she arrived at the EnCicla station. A primary dyad was identified as optimism. Another example is Daniel Mejia. He expressed feeling "desperate" when describing his experience of driving his bike while avoiding some obstacles (e.g. trash) that were left on the bike path. He described being "afraid of falling because of the trash" and sadness "at the lack of respect for the cyclist." The description given by the participant was interpreted as a secondary dyad of despair, which consists of a mixture of the basic emotions of fear and sadness.

In general, the user-centered approach allowed the creation of journey maps including the stages perceived during the experience of the service for each of the participants in the study. It also facilitated the identification of the functional aspects that were common to the UX, as well as the emotions that were experienced. The latter affective reactions were particular to every user and their own concerns. Yet, during the data analysis, similarities started to emerge across users. Interestingly, even though the EnCicla users' likes were usually directly related to their own experience of the BSS, the dislikes were focused unto other individuals (e.g., pedestrians) and the physical context. If only rational variables (on the functional level of the BSS) were to be considered in the study, some participants would have provided a pessimistic view of the system. On the contrary, overall findings beyond the functional level demonstrated that the majority of EnCicla users described the UX as beyond satisfying, sometimes to the level of delight.

4.2. Classification and characterisation of EnCicla user groups

This second part of the results section focuses on characterising and classifying the various users of the system (objective no. 4) and identifying the motivating factors for using EnCicla (objective no. 5). The thematic analysis for classifying and characterising EnCicla users was mainly based on the reports that were made for each participant and the interview transcripts.

During the classification process of all participants, the initial collation yielded five groups: Satisfied, Grateful, Adapted, Ecological, and Civic. During this classification, concerns were the most discriminant element when forming the groups. After further analysis, Ecological and Satisfied groups disappeared. Satisfied was absorbed by a new group called Lovers and Ecological was absorbed by the group Civic. Finally, only four groups remained. The first group is the *Lover*. These EnCicla users

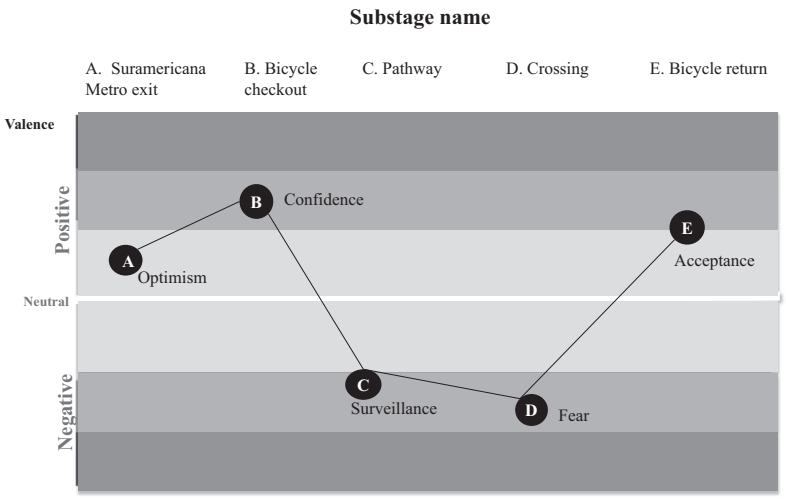

Fig. 3. Journey map of an EnCicla user: substages, emotions and valence felt during the bike tour.

felt proud and fulfilled when using EnCicla. Lovers enjoyed cycling and related the experience with fun and relaxation. An example is David Mejia when stating, "it makes it nicer going to college." He felt calm and enjoyed every moment of journey. Lovers also saw EnCicla as an excellent choice to help the environment and enjoy not only the journey but the city. For instance, Alejandra Correa explains, "it's an environmental system that saves time and is fun. The city feels different!" Similarly, Laura Ruiz commented, "it [EnCicla] makes it easier to be transported. It is clean, non-polluting, and does not destroy the city." Lastly, Lovers also liked to be admired by others while using the EnCicla's bikes, but would not be willing to take an active role in attracting new users or educating citizens.

The second group is the *Civic*. These EnCicla users were convinced EnCicla was the best things that happened to the city, as it is the case of Jose Rios. He explained that he liked "everything" about EnCicla, and further explains, "...I like its safety, the bicycle, lights, and basket. I do not need anything else. It has luxuries, it has it all." Civics saw EnCicla as a means of transformation to positively affect civic culture. Civics were individuals who liked to experience the city's development and strengthening of its culture. Arguably, they emphasised how the city inspired them even more than EnCicla itself. For example, Simon Velez said, "during the tour, I can see the city. I feel awe and wonder... I want other people to admire the new system and I want the bicycles to draw the attention of others." Civics also expressed commitment to any initiative that improves the quality of life and positively modifies the behaviour of citizens. Civics were active communicators who loved to educate both the pedestrian and automobile drivers.

Out of the four EnCicla user groups, the third group was the *Grateful*. These users felt that the BSS solved a problem because they no longer had to walk or take a bus, which additionally saved them time and money. EnCicla improved their quality of life and therefore they were grateful. EnCicla gave them comfort and independence in the form of transportation. Juan Lujan explains, "[EnCicla] greatly improved my mobility. Previously, I had to walk for half an hour from the [Metro] station to the university, and now it takes me 15 min! Then, that's a benefit." The fourth and last group was the *Adapted*. For these users, the EnCicla benefits outweigh the drawbacks. Although they were purely functional users, they were not emotionally attached to EnCicla and did not like cycling. Erika Ochoa commented about this, "[EnCicla] is practical. I do not have to own a bike." Then, EnCicla was the least-worst option of transportation. The system provided a connection between their departure and destination points. Jesy Hoyos further explains, "Now I save 10 min each way to go to college, I walk less, and sleep more." Yet, Adapted users usually felt insecure and fearful when riding the bikes. They were highly critical of the system and did not want to influence anyone else to use the system.

In overall, the integration of the visual analysis of individual users allowed researchers to create unified journey maps for each of the EnCicla user groups. An example of the journey map of the Lovers is provided in Fig. 4. This figure shows the three main stages and the identified emotions and its valence, for each of the EnCicla users that were classified as part of the Lover group. A different line represents each user in the group and each point corresponds to an emotion felt during the stages. Concentrations of points are visually highlighted in order to show possible patterns. Although there is a certain degree of subjectivity in this analysis, during the group sessions, researchers had to agree about these patterns. As an example, Fig. 4 shows how most emotions are positive with high intensity during the initial and middle stages of the journey. At the last stage, there is a concentration of positive emotions, although there are some negative emotions, like sadness or regret. However, some of these negative emotions were positive in meaning. As an example, some Lovers felt sorrow because they did not want to conclude the journey and wished the experience lasted longer.

When classifying EnCicla users in groups (objective no. 4), each EnCicla user group detailed description included the motivators (i.e., concerns) to use the EnCicla system, likes, dislikes, and emotions generated by the experience. This charac-

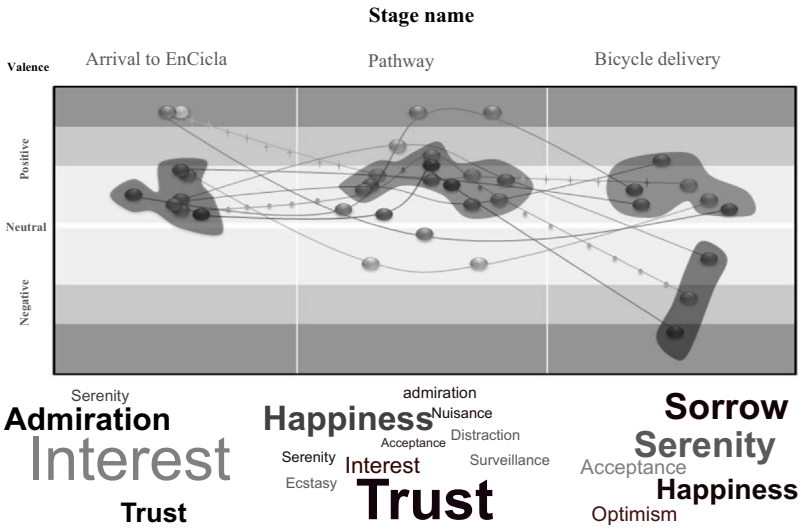

Fig. 4. Journey map of the EnCicla user group the Lover: stages, emotions and valence, and content analysis of the emotions per stage.

terisation then allowed for the identification of the main motivating factors for using EnCicla (objective no. 5). The following motivators were then identified: (a) *environmental impact*, users felt they were contributing to the environment through the usage of an ecological and alternative transportation; (b) *enjoyment*, users experienced fun and relaxation during usage of the system; (c) *saving time and money*, users perceived economical gains and efficiencies in transportation, as well as a positive change in their routines; and (d) *physical security and safety*, users were concerned about falls or collisions, as well as insecurity, as they were focused on external factors of the BSS. These motivators for using EnCicla varied among user groups. For the case of EnCicla users classified as Lovers, the environmental impact of EnCicla was the main motivator, followed by enjoyment, and savings in time and money. For Lovers, the BSS had a positive impact in their lives and the city and they felt proud to belong to it. Across EnCicla user groups, the environmental impact and enjoyment of using the system motivated Lovers and Civics. A sense of belonging, caring, and promoting the BSS, motivated the Civics. Time savings motivated all user groups; while money savings was the main motivator of the Grateful.

Findings differ from other studies of cyclists, such as Gatersleben and Haddad (2010), that focused on city cyclists in general rather than cyclists belonging to a bicycle sharing system. Nevertheless, some similarities can be found in their classification. The EnCicla user group the Lover presents similarities with the stereotypical Responsible cyclist. The latter was described as a kind person that abided by the rules of the road. The Commuter stereotype also presented parallels with most EnCicla user groups since they used the bike for commuting in all weathers. Other studies have focused not in the classification but the description of the structural stories of the cyclists. That is the case of Freudendal-Pedersen (2015) that describes the experience of being a cyclist in two European cities. The author explains that being a cyclist in Copenhagen is sometimes perceived as dangerous because of their car dependency. For EnCicla users instead, the dangers of using a BSS are outweighed by the benefits offered by the system. Furthermore, having a car would not solve their transportation needs because the cost of having a car may be inviable, parking is limited in the area, and the city car traffic is sometimes unbearable.

5. Conclusions

This study assessed the user experience with EnCicla, a new bicycle sharing system (BSS) in Medellin, Colombia. The main purpose was to understand how the users related to the system within a user-centred conceptual framework based on Desmet and Hekkert (2007). Researchers found the rational attributes (likes, dislikes, motivators) by directly observing and interviewing users. Most dislikes were related to the system's physical (e.g., trash on the pathways) and cultural context (e.g., behaviour of car drivers and pedestrians). EnCicla users described their experience as a continuum divided into three distinct stages: Arrival to the EnCicla station, travel to the university, and the bicycle return at the EnCicla station.

Although some likes and dislikes were similar across the four EnCicla user groups, the affective reaction showed differences across user groups. The emphasis on the affective nature of the experience allowed a further understanding of the UX. If only rational variables – functional level – had been taken into account, a pessimistic conclusion about the system may have been obtained. However, when evaluating the overall experience and considering affective reactions, researchers found an overall positive and beyond satisfactory experience. Furthermore, some of the emotional reactions with negative valence

– for example, sadness for having to return the bike – had a positive meaning in the user experience, which may be more difficult to understand with a quantitative approach.

Data revealed four EnCicla user groups: Lover, Civic, Grateful, and Adapted. The first user group, the Lover, usually enjoyed the journey and related excitement with the BSS and the city transformation that was taking place because of it. The second group, the Civic, was focused on the urban culture and was inspired by using EnCicla. The third group, the Grateful, was motivated by economic reasons because of time and money savings. The last user group, the Adapted, was a functional user that believed that EnCicla was the least-worst option of transportation. In regards to motivators (i.e., concerns) to using the BSS, the environmental impact and enjoyment motivated Lovers and Civics. A sense of belonging, caring, and promoting the BSS, motivated the Civics. Time savings motivated all user groups while the Grateful was mainly encouraged by economical gains.

The theoretical framework along with the chosen qualitative approach, were found appropriate for the understanding of the subjective aspects of the user experience. This further allowed to uncover aspects of the experience that are particular to EnCicla and its cultural and social context. During the interviews, participants easily expressed their opinions about the functional aspects of the experience. However, for understanding the subjective aspect of the user experience, the usage of the Plutchik circumplex proved useful. Laddering was also valuable for uncovering the reasons behind the emotions (i.e., concerns) and behaviours of the EnCicla users. Even though the motivators related to the functional variables were confirmed, such as saving time and money, other important and unexpected motivators were related to emotional variables, such as admiration for others and the pleasure of enjoying the city by bike. Moreover, some users considered themselves as leaders and educators of a civic cultural change.

6. Limitations

The main limitation is related to the sample that was selected during the pilot program of EnCicla. Participants were individuals who had already registered to use EnCicla. Therefore, many of them had shown willingness and excitement to use the new BSS.

7. Managerial implications and future research

Study findings provided managerial implications for improving the EnCicla service design. Some of the recommendations were to: (a) improve the signalling and lighting of the EnCicla pathways, and install cameras, emergency phones, and buttons in certain parts of the pathways; (b) articulate actions with other public agencies acting in the area, such as transit (e.g., better coordinate duration of traffic lights connected to EnCicla pathways), police (e.g., assign police patrols on bicycle routes), and the garbage collection entity (e.g., better coordinate garbage collection schedules); (c) improve efficiency of the bicycle return process; (d) automatise the bicycle lending process; (e) standardize hosts' scripts for explaining the BSS to new users; and (f) create a communication strategy to better engage the public and connect with the users of the system.

Findings confirmed that the BSS was perceived as an effort of the city to improve the quality of life of its citizens. EnCicla was found to favour sustainable development, responsible consumption, and environmental responsibility. However, findings further revealed that EnCicla operators had certain misconceptions about the motivators (and inhibitors) to use the system. For instance, operators initially believed that users were discouraged to use the system because of the tiredness and sweat the cycling may imply. On the contrary, users felt motivated to use the system because they enjoyed the ride and expressed feelings of relaxation and calmness. Operators also believed users were motivated by the health benefits of cycling. However, this motivator was not found relevant to users. Lastly, operators believed that users were afraid to have their bikes stolen. However, users in fact felt safer riding the bike than walking to the universities.

Findings also revealed other important aspects of the UX that were not initially considered by the operators of EnCicla. Some of these highlighted aspects were: the pride users felt when using the system, the enjoyment and pleasure of riding the bikes, and feelings of belonging to a civic culture. In regards to the later point, users strongly felt that the city cared about them because it has implemented the BSS. Users also believed that the BSS gave them a chance to give back to the city by being good citizens through the correct usage of the BSS and its promotion. Many users felt admired by others because they were using the system and felt they were pioneers in the transformation of the civic culture. Consequently, following the successful implementation of the Metro culture, researchers concluded that the EnCicla system had an opportunity to transcend their functional value and become a vehicle of civic change for transforming the area and its citizens. In this way, EnCicla could merge itself within the Metro culture. That is, EnCicla could educate users into being good cyclists and respecting pedestrians and the car traffic in order to expand civic engagement.

Additional recommendations were given to the EnCicla operators for hiring the most appropriate hosts. Hosts are EnCicla employees that play an important role at the EnCicla stations: They explain the system to new visitors and attend regular EnCicla users. Researchers recommended to hire Lovers as hosts because they enjoyed the system, were friendly to others, and usually shared their positive experiences.

In regards to policy, findings of this study can provide information to the city government for better articulate investments, as well as coordination with other public entities (e.g., transit and police), for favouring the BSS integration with the overall transport system of the city. Since integrating sustainability in urban mobility is facilitated by the cooperation

and funds from the national government (Tsay & Herrmann, 2013), local-level urban transport policies can continue to incorporate investment in projects and infrastructure for improving non-motorised systems, such as EnCicla. The medium-long term goal can be to positively influence the national-level urban transport policies. This is contrary to what is usually seen in advanced countries where the role of national governments (not the local) is to set the general vision for sustainable transportation (Tsay & Herrmann, 2013). In this way, local projects, such as EnCicla, can be connected to national goals and receive further funding and support. Local governance can also coordinate with other cities with BSSs and share best practices of management and operating of BSSs.

Future research may quantify the EnCicla user groups. Qualitative methodologies may follow up implemented changes in service design. Future research can also focus on collecting information to better locate new EnCicla stations and possibly articulate EnCicla with other means of transport, such as MetroPlus.

8. Glossary

8.1. EnCicla

A public bicycle sharing system that offers citizens a defined number of bicycles for sharing in Medellin, Colombia. These bikes facilitate user mobility and are to be used as means of public transport. The official website is: http://www.encicla.gov.co/.

8.2. UX

A user experience (UX) with a product or service is defined as the awareness of the psychological effects elicited by the interaction with the product (Hekkert & Schifferstein, 2008).

8.3. Concern

Concerns are preferences for a particular state of things in the world (Ortony et al., 1988). Concerns are expressed through interests, values, norms, objective, motives and others (Desmet, 2003a). Concerns are fundamental part of cognitive appraisal theories of emotions (Ortony et al., 1988).

8.4. Appraisal

A semiautomatic cognitive affective process in which emotions are generated as a result to an evaluative process to a stimulus (Ortony et al., 1988).

8.5. Emotion

A multicomponential psychological phenomenon presented as a reaction to a relevant stimulus (concern) for a subject. It has expressive, somatic, subjective components (Fridja & Scherer, 2009; Sander & Scherer, 2009). The relationships between each component phenomena and their role are far from clear (Fridja & Scherer, 2009). Emotions are characterised as having a positive or negative valence and a level of arousal.

8.6. Motivation

A psychological phenomenon concerned with "the nature and functions of wanting and their relation to knowledge and doing" (Higgins, 2009, p. 265). Motivation comprises different types of wants involving many different experiences. Obtaining or not what one wants will produce different emotions (Higgins, 2009).

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