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Perceived Attractiveness and Security of Design Features in Urban Parking Lots

Case study: Stationsplein, Enschede, the Netherlands

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Abstract:
Urban designers and landscape architects argue that physical characteristics of design elements in parking spaces have a direct influence in the perception of attractiveness and the sense of security of the users. Empirical research in human perception helps creating a solid conclusions and recommendations promoting quality of life. A lot of studies concluded that attractiveness and security were related to a number of the physical features and other scenery variables; still these variable elements and their influence on public perceptions are still vague. Thus, this study aims to empirically investigate the effects of architecturally designed elements on public perceptions of the attractiveness and security of public parking lots. For that end, the study introduced a methodology to asses these two variables on touch-screen decision tables, and how different users and stakeholders are affected by physical settings in the process of recognizing attractiveness and the sense of security in parking lots. A sample of urban planning and management students along with academic professors of urban based courses had been selected randomly to participate. A set of 360^{o} pictures were prepared; they represent an existing parking lot that suffers some attractiveness and security controversial issues. This set of 360^{o}'s was manipulated in terms of the designed physical features, other human spotted, and the occupancy rate of the parking lot. The current status of the parking lot and these manipulated images were rated by the participants for both attributes of attractiveness and sense of security. Specific elements were pointed out and graded for both attributes. This study follows a quantitative case study methodology to identify how the abstract environmental qualities such as attractiveness and sense of security are being perceived in urban parking lots by their contents and physical settings.

Keywords: Urban design- parking lots - attractiveness - sense of security.

1. Introduction & research necessity:

Urban development must respond to many factors such as economics, technology and function, but this does not mean that visual quality and the feeling of being secure should be overlooked (Nasar, 1987). Instead, human perception should be considered along with the other factors. Urban development creates a lot of interconnected functions and land uses that are necessary to the healthy flow of inhabitants in their daily life. Although parking lots may detract from the overall visual quality of urban areas, parking is mandatory as most zoning ordinances regulate the appropriate amount of parking that is provided for different densities of development especially in central commercial areas, where customer flow depends in part upon adequate, convenient parking (Anderson & Strokes, 1989; Shaffer & Anderson, 1983; Schuler, 1981).

Parking areas and intrusive elements are the type of land uses that tend normally to decrease perceptions of satisfaction predominate in the urban scene (Anderson & Schroeder, 1983; Kaplan, 1983). Incorporating landscape materials in parking lot design is one of the best and most frequently used techniques to improve the visual quality of urban-sites (Anderson & Strokes, 1989). Therefore, research in human perception and cognition can contribute to the development of guidelines for environmental quality of parking areas as well as generating innovative solutions to improving existing ones. Results can also be used to guide private development, public improvements and the selection from landscape design alternatives to satisfy the aesthetic and safety needs of the parking plots' users.

Though, these definitions must be described carefully to set a common understanding and to limit the scope of this research. Human aesthetic preference and his perception of attractiveness towards parking lots are identified in this research as: the good appealing of the surrounding scene based on its components, and whether it's attractive to walk or cycle through or even park your car inside. While the sense of security is defined as how people perceive the surrounding physical environment to judge their possibilities of not being attacked insulted or harmed in that situation, and/or the possibility of getting urgent help.

Urban designers and landscape architects argue that physical characteristics of design elements in parking lots have a direct influence in the perception of attractiveness and the sense of security of the users. Van Herzele & Wiedemann (2003) claimed that in one way or another, the abstract qualities derived from human—environment studies are perceived through physical features. A comprehensive explanation of the relationship between urban design and criminal behavior has not yet emerged (Repetto, 1976). Craik and Appleyard (1980) pointed to a glaring need for determining what aspects existing in the surrounding spaces increase perceptions of safety from crime and how attributes of settings lead to differential sense of fear. However, existing knowledge on how the physical appearance effects perceived qualities is still limited, especially in relatively neglected environments such as parking lots.

Since this parking areas make up such an inseparable part of urban land use, the present study will empirically investigate potential physical features and visual influences that can be manipulated or implemented to increase the sense of security and attractiveness perceptions of the users. In another words, this study asks which physical features of urban parking lots that when carefully designed, can increase the common perception of such areas in both terms of safety and attractiveness?

2. Literature review:

Carp and Carp (1982a) indicated that both aesthetics and safety were very important in assessing the perceived environmental quality of a neighborhood. Previous research in

urban spaces indicated that attractiveness and perceived safety are at odds in some setting, but that the two attributes can be enhanced simultaneously by appropriate combinations of design features (Anderson & Strokes, 1989). Foster, Glies-Corti & Knuiman (2011) mentioned that attractiveness tended to be associated with pedestrian infrastructure, aesthetic qualities and activity generating land-uses (ensuring the presence of people).

Social science research and theory has emphasized the role of water in human perception, evaluation and interpretation of places. The importance of water as an aesthetic element in the landscape was recognized as early as the Mesopotamian, Egyptian and Islamic gardens, and the importance of water continues to be recognized by contemporary landscape planners and designers. Attempts have been made to characterize the formal aesthetic and scenic qualities of water in the landscape. Water features have consistently been found to be important to human perceptual evaluations of landscape scenic quality and to the quality of many outdoor recreation experiences. Viewing water in the landscape has been found to have beneficial psycho-physiological effects, potentially serving important restorative health needs. For the human users, water in the urban spaces can also be a source of aesthetic attraction. Water experience is relatively passive, as in viewing the scenery or enjoying a cool, shady respite. Sound of running water can be an important component of human experience of water in the landscape, either separately or in interaction with visual experiences (Burmil et al., 1999; Hetherington et al., 1993). Burmil et al. (1999) concluded that water's motion, individually and conjointly with its sound, has shown important effects on human perceptions and evaluations of urban spaces.

For the enhancing aesthetic preferences, Anderson & Strokes (1989) said that incorporating landscape materials in parking lot design is one of the best and most frequently used techniques to improve the visual quality of urban sites. Colorful flowers and bushes always contribute positively to the feeling of comfort and harmony in nature. The view of green spaces and shaded areas under high trees always encourage outdoor behaviors and social gatherings. Akbar (2003) suggests that the people like a combination of grass and flowering herbs along with trees in hedges. Another important result of Akbar's research derives from the preference of majority of the respondents for randomly spread vegetation growing in adjacent areas. This finding supports one of the principles of environmental aesthetics according to which a thing in its unorganized order is beautiful.

Planting, however is a mixed blessing, however; it may improve attractiveness but it can detract from users' sense of security, because the ability to detect the presence of potential attackers is intuitively important to one's sense of safety, some designers recommend the removal of vegetation to increase the perceived security of urban outdoor spaces (Anderson & Strokes, 1989). Preliminary findings in the literature indicate that the vegetation, as well as spatial design, levels of use, communication, lighting and surveillance contribute to the safety of parking lots. A positive influence of a well-designed landscape was identified in the perception of security by Ozguner & Kendle (2006). Shaffer & Anderson (1983) and Bolden & Sharitz (1983) mentioned that landscape experts frequently recommend enhancing the attractiveness of commercial properties by planting vegetation. But in turn experts recommend removing vegetation to enhance another important aspect of urban settings, the perceptions of security by patrons (Boldon & Sharitz, 1983).

Lewis & Maxfield (1980) suggested that fear of crime in a neighborhood may be triggered by a broad range of conditions, and that fear does not consistently respond to official crime statistics. Foster, Glies-Corti & Knuiman (2011) and Brown & Altman (1983) found physical barriers (e.g., fences and locked gates); symbolic barriers (e.g., evidence the home was occupied, personalized decoration) and the potential for surveillance (e.g.,

visibility from neighboring properties) were protective against home burglary. High levels of enclosure and walls may lead to decrease in perceived security due to getting into a dangerous neighborhood.

Foster, Glies-Corti & Knuiman (2011), Luymes & Tamminga (1995), and Nager & Wentworth (1976) nominated neighborhood incivilities such as litter, graffiti and vandalism may directly affect residents walking behavior by detracting from the aesthetic appeal of public space; while environmental attributes of parks which contribute to a perception of danger are dark, enclosed places and visual isolation, along with evidence of anti-social behavior such as graffiti, trash and broken bottles and drug paraphernalia.

Graffiti is the name for images or lettering scratched, scrawled, painted or marked in any manner on property. It is defined as any type of public markings that may appear in the forms of simple written words to elaborate wall paintings. Sometimes graffiti expresses social and political messages and a whole genre of artistic expression is based upon spray paint graffiti styles. Graffiti may simply indicate bored teenagers, and graffiti writers may achieve some personal gratification from exposing their graffiti to as many people as possible. To some, it is an art form worthy of display in galleries and exhibitions; to others it is merely vandalism. Graffiti can be used as a gang signal to mark territory or to serve as an indicator or "tag" for gang-related activity (www.wikipedia.com). Hence some people recognize it as an outlaw act, the capacity for incivilities to inhibit physical activity and walking may be mediated by perceptions of crime and safety (Foster & Giles-Corti, 2008; Loukaitou-Sideris & Eck, 2007; Ross, 1993). Foster, Glies-Corti & Knuiman (2011) warned that if these incivilities such as graffiti are not promptly repaired, disorder will escalate, initiating a spiral of fear and community mistrust, which according to Skogan (1990) will weaken social control in the neighborhood, allowing incivilities and crime to proliferate.

A growing body of literature is concerned with the issue of safety in public spaces, and in particular with women's' perceptions of safety (Orsini, 1990; Wekerle, 1991; Luymes & Tamminga, 1995). Mozingo (1989) has documented distinct differences in the ways men and women perceive and use spaces. Women in particular tend to avoid open spaces that are less used and thus perceived as unsafe, especially at night (Wekerle, 1991). Even during the day, observations have shown that men comprise the overwhelming majority of users in many public urban lands (Nager & Wentworth, 1976; Mozingo, 1989; Luymes, 1992).

The literature seems mixed in providing an indication of what urban planners can do to achieve attractiveness and security for city dwellers and visitors. Previous research with urban parks indicates that attractiveness and security can be achieved simultaneously by appropriate combinations of design features. For example, a combination of natural vegetation emphasizing well maintained ground covers and taller, clean-bold trees, along with developed features, were associated with higher evaluations of both perceived security and scenic quality for urban parks in Atlanta, Georgia, and Chicago, Illinois (Schroeder and Anderson, 1984).

A comprehensive explanation of the relationship between urban design and criminal behavior has not yet emerged (Shaffer & Anderson 1983; Repetto, 1976). Craik and Appleyard (1980) pointed to a glaring need for determining how elements in the built environment would increase perceptions of attractiveness and safety from crime, and how attributes of settings lead to differential fear of crime.

3. Methodology:

3.1 Research design

A case study research design will be adopted. A case study is an empirical inquiry that investigates a setting or phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident (Groat & Wang,

2002). This approach best fits the current investigation because it has the following advantages: it focuses on cases in their contexts; it holds the capacity to explain causal links, helps developing a theory, uses multiple sources of evidence, generalizability to theory, and distinguishing the case study. The quantitative paradigm was chosen because it's high accuracy in alternative design evaluation. It refers to systematically converting empirical investigation of subjective properties and phenomena, into relationships expressed by statistical operations. Still this research approach might be questionable considering the quantitative data as rigid information.

The procedures used in this study is adapted from a previously developed one to provide public evaluations of wild-land scenic quality (Daniel and Boster, 1976), and has since been successfully applied to the urban landscape for both attractiveness (Anderson and Schroeder, 1983; Shaffer & Anderson, 1983) and security assessment purposes (Schroeder and Anderson, 1984; Shaffer & Anderson, 1983).

3.2 Study area:

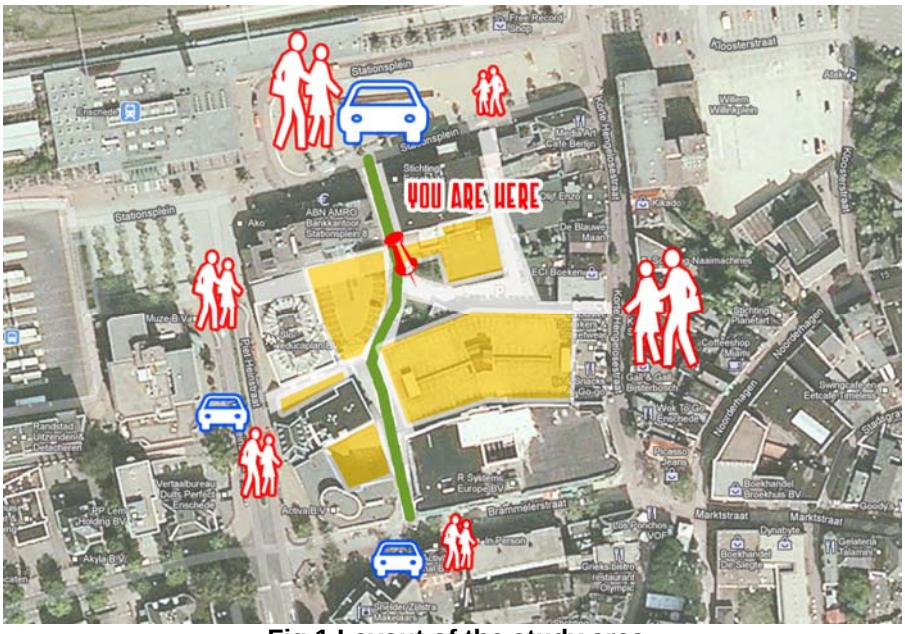

Fig.1 Layout of the study area

Showing different usage patterns & the standing point of where all the pictures were taken.

A wide public space in the city of Enschede, the Netherlands called "Stationsplein" was selected to represent the case study location (Figure 1) showing the different usages & the standing point of where all the pictures were taken. Parking spaces in yellow, paths in white and the size of human or car figures indicate the usage frequency of each illustrated path. The larger the symbol, the more frequent user-flow occurs. It exists in a central location in the city; it lies between the main bus & train stations leading in and out of the city, and the commercial centers of Enschede. Wide array of users pass by this area crossing to their destinations. In spite of its prime location, it is highly isolated from the open street. The open space is enclosed by a number of active and frequently used buildings which are:

- A multi-story parking garage in the south
- SLO/educaplan B.V. & ABN AMRO Bankkantoor Stationsplein in the west.
- The back side of Ricoh Document Center Enschede & Stichting Enschede Promotie in the north.
- The back side of Media Art Café Berlijn, Bagels & Beans cafe', Olijf Enzo shop, De Blauwe Maan shop, De Leckernij shop, ECI Boeken on the east.

On the vehicle usage levels, the open space itself has a parking space for two institutions, and it is an entrance to the multi-story parking garages, in addition to being an entrance to two private parking lots through the “Brammelerdwarsstraat” tight street (Marked green in Figure 1). There is no open access to streets through that space, this fact causes very poor average rate of 40 cars accessing the area per hour.

While on the human level of usage, it is mostly used as a short-cut that people use to walk or cycle from the train & bus stations to the active shopping centre and vice versa. People having their vehicles parked in the southern multi-story parking building, have their pedestrian entrance and exit directly into the study area but on a lower level of -1.10 m. Despite having a central location as well as having a lot of actively used building surrounding it, the study area only have pedestrian and cyclists passing by in average of 90 per hour.

The reason behind the previously mentioned low frequency usages is that passer byes, car owners, and users of this space have the fear of being attacked or being harassed. They related their fear to the constant existence of gangs and illegal drug addicts/dealers around that space. Nearby shop owners raised a lot of complaints to the local municipality calling for design interventions to limit the illegal activities and criminal behaviors in this parking zone, and consequently enhance the beautifulness of that space. According to the operative objectives, this research will determine the rational design features and the type of activities that when implemented or added will affect the sense of security and increase the attractiveness of the users.

3.3 Subjects:

A sample of 11 students of the ITC, Twente University, The Netherlands, in the 2011 academic year were selected randomly to participate in this study. Two academic professors teaching in ITC had participated as well. Thus, while the judgments were psychological, they should reflect those of planning and design practitioners. This institution hosts students and professors from all over the world; they come from diverse backgrounds, and different countries. This diversity in the selected sample had emphasized the effect of cultural background on the perception of measured variables in the results, in order to help defining how cultural differences influence the perception of the surrounding environment in the case of urban car parking spaces.

Some evidence exists for sex differences in perceptions of security with females tending to be less positive about safety (Carp & Carp, 1982b; Nasar et al., 1983). Moreover, females tend to prefer enclosed observation points, but men prefer open observation perspectives (Nasar et al., 1983), indicating that men and women view physical characteristics of scenes differently. To overcome the above mentioned limitations, all the subjects were randomly chosen to assure that the participants’ gender had varied in an intention to marginalize the error of gender differences of perception.

There is evidence (Nasar, 1982) that age might be an important factor influencing security evaluations. The participants’ age range might negatively affect the research results if the vast majority of the sample is less than 40 years old. This criteria was implemented due to the fact that young people tend to be more courageous and feel more confident about some situations than the elders. On the other hand, youth always have a changing mood of cognition when it comes to aesthetic preference; they compare the scene to more fashionable and famous background imagery of which in that case would be a fashionable contemporary landscape design, or they might be more classical oriented . The consistence of the results would then vary which might have misled the results. Therefore, more than 25% of the sample were 40 years old or more.

3.4 Photo samples and image manipulation:

This study depended mainly on evaluations conducted based on affecting the visual senses of the participants by observing real landscape, to result in certain emotions and

cognitions. According to Chokor (1990), the use of photographs as surrogates for real places or landscapes has become well established. Much of the researches on evaluating perceptions had recently worked with real effects manipulated shots as an attempt to standardize scenery and to make comparisons more objective. According to Jorgensen et al. (2002) computer manipulated images were found to be an effective way of illustrating and evaluating human reactions. The acceptability of photographs in such applications had indicated good results (Shaffer & Anderson, 1983). They had verified some results by comparing site visits to photo evaluation and find the results persistent.
Shaffer & Anderson (1983) had faced a main difficulty while shooting photographs of the parking lots. The number of photo slides taken per lot varied by size of the lot. For narrow lots along commercial strips, only one or two photos were enough to present the parking space environment, but for large mall areas and residential developments, as many as seven slides were needed and thus included in the sample. This limitation in available photography techniques had caused fragmentation of the study zone shown into several photos. There were too many slides for the observers to view comfortably, which makes the validity of the results questionable.
Having the previous problems in consideration, this research had used 360o panoramic photography that revealed the whole surrounding environment in high resolution imagery.

Fig. 1 Panoramic image just after sun set in the current status.

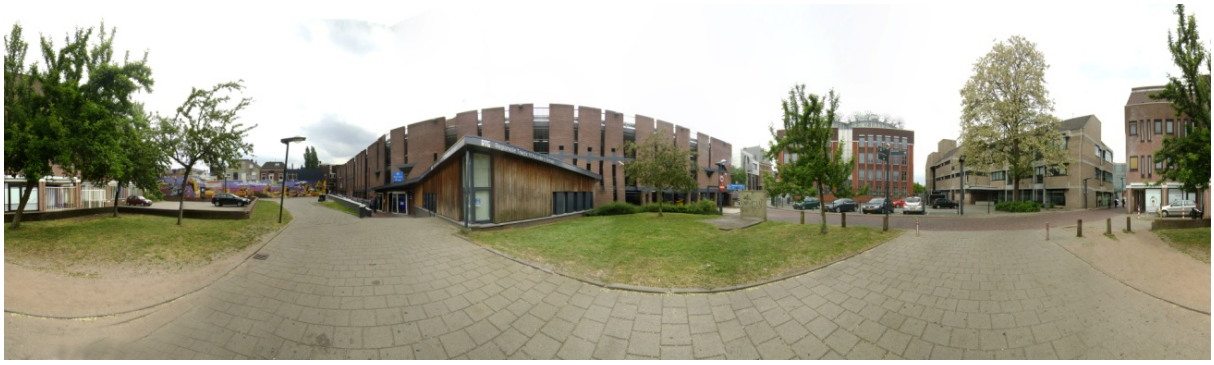

Fig. 2 Panoramic image in the early morning in the current status.

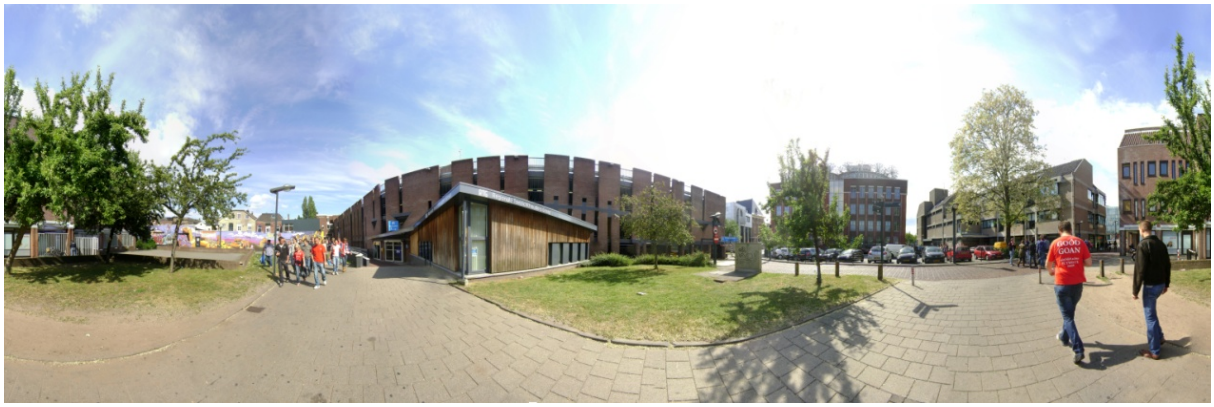

Fig. 3 Panoramic image in the afternoon after an important football match, it describes the area in its current status.

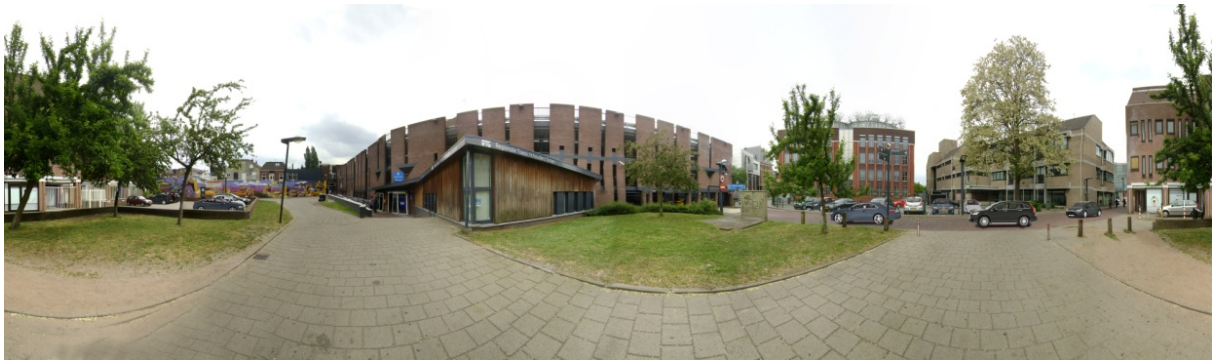

Fig. 4 Manipulated panoramic image adding extra numbers of vehicles to the scene.

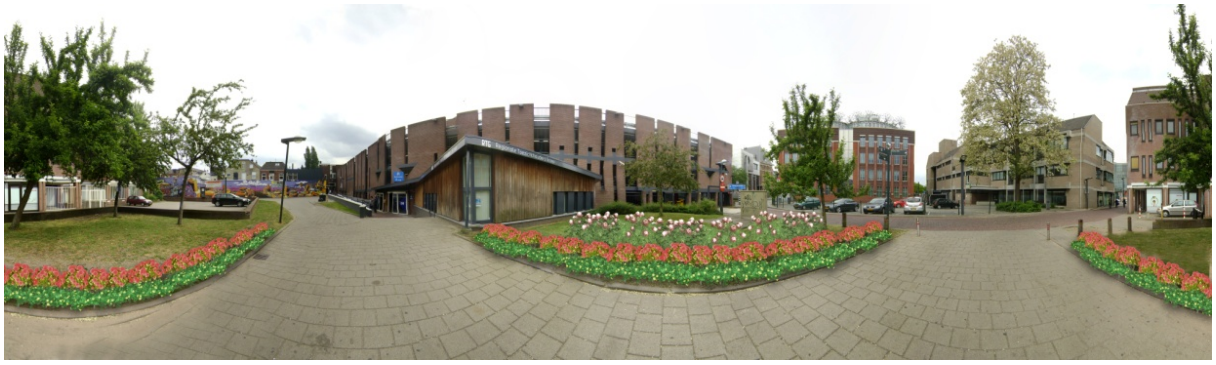

Fig. 5 Manipulated panoramic image adding flowers to the scene.

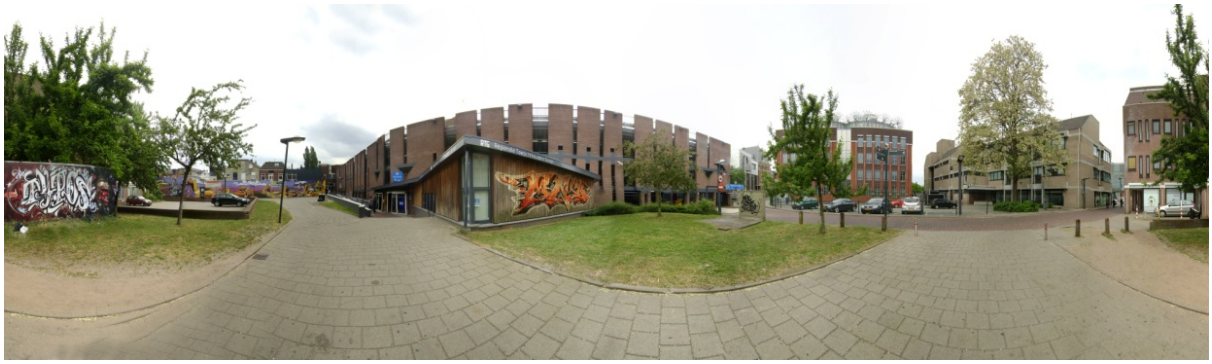

Fig. 6 Manipulated panoramic image adding graffiti drawings to the scene.

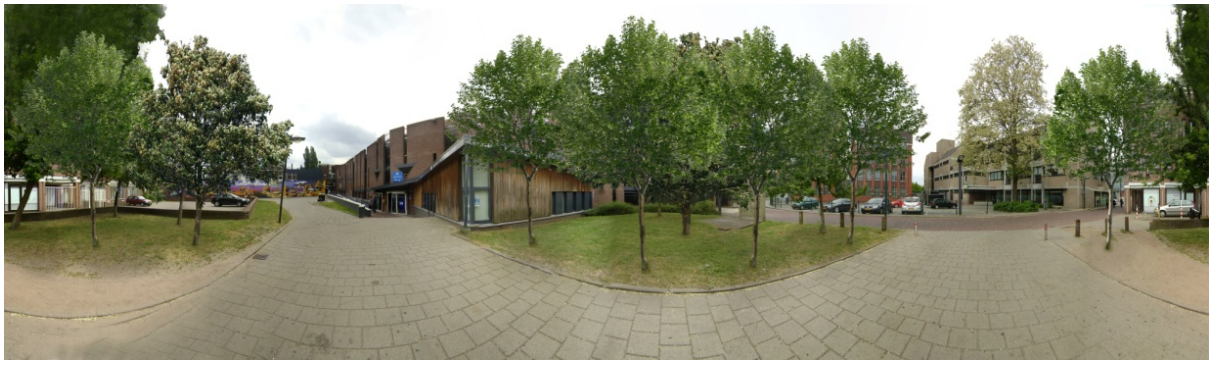

Fig. 7 Manipulated panoramic image adding heavy vegetation to cover buildings to the scene.

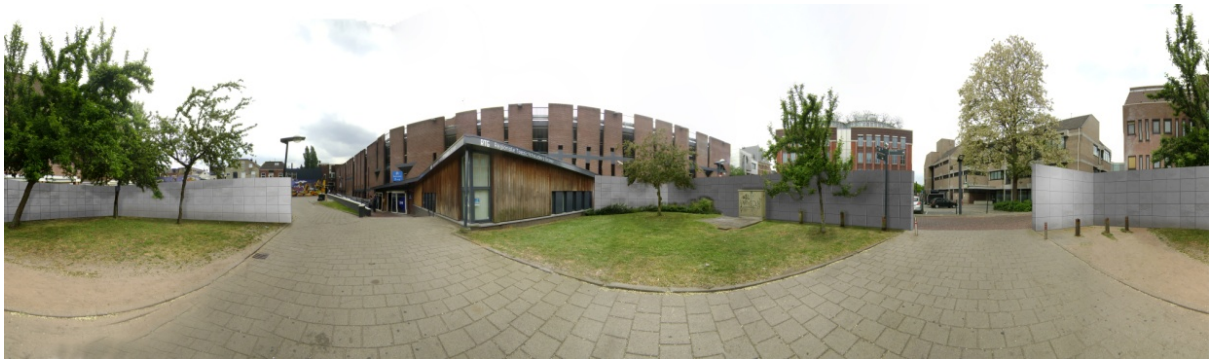

Fig. 8 Manipulated panoramic image adding walls to the scene in order to provide spatial enclosure.

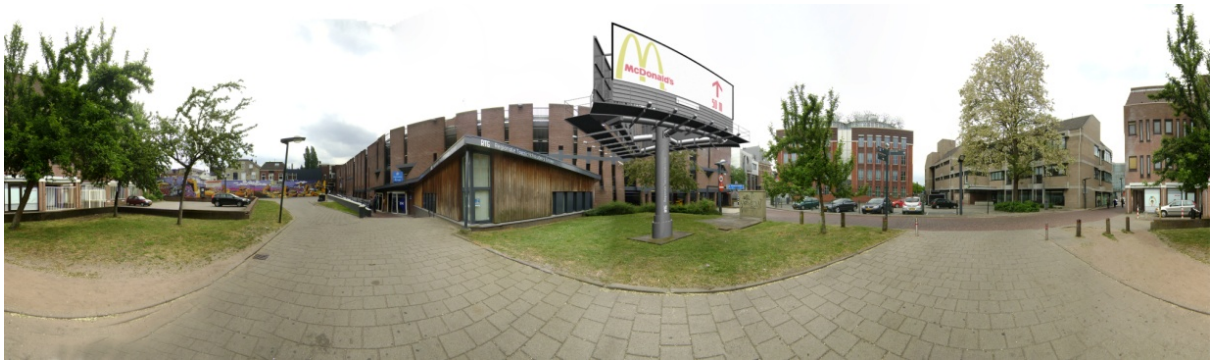

Fig. 9 Manipulated panoramic image adding familiar signs to the scene.

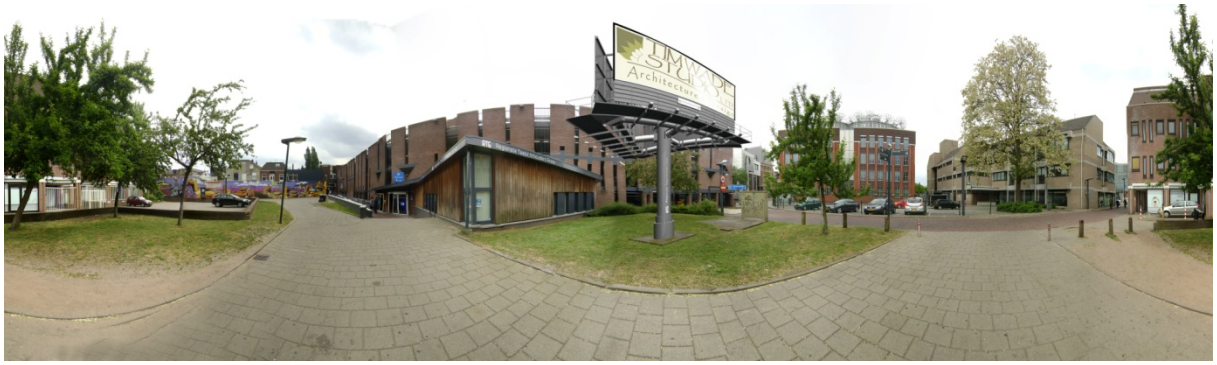

Fig. 10 Manipulated panoramic image adding unfamiliar signs to the scene.

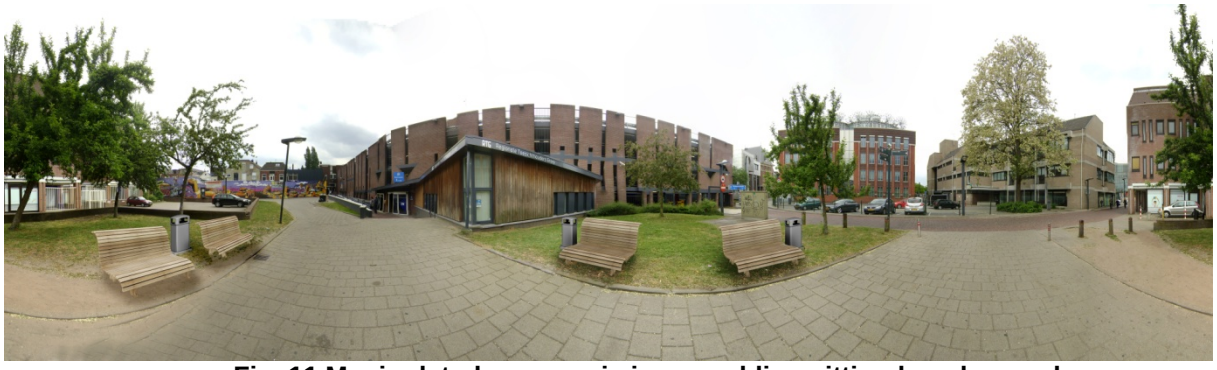

Fig. 11 Manipulated panoramic image adding sitting benches and trash cans to the scene.

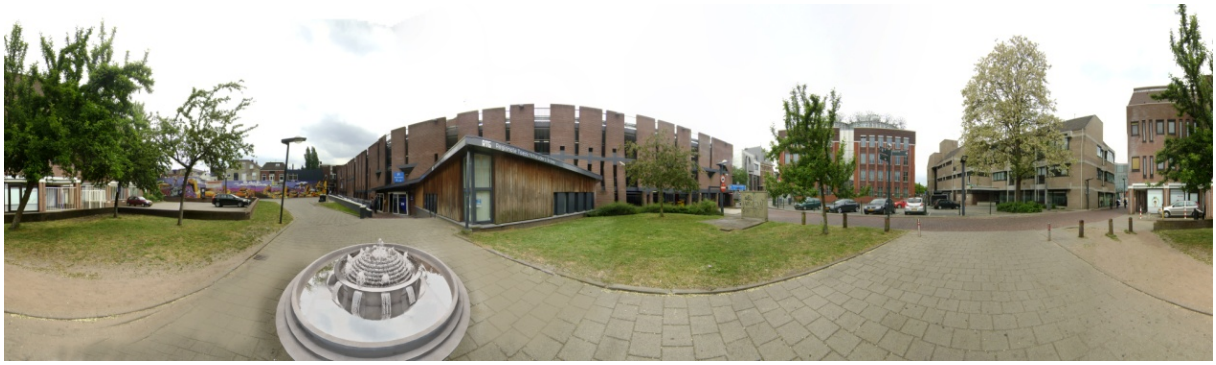

Fig. 12 Manipulated panoramic image adding water fountain to the scene.

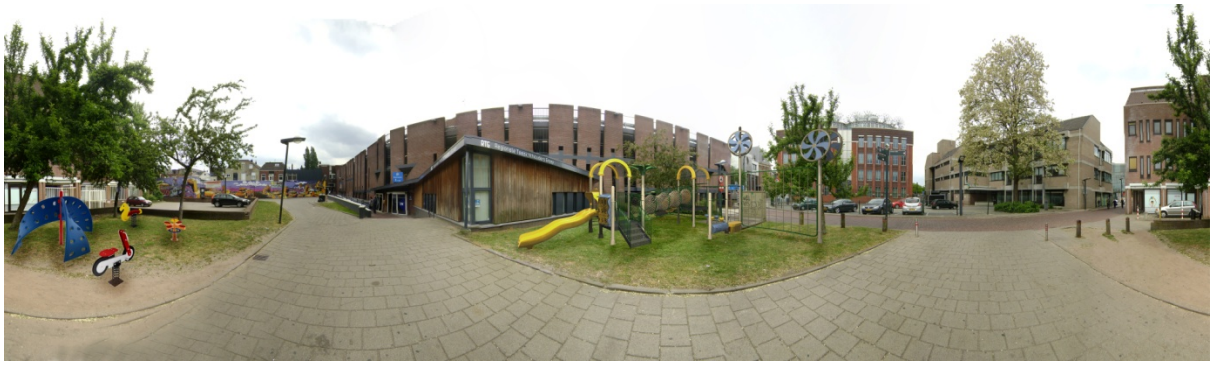

Fig. 13 Manipulated panoramic image adding children playground furniture to the scene.

Since the factor of time of day or night affects the perception of attractiveness and sense of security (Shaffer & Anderson, 1983); the current case study area was captured two times in different times of the day. The first was right after the sunset (Figure 2); the second was during the early cloudy morning (Figure 3). The third original image was taken in a sunny afternoon after an important football match for the whole of Twente Region (Enschede and surrounding towns) (Figure 4).

The process of preparing the panoramic images was developed by the author by the assistance of web tutorials and professional software. After capturing the images using normal digital camera, the images were assembled automatically using Adobe Photoshop CS3 and stitched together to form the flat wide image. The next step was to connect both ends of the wide images to form a complete 360^{o} that runs smoothly. There is a plug-in developed specially for that purpose using the Photoshop program called Panoramic Server Action. The final step was to export the panoramic 360^{o} movie to Quick time player by using Arcsoft Panorama Maker V.5. A series of movies that ran in Quick Time player were presented to the samples later during the evaluation process (Figure 15). Participants could navigate left and right into that image to see the whole panoramic scene. This small window had helped the sample to only concentrate on one visual cone instead of getting distracted by the whole wide 360^{o} image that looks unreasonable to the perceiver.

These 13 panoramic 360^{o} images were prepared to cover a wide range of physical design elements and patterns of using that space that could possibly be implemented and occur into the case study parking lot. The original image is (Fig. **2**) showing the current status. The elements added in the images were selected based on previous research's assumptions as well as the author's hypothesis regarding the affordability of the space to house such features.

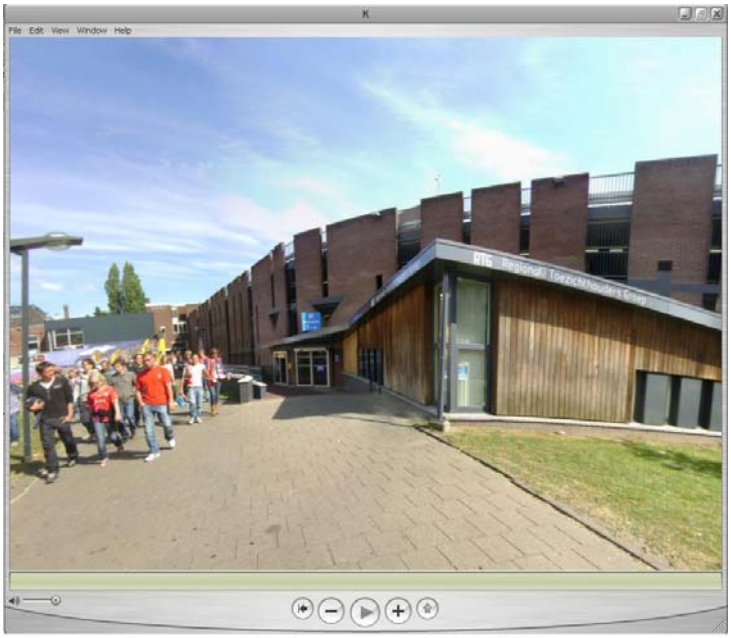

Fig. 14 Window of the 360^{o} image as opened to the participants on the touch-screen tables.

- Illumination and building lighting: in night is often perceived as unsafe potential entrapment places. In no case should lighting blur a person into a hazy shape, area-lighting should either be comprehensive and effective or not used at all, and its absence clearly communicated (Luymes & Tamminga, 1995). Fig. **1** shows the study area just after the sun set time so natural light was still in the sky, artificial lighting systems appeared clearly on the building facades or from light columns in that space. The multi story parking had full interior illumination that was noticeable from the outside. All of these light elements were expected to have a common effect on people's perception of attractiveness and sense of security.
- The presence of people in the scene (Fig. **3**), or the visibility of others (Luymes & Tamminga, 1995) has been found to be related to environmental preference. Whyte (1980) found that individuals sit where they can observe other people. Although Whyte (1980) did not obtain subjective evaluations, his findings suggest that the presence of people in a scene would enhance evaluation. On the other hand, the view of people loitering into the area might give the opposite feeling. Thus, attractiveness and sense of security preferences would be evaluated for getting affected in which way with the number of people in view.
- Number of vehicle occupancies (Fig. **4**) shows the increased of rate of vehicles using that street leading to parking spaces, as well as the increase in the number of parked cars had been believed to increase the attractiveness and sense of security perceptions for human samples.
- Flowers as a beautiful landscape element into the scene can never be questioned to increase the attractiveness perceptions among humans, but its affect on the perception of security had never been investigated (Fig. **5**).
- The wall art "Graffiti" is very usual to see in Europe, although being common and widely spread, some people perceive this type of street art as chaos and as an evidence of illegal activities going on into that neighbourhood. The parking space in our case study has wall graffiti in its current status, it is the end product of a competition organized by the municipality of Enschede in order to increase

the good appealing of that area. However, the effect of Graffiti on attractiveness may vary according to the design and colours. So in Fig. **6** some additional graffiti had been added to investigate this kind of art when placed in parking spaces and how is it usually perceived.

- Vegetation: the added value of greenery to the perceived attractiveness in public open spaces had been commonly agreed. Though excess vegetation and trees have sometimes resulted in reducing the sense of security. In order to reduce crime in the higher crime areas, Molumby (1976) recommended removing shrubbery and trees that are too large around buildings, since occupant visibility was a very important factor. A study by Craik & Appleyard (1980) pointed to the importance of upkeep and maintenance, as well as indicators of affluence, such as the number of trees. Since social and physical attributes may interact to provide signals of safety (Taylor et al., 1976), Fig. **7** examined the effect of heavy trees with thin trunks added to the scene when perceived by human samples, to know to which extend does the attractiveness of trees affect the sense of security to space users.
- Degree of spatial enclosure by constructing fences and walls: Brown and Altman (1983) had reported that fences and enhanced visibility were associated with lower actual burglary rates in a suburban area. The notion of unknowing what lies behind the walls is very persuasive when it comes to sense of fear. Nevertheless, fences and tight walls give the feeling of being trapped with nowhere to escape. In Fig. **8** three meters walls were added to the panoramic image all around, with only two openings that allowed pedestrians to enter or exit that location. This intimacy achieved by space enclosure was prepared in the scene in order to investigate the effect of walls in such parking spaces on the perception of security to the users.
- Familiar V.S. unfamiliar signs and advertisements: A distinction was made between the prominences of familiar versus unfamiliar signs. Familiar signs were those for widely advertised fast-food restaurants and major department store chains. Unfamiliar signs were those of small businesses advertised on a very limited scale if at all. Fig. **9** & Fig. **10** show the scene after adding MacDonald's famous sign and an architectural firm signage respectively. The MacDonald's sign carried an announcement that the restaurant itself is away by a distance of 50 meters into some direction, while the unfamiliar architectural studio didn't have any comments of that sort. This distinction was done on purpose based on the results of Shaffer & Anderson (1983) that the familiarity of particular signs associated with past experiences might help investigating how observers view some scenes as more secure.
- Sitting benches and trash cans had been added to the panoramic image (Fig. **11**). The scene was manipulated as such to measure the observer's possibilities to getting some rest or to sit and enjoy while passing by, or even the possibility of targeting that area to have recreational time with friends on a weekend. The perceived attractiveness and sense of security of the viewers would have definitely helped them decide what kind of activity they could do in such area.
- Water elements and fountains are generally perceived as enhancing the attractiveness of public spaces especially when having sounds of running water. Islamic architecture was famous of designing water features and fountains to help relaxing and meditating. Adding a water feature in the panoramic image Fig. **12**, was by the intention to understand whether people would appreciate water elements in parking spaces or it would cause disturbance and undesired effects to space users.

- Basically, Children playground and Toys are placed in safe neighbourhoods and lively ones; they provide a good gathering space for children and parents to enjoy lovely weather and accompanied outdoor activities. Adding children playground to urban parking spaces (Fig. **13**) is a new approach introduced in this research to examine the added values of such an element on the human perception, especially in terms of sense of security and attractiveness.

3.5 Settings:

Perceptions and preferences expressed on the basis of pictures are less effective compared to those, which might be made in real places. Their use in landscape preference studies is supported by the accuracy with which the shots elicit verbal and descriptive responses comparable with those of real environments, thus forming an effective alternative to the much time and money demanding procedure of having people experience the real environment directly, for example, through guided walks or closely supervised vehicular trips (Chokor, 1990). However, it should be conceded that due to time and budget limitations within the present study, real site visits to test the samples cannot be conducted. To overcome these limitations, the setting of this research was done in the decision room in the faculty of ITC (see Fig. **15**). This room houses a 32" touch-screen table that easily displayed the panoramic images for the participants in a handy interface to deal with. It enabled the participants to browse, zoom in, or pan the window by touching the screens. Observations and interviews were held in the same time per each participant.

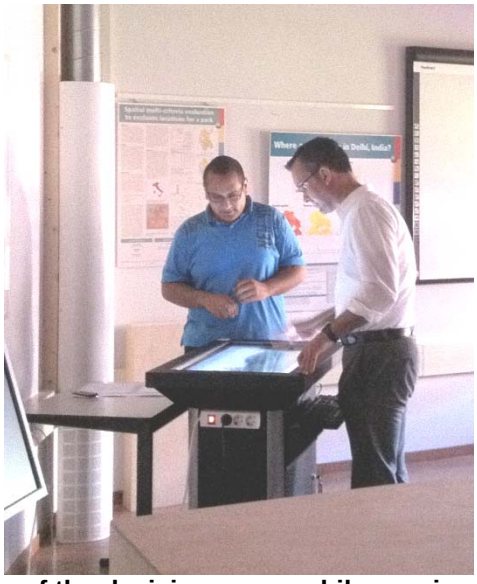

Fig. 15 Image of the decision room, while running the research with a participant on a touch screen table.

3.6 Research phases

The study was conducted in three coincident phases per observer. First each participant was shown a short presentation about the study area and the main usage of such spaces. After that, the responded attractiveness and perceived security of the parking lot in its manipulated conditions along with the current condition had been investigated. Then on each slide after being rated, the evaluators pointed out any element or expressed any reason he/she felt affecting their security and attractiveness perceptions in the panoramic images, and thus explained whether each element had affected their perception positively or negatively or even being neutral.

1. *Short Presentation:*

Most of the participants had been living in Enschede for quit a short period; they might have not been familiar with the case study area or may have ever used it during that time.

A 5-slide power point presentation was prepared to quickly introduce the Stationsplein area and explain the main usage patterns of this area. A series of layouts in a power point presentation briefly explained the pedestrian, cyclists, cars, and main entrances designated to each type of users. The normal flow and main destinations of people accessing this area were also explained briefly. The point from which the photographs were taken had been pinned on a layout image (**Error! Reference source not found.**), and presented to the participants to help them realize the 360^{o} images easily. The last slide of the presentation defined "Attractiveness and sense of security" in simple words to avoid any bias or misunderstanding during the rating afterwards. The participants were also shown a ruler grading image to explain the rating criteria, and how each number resembles a level of feeling they would like to record later on. Any operational questions the samples had in mind were answered right after that presentation.

2. Attractiveness and security evaluations:

It is common to human perception that it may mix things up during the first few minutes of the evaluation due to many factors, such as the lack of self-emotional assessments or any misunderstanding in the beginning of the process. In turn, this might affect the accuracy of the results. As a precautionary measure, three images of parking spaces downloaded randomly from the internet were rated by the participants before even displaying the panoramic images. The ratings out of those three images were not considered in the research. This strategy had helped to avoid the misleading perceptions that might be recorded during the learning curves of the participants, and to set some time in advance for the participants to clearly understand their task. It helped also in avoiding any bias or confusion while perceiving the panoramic images that matters for the results.

Then, the 360^{o} panoramic shots were presented in a random order to reduce the likelihood that slides of the same lot would be shown in succession. Each shot varied in terms of the designed physical features of the case study area. Along with the large number of images rated by each individual and the rapidity of image advancement for a range of one minute, this had decreased the possibility that individuals can make a serious attempt to rate lots consistently rather than rating each scene independently. The respondents had the privilege of using their hands to move around the scene, they panned right and left to view the whole 360o scene, they zoomed in and out to focus on certain element or feature in the images. Participants were then instructed to rate the scenes according to how safe from crime or other anti-social behavior they would feel in the case study area, and according to how attractive they had found the scene. Both scenic quality and personal security were rated on a 5 point scale (-2= strong negatively perceived, -1= negatively perceived, 0= normative feeling, 1= normally appreciated & 2= highly appreciated).

3. Elements recognition

In demonstrating preference for elements and variables in car parking lots, respondents were asked to provide real or imagined reasons each time the case study area was judged either as positively rated or negatively valued. Responses to this important question had provided some indications of the nature of physical elements that were manipulated or placed in the surrounding environment. Once the ratings were recorded, raters discussed their ratings to reduce any errors. Conducting these discussions was based on the need to obtain clarifications about the selective design elements planted in the scene and to listen to every useful detail the participants would add.

The short discussion phase in this research had shown to be very helpful to explore unexpected aspects of some design elements. It had also made use of cultural background of the samples to judge human perception towards design elements in parking spaces. Allowing the samples to express their perception freely was of great value to the research. They had the opportunity to identify unexpected physical elements in the

scene that had never been previously recognized to affect attractiveness and sense of security perceptions.

4. Results:

The main results of this study concern the relationships between noticed physical characteristics of the case study parking lot and evaluations of its security and attractiveness. Although some of the elements were not considered during the preparation of the research, the participants had noticed and searched for some elements to give them the sense of security such as the closed circuit TV cameras. In order to summarize the available data pool, recorded data were distributed to categories of a set of mentioned physical elements. These elements were both, the ones added on purpose and the ones mentioned by the participants during the evaluation. The criteria of selecting and counting physical elements were as follows: the ones pointed out by the participants for having either positive, normative, or negative effect on their perception; and the elements that were put on purpose in each panoramic image measured by the rated perception for each attribute. So each rating for a physical element can be repeated as much as the participant mentioned. All ratings regarding those two criteria were calculated according to the strength values (-2, -1, 0, 1, and 2) were (-2) is the least rated, and (2) is the best rated, while (0) means that it didn't change how the participants perceived the element. The investigators rated 20 variables in 13 panoramic scenes with variance in perceived attractiveness and sense of security, which are described and listed in Table 1.

Table. 1 Sum of physical feature ratings with respect to the degree of perceived security and attractiveness

Comparative attribute	Attractiveness					Sense of security				
	-2	-1	0	1	2	-2	-1	0	1	2
Physical features										
Good designed illumination	0	2	**4**	**4**	1	0	3	**5**	2	1
Flowers	0	1	1	**7**	4	0	1	**7**	5	1
Graffiti	1	**6**	3	3	1	3	**15**	3	0	1
Spatial enclosure	0	**3**	0	0	0	1	**5**	2	1	0
Fences and walls	5	**6**	2	0	0	4	**7**	1	0	1
Familiar advertisements	1	3	**5**	4	0	0	4	**7**	1	1
Unfamiliar advertisements	0	4	**7**	2	0	0	0	**9**	3	1
Vegetation and trees	0	1	2	**13**	3	0	3	3	**7**	1
Fountain	2	0	**5**	**5**	1	0	1	**9**	2	1
Sitting benches	0	1	4	**8**	0	1	3	**5**	3	1
Children playground	0	0	2	**6**	5	0	0	4	**6**	3
Closed circuit TV cameras	0	0	**0**	0	0	0	0	1	**3**	0
Maintenance	0	1	1	**2**	0	0	0	0	**2**	0
Good Architectural style	0	0	2	**10**	0	0	0	0	**1**	0
Landscape design	0	0	1	**2**	0	0	0	0	**3**	0
Time of day										
Morning	0	0	0	**3**	0	0	0	1	**2**	0
Night	0	5	**6**	1	1	0	**6**	4	1	1
People & Activities										
No of space users	0	2	**6**	5	0	0	6	6	**19**	4
Increase of vehicle occupancies	0	**7**	5	2	0	0	1	**6**	**6**	3
Security staff	0	0	**0**	0	0	0	0	0	**4**	0

Performing sensitivity analysis had helped in easily displaying the results, and summarizing the effect of each element that was mentioned or even noticed on the attractiveness and security perceptions.

Attractiveness was associated with designed lighting systems at night and existing water element, while it had been strongly associated with elements related to vegetation such as the prominence of trees and flowers. Attractiveness increased with the increase of elements that encouraged public involvement and existence of people, such as children playgrounds, fountains and sitting benches. The existence of the sitting benches had been mentioned to tempt the participants to sit down and have some rest, especially if they have to wait for somebody at that zone or before getting into their vehicles and drive away.

Apparent architectural style and landscape design had been mentioned to have a good effect on the perception of attractiveness of such area. Good maintenance of the surroundings was recognized as crucial for increasing how good the scene would look like. The time of the day also enhanced the aesthetic appealing of such parking space, where in day light it was perceived better than at night. The participants mentioned that the scene hadn't enough light at night to be recognized, so they didn't have any attractive feelings, on the contrary, it was repulsive to go through that area at night. The existing Graffiti as well as the added ones in the manipulated panoramic image were generally perceived as strongly repulsive type of art to exist in parking spaces. High spatial enclosure and fences surrounding the location had shown significant decrease in the sense of attractiveness for open parking spaces. Advertisement Billboards were perceived to have week effect on the attractiveness of panoramic images, while number of vehicle occupancies had significantly decreased the attractiveness. The number of people increasing in the parking space had a normative effect on the samples. Security staff absence and the closed circuit TV camera were shown to have absolutely no effect on the perceived attractiveness of parking spaces.

On the other hand, the presence or implied presence of others was also related to higher security ratings; with a high degree of lot use, the number of cars in the lot and the presence of people in the scenes being positively correlated with perceived security. Good architecture design, landscape design and rapid maintenance had positively affected the perception of security. Implementing children playground and toys had affected the increase in security for the subjects. Closed circuit TV cameras added to the sense of security when seen above the entrance of the parking garage. Flowers, water features and both types of advertisement had a normative impact on security, while vegetation had an increasing effect. Visibility-related features were negatively related to perceived security, including the degree to which the lot was enclosed by a barrier, including fencing or retaining walls. Perceptions of security were higher in scenes of day times, also probably related to visibility. In night images, security decreased especially when accompanied with bad artificial lighting. The perception of Graffiti had the highest rates of fear of crime when spotted in the images. The absence of security guards and/or policemen increased the notion of unsecure area to some participants. There was an unpredicted result of sitting benches, they didn't affect the sense of security, instead there was conflict opinions regarding that physical element.

Vegetation, low trees that have wide spreading branches gave a sense of relaxation to the participants, as they imagined themselves to sit beneath the trees and enjoy for some time, or to wait in that landscaped space instead of waiting in the train station nearby if they are planning to leave the city

The number of people viewed in the scene, day time panoramic images, and children playground was associated with elevated ratings for both perceptual dimensions. The existence of children playground enhanced both attributes of attractiveness and security; it

had significant mutual effect. Children always add sense of enjoyable activities and fun to the public spaces, thus enhancing the attractiveness perception. The participants mentioned the fact that they felt also safe because the architect had placed such toys in parking area, which gave the feeling that no harassment or illegal act would be done in such playful part of the neighbourhood. They commented that the existence of playing children in the scene would have been better for both attractiveness and sense of security. Architectural style and landscape design was mentioned to have a good effect on the perception of attractiveness and sense of security especially by the participants who are originally not from Europe.
A handful of undesirable features were negatively rated for both attributes, including strong spatial enclosure, walls, and graffiti. Though, water elements and billboard advertisements didn't have any effect to both attributes.

Odd observations
Although most of the results seems reasonable and normally anticipated to common sense, some of the recorded perceptions were extraordinary and needed special mentioning. The evaluator sample, as mentioned before was a mixture of nationalities that study in ITC, so this divergence in cultural backgrounds had resulted in the odd results. A male Ethiopian student rated the highest sense of security in all viewed images, the participant's reasoned was that Europe is definitely safer than Ethiopia and he didn't expect to get harmed or insulted in such parking area, even after viewing the negatively rated elements in the panoramic images. In the image that had high walls blocking the view and limiting the escape routes, he rated it as totally safe and didn't anticipate any sudden attack from behind such block.
Also the same Ethiopian male participant had judged the architectural style comparing it to the local Ethiopian architecture, so he rated the whole scenes as relatively high attractive although other participants of all other nationalities rated it as neutrally perceived in aesthetic preferences, as they are accustomed to better looking buildings and architecture designs.
On the other hand, an Egyptian female architect rated the architecture style of the surrounding buildings as very poor; she mentioned that as an architect she perceived this architecture as "strongly below normal" given that it's located in the Netherlands. She even added that the fountain in its location and shape-design doesn't appeal to her, and thus rated as ugly.
Another odd rating was made by a male Pakistanian participant. He had searched the image looking for CCTV Cameras and security staff. The subject stressed upon these elements as necessary in Pakistanian neighbourhoods to increase their sense of security. Also CCTVC was noticed by the female Egyptian architect to increase the sense of security because it gave the feeling that someone is watching. Whenever CCTVC were spotted by those two participants, the security rating was the highest.
Few participants rated the Graffiti as a nice looking art that enhanced the scene without any fear of associated crime behaviours. They related that to background memories of their home city where graffiti is considered a Hip art. The graffiti in their country describes the status of the community and resembles simply local artistic creations. Although some of them said it doesn't affect their fear of gangs or any anticipated harassments, they suggested another type of art such as natural landscape paintings to enhance the attractiveness of such areas.
While most of the participants rated the billboards both unattractive and intruding on such open space, an Indian female along with a male Syrian participant didn't even notice one of the billboards (the unfamiliar advertisement), thus rated that image as normative sense of security and attractiveness. It is worth mentioning that the male Syrian participant had

been affected by MacDonald's advertisement on the billboard, he rated that image as more secure due to the fact that a familiar restaurant is just 50 meters away to which he would run in case of emergency knowing that it is not too far. He mentioned also that this sign made him feel close to a shopping centre and that usually this parking areas next to busy commercial centres are safer than others. The other participants didn't share that same point of view at all.
In order to reach a sufficient discussion that best describes the results and then, form an affirmative conclusion, the results were analyzed by categories as follows.

5. Discussion and Conclusion:

The primary interest in conducting the present research was to identify physical features that when added or removed, could maximize both security and attractiveness perceptions of urban parking spaces, particularly those features that may enhance one perception without detracting from the other. In another word, this research main focus was to find design elements that when put or removed in urban parking spaces to enhance both, the attractiveness and security perceptions and thus explained by the mutual relations mentioned by the evaluators Table 2. This alignment in perception is partially explained by the emotional effect that if somewhere is perceived as highly attractive, then consequently it is highly secure.

Table. 2 The conclusion and recommendations of design elements as well as other variables in parking spaces

	Enhancing both attractiveness & security	Disturb both attractiveness & security	Recommended for enhancing attractiveness	Recommended for enhancing sense of security
Physical features				
	Vegetation and trees	Graffiti	Water elements	Water elements
	Flowers	Strong spatial enclosure	Sitting benches	Sitting benches
	Regular maintenance	Fences and walls		CCTV cameras
	Children Playground	Trash canes		
	Good scene illumination	Rubbish		
	Architectural & landscape style	Noticeable electric boxes		
		Bare soil		
Time of day				
	Daytime			
People & Activities				
	Nu. of space users			Interesting activities
	Children playing			Increased vehicles
				Security staff existence

Perhaps most important elements to the perceptions of both security and attractiveness are those features that demonstrate care and attention by people. The findings suggest that flowers and trees may increase both perceptions of attractiveness and security, if the overall look of vegetation is well-maintained and attractively landscaped. The presence of unmaintained and bare land (bare soil) has the opposite effect on both perceptions, particularly in isolated, parking spaces. The extent of agreement on the importance of good maintenance had also reached the architectural buildings and landscape paths, clean pedestrian walkways and good architectural style would enhance the sense of security and attractiveness. Generally accepted architectural, and landscape designs is encouraged for having a good effect on the perception of attractiveness and sense of security especially in the cities hosting multi-cultural communities.

Although the findings suggest that hiding ugly structures with dense vegetation enhances evaluations of attractiveness somewhat, the findings overall suggest that urban designers should not try to hide the presence of buildings altogether. Instead, perceived security might be enhanced with well-maintained structures where individuals feel they can seek refuge or that imply the presence of others who can either provide deterrence or assistance (Shaffer & Anderson, 1983).

The existence of children playground enhanced both attributes of attractiveness and security; it would have even more significant mutual effect for the sense of security and attractiveness if the people see the place as lively and full of playful children. During the daytime, people perceive the area as secure and relatively attractive, this is due to good visibility compared to night images. Good night visibility and illuminating dark corners at night will enhance both attributes even if the landscape design is not well maintained.

Those features associated with lower ratings for both security and attractiveness perceptions point to another possibility for designing urban areas. The presence of trashcans, rubbish and electricity boxes were negatively correlated with both perception ratings. It is possible that such detractors could be camouflaged with landscaping. Graffiti, high level of spatial enclosure and fences were shown to be very disruptive to the sense of attractiveness and security. Although when the graffiti style is neat, well designed for certain age and fashion modes, it may enhance the attractiveness, but still people would feel threatened and unsecure especially in public parking spaces.

This research had been conducted on the basis that different backgrounds of the participants will have contradictory results. The nature of human perception depends upon balancing previous experiences, values, and norms with the learnt experience to reach the decision. The criteria of rating the desired attributes emerge from the basic mental images in the memory storage of human being (Lynch, 1960). In this research the decision was to judge how far the participants' felt attracted and secured in an urban parking lot in Enschede, the Netherlands. This contradictory in culture-based perception can lead to very broad and extreme point of views among the participants. Thus architects and urban designers would better be careful when duplicating parking lot designs without considering each country's unique values and traditions.

Results also indicated that female evaluators in general rated security lower than males. However, sex accounted showed no huge difference in perception. No other main effects or interaction effects achieved significance. Thus, it is not advised to maintain the gender distinction in subsequent analyses or further calculations.

6. Limitations and future research

During the evaluation of the panoramic images, an unexpected fault had aroused. The participants started to get used to the scene and get familiar with the original components. They had begun to compare images after the 6th or the 7th slide presented to them, favoring one feature to the other instead of focusing on the whole scene. By then, they had almost figured out the original scene and identified the added elements later on. Of course this might have influenced the evaluated measurements and resulted in a curve of error directly proportional with the number of viewed slides.

Due to the fact that this research was basically accomplished in three weeks, it is a very short period to produce such kind of project. The tight time schedule limited the sample size. In the study made by Shaffer & Anderson (1983), they had a sample of 211 participants, therefore; the optimum number to reach dependable results would have been about 200 participants. Despite having only 13 participants in this research, the concluded results verified Shaffer & Anderson's findings and added some design elements they didn't consider at that time (e.g. CCTVC, children playground).

Future research can be detailed till more accurate evaluation for each design feature can be made. This study considered the general rating of the whole panoramic image as the rating that belonged to the design element added in this image. This calculation method was not totally accurate either in statistical analysis or in measuring overlapping effects of implemented features. Systematic statistical analysis was not performed due to the small sample size; therefore the scope of the investigation was limited. Also the analysis was prepared quantitatively, regardless the complex and overlapping effects of multiple design elements per panoramic slide.

Other usual occurring events, such as illegal acts and whether the person is alone or in a group in visiting the site, may also influence perceived security and were not addressed in this study. Although a couple of panoramic images were prepared to investigate the effect of gang gatherings at day and night times on the human perception of security, they were removed from the set of images shown to the last 8 participants. Those extra images would have required more research into criminal behaviors and human psychology, which might have broadened the scope of the research dramatically.

Finally, this study involved perceived security, not the actual incidence of crime. This study indicates that the appearance of safety is related to urban contents and properties that may be manipulated by architects and landscape designers to overcome current security and aesthetic problems of urban parking spaces. This research addressed urban parking spaces; future research can focus on other type of parking spaces such as multi-story parking buildings where other design variables might be introduced. This research is a base ground for any further research investigating human perception in the built environment.

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