



DESIGN FOR CROWD WELL-BEING: NEEDS AND DESIGN SUGGESTIONS

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ABSTRACT

This paper investigates the needs or criteria for sustaining well-being in crowded situations through two focus group discussions with a total of ten participants. We conclude that pursuing crowd well-being could be divided into two different cases: one is obtaining the enhancement of the current state in normal situations, and the other is avoiding the deficiencies in case of emergencies. The psychological needs are different in these two cases. Crowd members pay attention to higher level of psychological needs, i.e. staying autonomic, connected, competent and respected in the former situation, while their focus will immediately change to low level needs, i.e. safety and security issues, when unexpected things happen. These findings are consistent with Sheldon et al.'s new hierarchy of needs. We also find that all the crowd types mentioned in the focus group discussions could be classified into two categories, namely event crowds and non-event crowds. A crowd can also consist of both event moments (e.g. watching performances or dancing with the crowds) and non-event moments (e.g. waiting in queues). The event crowds are looking for enhancement of their experiences in the crowds, whose needs are usually higher level, whereas the non-event crowds usually cannot help joining the crowds in order to achieve their goals. The event moments when the higher level needs is fulfilled are usually associated with positive moments. The non-event moments when only security is promised and have no support on higher level needs are usually associated with negative moments. To get insights into how crowd well-being is currently fulfilled by crowd management strategies and designs, we investigated a number of influential crowd management literatures. The results reveal that emphasis is placed on supporting the safety. Most strategies focus on preparation and prediction instead sustaining real-time crowd well-being. Most of the designs tend to be coercive instead of respecting the autonomy. In conclusion, designing for crowd well-being could change towards the real-time and aim at fulfilling the higher needs, i.e. autonomy, competence, self-esteem and relatedness on the premise of security.

Keywords: human-centered design, crowd well-being, hierarchy of needs, crowd types

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1. INTRODUCTION

The earth is getting more and more crowded, not only in Asia. Also in Europe, we are trapped in crowds more than ever. Train stations have multiple peak hours every day. Large-scale recreation events are prevalent everywhere. Crowd managers and designers keep developing better strategies and designs in order to sustain the well-being of people in crowds.

Well-being is a very commonly studied terms across disciplines, resulting in highly variable definitions. Pollard and Lee (2003) did a systematic literature review and identified five distinct domains of well-being: physical, psychological, cognitive, social and economic. So far, the measurement of well-being have primarily focused on subjective evaluations, because researchers believe that people react differently to the same circumstances and tend to evaluate them based on their unique individual experiences, which have built a field named "subjective well-being (SWB)" with multiple components, such as pleasant affect, unpleasant affect, life satisfaction and domain satisfactions. Affect is labeled as moods and emotions altogether, which is more proper to reflect people's instantaneous reactions. Domain satisfaction includes satisfactions in work, family, leisure and health, finances and self. In contrast, life satisfaction and domain satisfaction reflect more on long-term evaluations. In addition, merely avoiding unpleasantness cannot sufficiently contribute to SWB. People need to obtain pleasant affects (Diener et al., 1999). Therefore, enhancing positive affect and restricting negative affect are the SWB components related well-being in a crowded situation due to their short-term characteristic. According to the definition of SWB by Diener and his colleagues (2003), crowd well-being can be interpreted as crowd members' evaluations on their emotional reactions, moods and judgments they form about their satisfactions, goals or needs fulfillment in a crowded situation.

Needs fulfillment does make contributions to a person's feeling of well-being (Tay and Diener, 2011). But what are these needs? Maslow's (1954) famous hierarchy of needs theory (including physiological needs, safety needs, love and belongingness needs, self-esteem needs and self-actualization needs), and more recently, Ryan and Deci's (2000) self-determination theory (including needs to feel competent, autonomic and related) both postulated a list of needs. They suggested that these needs are independent from each other to a degree, but can all contribute to well-being to some extent once they are fulfilled. Like the analogy made by Maslow, these needs are similar to the vitamins. We require different vitamins to survive. But having sufficient Vitamin C does not mean the need for other vitamins diminishes. Usually people need to fulfill a variety of needs and balanced them well in order to achieve an optimal well-being (Tay and Diener, 2011). However, these lists mentioned above still cannot claim to be the universal ones for enhancing well-being due to the large amount of varieties existing in different contexts.



Crowd well-being is not simply the union of the individual well-beings, because individuals tend to influence each other. As early as the end of 19th century, Le Bon (1895) already claimed the power of crowd contagion. Crowd members can easily become subject to the ideas, suggestions, emotions or judgments that are formed in the crowds, which will certainly affect crowd well-being. In other words, people are socially connected, whose well-being does not only build upon their own needs fulfillment, but also on the needs fulfillment of others around them (Christakis and Fowler, 2009).

The purpose of this article is to discover people's needs for maintaining well-being in crowded situations. A crowd itself is already a complex system, not to mention the complexity of need theories. Therefore, we carried out two focus group discussions, as the starting point to approach the human needs in crowds. The focus groups were aided by creative collage making with abstract pictures and words, which could be interpreted differently. Each participant was asked to explain the collage they made, from which we gathered much richer insights about their tacit or even latent needs (Sleeswijk-Visser et al., 2005).

2. SHELDON'S NEW HIERARCHY OF NEEDS

Sheldon and his colleagues (2001) carried out three studies to examine 10 candidate psychological needs, attempting to uncover the relative fundamental ones for humans in both "most satisfying events" and "most unsatisfying events" (Table 1). These 10 candidate needs are extracted from several prominent need theories, i.e. Ryan and Deci's (2000) self-determination theory, Maslow's (1954) hierarchy of needs theory, Epstein's (1990) cognitive-experiential self-theory and Derber's (1979) lay theory of human needs. Notably, although the set of 10 needs does not necessarily capture all potential needs, they cover a wide range of other influential psychology theories as well.

Table 1. Sheldon's 10 Candidate Psychological Needs

Candidate Needs	Explanations
Autonomy	Feel independent and self-decided
Competence	Feel capable and effective
Relatedness	Feel a sense of belongingness and closeness
Self-Actualization	Feel meaningful in life and capable to progress toward the highest potentials
Security	Feel safe and in control
Money-luxury	Feel sufficiently rich and able to purchase most of the desirable things
Popularity-influence	Feel popular and influential
Physical thriving	Feel healthy and well taken care of
Self-Esteem	Feel respected and worthy
Pleasure-stimulation	Feel enjoyed and pleased

Sheldon et al. (2001) concluded that the presence of autonomy, competence, relatedness and self-esteem was most strongly correlated to positive emotions in satisfying events, whereas the absence of security, self-esteem and competence has the greatest contribute to negative emotions in unsatisfying events. Furthermore, pleasure-stimulation, physical thriving, self-actualization and security were less contributed to the positive feelings in satisfying events.

However, in case of unsatisfying events, security immediately become salient above all other needs. Money-luxury and popularity-influence were always at the bottom of the list, which were considered of little or no importance to satisfying experiences. Therefore, Sheldon suggested a new hierarchy of needs (Figure 1b), which is a two-level hierarchy, much different from Maslow's 5 levels (Figure 1a). There is no particular order of the four needs in the top level, because their importance may vary from context to context. That is to say, satisfying any one of the four needs is not a precondition for the fulfillment of other three needs. The physiological needs (e.g. food, drink, etc.), which are placed at the ground level in Maslow's pyramid, are no longer perceived as basic necessities in the modern society, since people hardly experience urgent hunger nowadays. Needs for food and drinks are usually stimulated by appetite rather than extreme hunger (Maslow, 1954). In spite of these differences, Maslow and Sheldon both agree that guarantees for safety and security are the premise before the needs for autonomy, competency, relatedness and self-esteem become prominent.

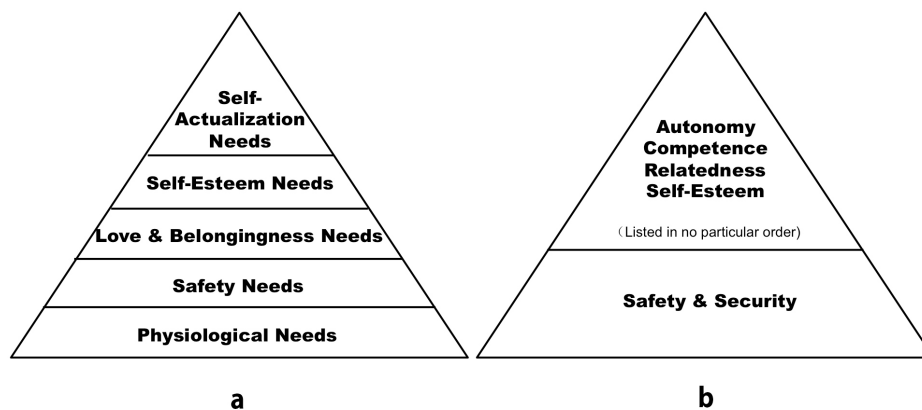


Figure 1. a) Maslow's hierarchy of needs, b) Sheldon's new hierarchy of needs

In addition, this two-level distinction indicates that achieving well-being can be interpreted into two levels as well. In normal situations, it is the attempt to obtain enhancement of well-being, where staying autonomic, competent, related and respected all contribute to the enhancement. In emergent situations, the efforts change to avoiding deficiencies to well-being, where keeping safe and in control is the priority.

Sheldon's set of 10 psychological needs is the theory base for the study in this article. We are curious if we could attain findings in crowded situations that are consistent or against the need theories.

3. FOCUS GROUP STUDIES

The goal of focus group is to gather rich qualitative data, including participants' individual talking, group discussions, brainstormings, collage makings, etc. and try to extract the needs that consist in crowd well-being. Furthermore, we compared the extracted well-being needs with the need theories to see whether they are consistent or not. We aimed to explore answers



for the following four research questions, which were formulated based on Sheldon's two-level hierarchy of needs.

- 1) What are the characteristics of crowds that attract people joining (attractive crowds) or make people avoid them (unattractive crowds)?
- 2) What are people's needs and activities in attractive or unattractive crowds?
- 3) Are these needs or activities in attractive crowds substantially different from those in unattractive crowds? What are the differences?
- 4) How do people's emotions fluctuate in both attractive and unattractive crowds? Do these fluctuations influence their needs?

This study combined the traditional focus group interviews and contextmapping techniques. The former bring a small group of participants together to discuss a focused topic (Morgan and Spanish, 1984), and the latter apply generative techniques, such as asking participants to make collage or artifact that can help them better express themselves, thus indirectly access to the latent knowledge (Stappers and Sanders, 2002).

Three sets of questions were asked in this study according to the four research questions (Table 2).

Table 2. Three sets of questions in focus group studies

Question Set 1 (QS 1)	1) Obtaining the enhancement of well-being <ul style="list-style-type: none">● What crowds attract you joining? Please recall as many as possible.● Why do you want to join these crowds?● What do you do in an attractive crowd? Please write on the timeline and point out the positive and negative moments.
Question Set 2 (QS 2)	2) Avoiding the deficiencies to well-being <ul style="list-style-type: none">● What crowds make you uncomfortable and want to avoid? Please recall as many as possible.● Why do you want to avoid these crowds?● What do you do if trapped in an uncomfortable crowd? Please write on the timeline and point out the negative moments, and if possible, some positive moments.
Question Set 3 (QS 3)	3) Expectations <ul style="list-style-type: none">● What are your expectations to sustain well-being in the crowds?● Please make a collage of pictures, words or drawings that can help you explain.

3.1 Participants

Two focus groups were conducted with 6 and 4 participants respectively, and both composed of 50% male and 50% female. They vary in age groups, occupations and nationalities and all have experience in crowds. In order to decrease the possibility of the dominant person leading the group, two facilitators were presented. The session held in a relaxing environment to make the participants feel at ease.

3.2 Procedure

Having the participants get a feeling about the topic before the focus group session and having them more willing to participate, can lead to more insights and a smoother discussion. So each participant got a booklet one week in advance of the session (Figure 2). The booklet

is a small workbook including all the open-ended questions in Question Set (QS) 1 and 2 (Table 2). Through accomplishing the tasks, participants had to think actively about the topic (Sleeswijk-Visser et al., 2005).

In the focus group session, participants' emotions and memories of crowd experiences were evoked step by step through warm-up videos about crowd experiences, pair discussions on the contents of their workbooks, collage making, story telling and group discussion. The whole session took about two hours. In collage making, each participant was asked to make a collage to express their expectations to maintain well-being in crowds. Random pictures and words were provided as stimulators for the collage making. Each participant interpreted these pictures and words differently. They were also encouraged to add their own words or draw freely (Figure 3). The creative collage making and story telling helped participants to express their tacit or latent feelings. In the final group discussion, participants responded to each other's presentation and more insights were generated.

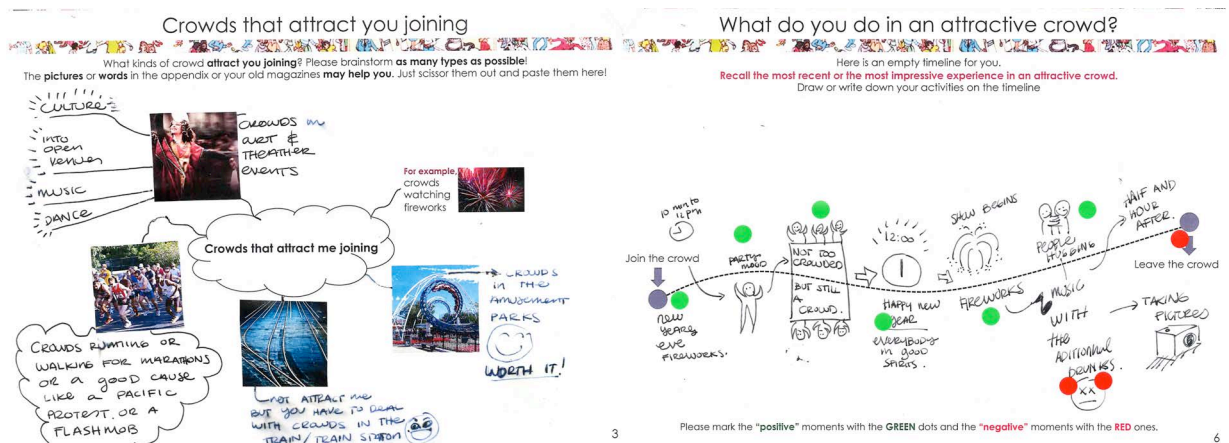


Figure 2. Two example pages of the workbook



Figure 3. An example of collage making in the focus group sessions

3.3 Analysis

All the workbooks and collages were collected, and the whole focus group sessions were video tapped and transcribed. These gathered documents were processed right after the sessions. This is the first step suggested by Rabiee (2004) as "a trail of evidence", which allow

other researchers to verify these documents. The goal of analysis was to reduce data and search for categories or patterns according to the research questions.

A team of three researchers read through all the transcripts with questions in mind, e.g. “Why do they mention this?” “What do they say about the attractive crowds?” etc. Each researcher marked the interesting passages with a short phrase to interpret subjectively (Figure 4). Then all the selected paragraphs and the interpretations from three researchers were compared and put into five categories, which follow the three question sets: 1) crowds that attract you joining, 2) reasons for joining these crowds, 3) crowds that you want to avoid, 4) reasons for avoiding these crowds, 5) expectations. Decisions on which contents should be put into which category were made within the research team. Besides, the answers for the first two questions in QS 1 and 2 in the workbook were examined and classified into Category 1 to 4 accordingly. The answers to the third question in both QS 1 and 2 are in the form of timeline, on which positive and negative moments were pointed out by participants using green and red dots respectively (Figure 2). These timelines provide an overview of the activity in a crowd and the reasons why positive or negative emotions pop up in both attractive crowds and unattractive crowds.

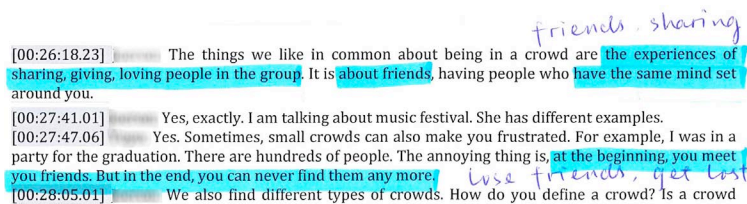


Figure 4. Interpreting transcripts

4. RESULTS

This section presents the main findings of the focus group studies. There are four sub-sections: crowd types, reasons for joining and avoiding the crowds, event moments and non-event moments in crowds, and needs and crowd well-being.

4.1 Crowd Types

Each participant made a list of attractive crowds and unattractive crowds. Combining the overlaps, we got a total of 46 attractive crowds and 37 unattractive crowds. The most frequently mentioned attractive crowds, which were at least mentioned by 4 participants, are crowds at festivals, friends or family gatherings, theaters or cinemas, public transportation and sport events. With the same criterion, the most frequently mentioned unattractive crowds are disordered crowds, crowds of unfamiliar people or culture, violent crowds, public transportation crowds and crazy crowds for cheap or free goods (Table 3).

Table 3. The most frequently mentioned attractive and unattractive crowds
(at least mentioned by 4 participants)

Number of participants mentioned	Crowds that attract you joining	Number of participants mentioned	Crowds that you want to avoid
6	Music, movie or other outdoor festivals	5	Disordered or ill-disciplined crowds
5	Friends or family gathering/parties	4	Crowds of unfamiliar people/culture
4	Theater/Cinema	4	Violent/morally incorrect crowds
4	Public transportation	4	Public transportation
4	Sport events	4	Crazy crowds for cheap or free goods

Notably, crowds at public transportations were on both lists. Participants gave explanations to this love-hate conflict, quoted as follows:

- *“The bus attracts me in different way. I need to go to somewhere. So I definitely need to take a bus. But I feel unhappy on a crowded bus even it attracts me.”*
- *“I am usually not attracted to the crowds at the train station, but to a goal.”*
- *“For some crowds, you have to join them, for example, the train station. But there are other crowds, which you would love to or volunteer to join them.”*

Therefore, we found that all the attractive crowds and unattractive crowds can be divided into two major types, namely event crowds and non-event crowds. An event crowd is always event-based. People join the crowds because of the performances or the activities in that event, e.g. concerts, dancing, fireworks, exhibitions etc. or because they want to interact with the people in the crowds, e.g. conferences, family or friends gatherings, parties, etc. An non-event crowd usually does not involve any performance, people presenting is not because they enjoy the crowds, but want to achieve some external goals or receive some benefits outside the crowds, e.g. crowds at public transportation, crowds waiting in queues for free goods, etc.

Event crowds exist along with the event, and are the necessities for the event. That is to say, the event is organized for the big crowds. If there are no people, it is not necessary to have big festivals or parties. Event crowds’ goals are within the crowds, who are simply enjoying the event and interacting with the crowds (Figure 5). However, non-event situations are not always involving large crowds, which exist even without crowds. For instance, trains are still operating even when no people are waiting on the platform. Non-event crowds’ goals are usually outside the crowds, i.e. the benefits do not come from the crowds. In non-event crowds, the interaction level is usually low (Figure 6).

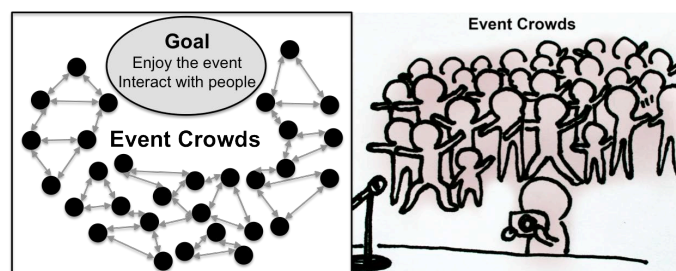


Figure 5. Event crowds

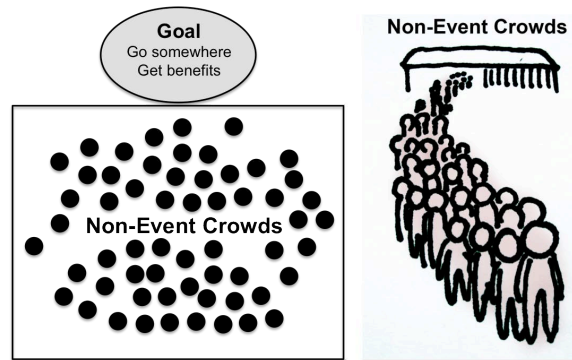


Figure 6. Non-event crowds: low interaction level

4.2 Reasons for joining and avoiding crowds

As can be seen from Table 4, the top reasons for joining a crowd can be summarized as relatedness (e.g. go with friends or family and feel belonging to a group), pleasure-stimulation (e.g. look for fun or relaxation), benefit motivation (e.g. waiting for benefits in crowds), while the top reasons for avoiding a crowd are security considerations (e.g. have no control of safety), autonomy (e.g. easily get trapped) and pleasure-stimulation (e.g. feel bored).

Table 4. The most frequently mentioned reasons (at least mentioned by 4 participants)

Number of participants mentioned	Reasons for joining	Number of participants mentioned	Reasons for avoiding
7	Go with friends/family (Relatedness)	7	Have no control of safety (Security)
6	Look for fun/relaxation (Pleasure-stimulation)	5	Easily get trapped in jammed crowds (Autonomy)
5	Feel belonging to a group (Relatedness)	4	Feel bored (Pleasure-stimulation)
4	External goals, e.g. waiting for benefits (Benefit motivation)		

In conclusion, in an attractive and event-crowd situation, the reasons for people joining the crowds are that they need belongingness and want to search for pleasure. Sometimes, the non-event crowds attract people joining because there are benefits beyond the crowd itself. They join the crowds for the benefits, not for the crowds. When things going wrong in a crowd, no matter it is happening in an event crowd or non-event crowd, both will turn unattractive. It is easy to associate a crowd that you want to avoid with an unsafe crowd. Thus, security is mentioned the most as the avoidance reason and placed at the top. The unwillingness to get trapped in jammed crowds does not only relate to autonomy needs, but also reflects people's security considerations. They want to control over their own movements and have the freedom to escape.

These finding are consistency with Sheldon's studies (Sheldon et al., 2001). Relatedness is the primary need when people are in crowds for the enhancement of well-being, which also prove that crowd well-being is on a social level. Security is not one of the top reasons for joining a crowd, but definitely the most considered reason when lack it.

Furthermore, the needs for pleasure-stimulation are frequently mentioned as well. It is one of the most considered reasons for a crowd becoming attractive and at the same time, lacking it is one of the most considered reasons to make people avoid the crowd.

4.3 Event moments and non-event moments in crowds

Each participant was requested to complete timelines based on their most recent or most impressive crowd experience in the workbook. From entering the crowds until leaving the crowds, they made one timeline for both attractive crowds and unattractive crowds. Besides, they also pointed out the positive moments and negative moments on both timelines. The right part of Figure 2 is a timeline made by one participant.

Syncretizing the timelines, we had an overview and comparison of people’s activities and feelings in an attractive crowd and an unattractive crowd (Figure 7 & 8). The plus and minus signs represent the green and red dots placed by participants on their timelines. The number of these signs means the number of participants that mentioned this activity. For instance, there are five participants think “eat and drink” is a positive moment in Figure 7.

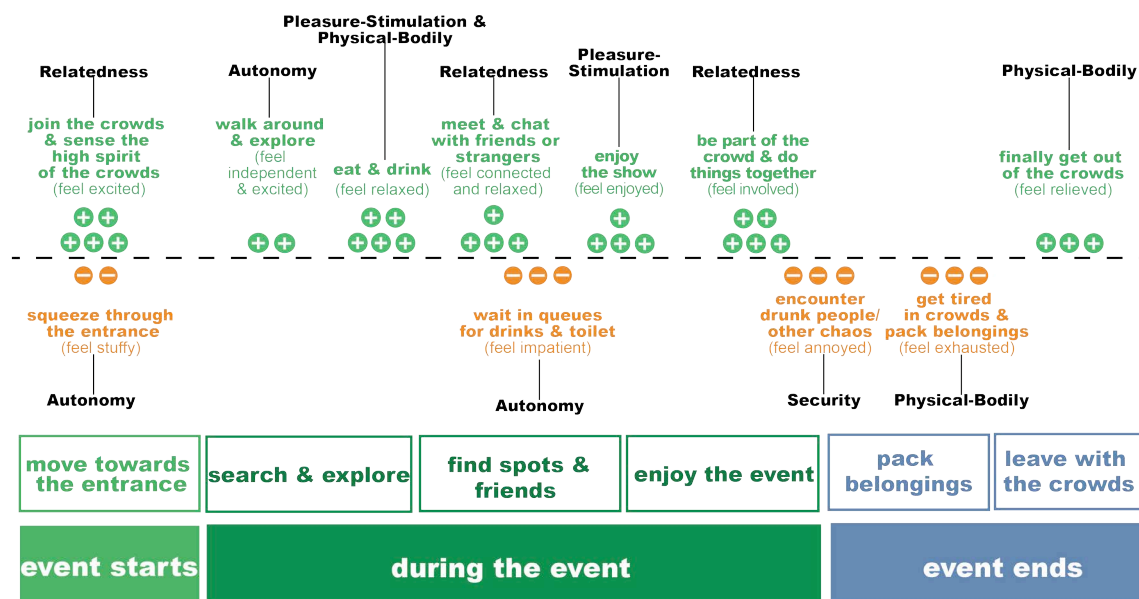


Figure 7. Attractive crowds timeline with positive and negative moments

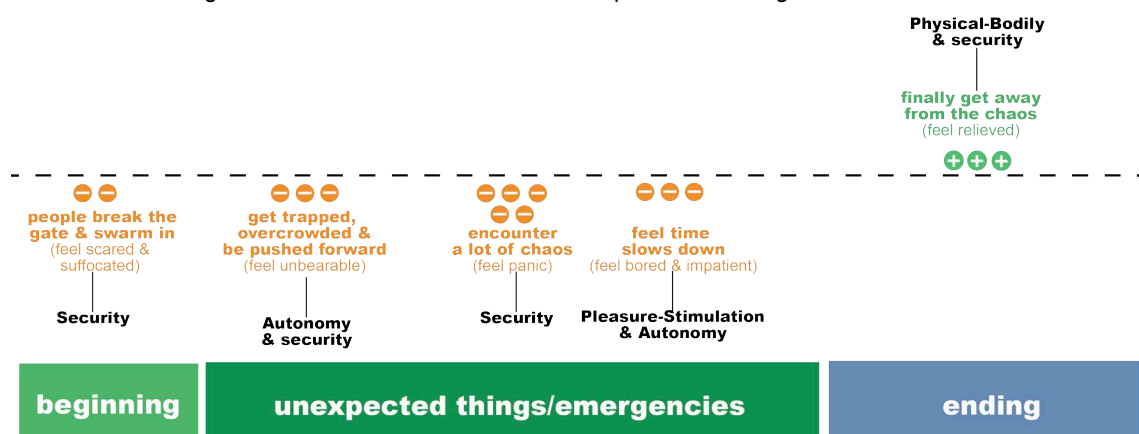


Figure 8. Unattractive crowds timeline with positive and negative moments

Obviously, attractive crowds have much more positive moments than negative moments whereas unattractive crowds are dominated by negative moments. The only positive moment in unattractive crowds is “finally get rid of the crowds” and security is ensured.



Furthermore, we found that timelines for attractive crowds are mostly based on activities in the event crowds with clear schedules while those for unattractive crowds are generally based on the non-event crowds without well-organized activities. One crowd timeline can be further split into event moments and non-event moments. Take the timeline in Figure 7 as an example. “Squeeze through the entrance” “wait in queues” etc. are non-event moments according to the definition of non-event crowds in Section 4.1 of this article, but “meet and chat with friends” “enjoy the show” etc. are event moments.

Apparently, event crowds are mostly regard as attractive crowds and even event moments on a crowd timeline are mostly associated with positive moments. In contrast, non-event crowds and non-event moments are mainly counted as unattractive and negative.

It is also visible on the timeline in Figure 7 that people tend to search for relatedness, pleasure, and autonomy and need for security is hardly mentioned, since an attractive crowd usually guarantees the security. In contrary to Figure 7, the timeline in Figure 8 shows that people are more anxious about security issues because they usually feel unsafe in unattractive crowds.

4.4 Needs and Crowd Well-being

The last set of questions (QS3, Table 2) attempts to investigate the overall expectations or needs for sustaining well-being in crowds. Participants accomplished a collage and made a presentation to express their expectations. We went through all the collages along with the transcripts and mapped a list according the mention frequency (Table 5). Relatedness, autonomy, competency and security are the foremost needs in sustaining crowd well-being.

Table 5. The most frequently mentioned expectations (at least mentioned by 4 participants)

Number of participants mentioned	Expectations for sustaining well-being in the crowds
10	Stay well-informed, well-guided and well-prepared (Autonomy, competency and security)
7	Stay connected with family or friends, know people's mood and feel involved (Relatedness)
7	Feel safe (Security)
4	Free to escape from the crowds when in need of (Security, autonomy)

In Sheldon's studies, security does not contribute significantly to the positive feelings in a satisfying event (Sheldon et al., 2001). However, it is always considered as the preconditions of all the events. Crowded situations are not always “satisfying events”. Sometimes they are very attractive and positive, but they can turn into disasters if managed improperly. Therefore, security is heavily referred by all the participants as the premise for achieving crowd well-being. As expected, higher level needs, relatedness, autonomy and competency are essential for crowd well-being. Self-esteem was not noticeably mentioned as the criterion for crowd well-being.



5. CONCLUSION

The section reflects on the research questions (RQ) in Section 3, examining if this study answers them.

For RQ1, we found that event crowds usually can attract people joining, which are well organized with interesting programs and encourage people to interact with each other. Non-event crowds are not as attractive as event crowds. People join a non-event crowd because they use it as a means to achieve the goals. An unattractive crowd is associated with violence, ill organization, where the security is not guaranteed.

For RQ2, results show that people's needs in attractive crowds are mostly the higher-level needs, i.e. relatedness, autonomy, etc. while need for security becomes prominent in case of unattractive crowds.

For RQ3, it is clear that needs and activities in attractive crowds are substantially different from those in unattractive crowds. Activities in attractive crowds are mostly associated with positive feelings, which fulfill the higher level needs. However, there is hardly any positive moment in unattractive crowds.

For RQ4, we found that people's emotion fluctuations do influence their needs. Generally, people feel more positive in event moments than in non-event moments. During event moments, their needs are mostly the high-level ones. Oppositely, security concerns usually pop up during non-event moments.

6. DESIGN SUGGESTIONS

To come up with the design suggestions for crowd well-being, a series of literatures about the existing crowd management strategies and design solutions was studied (Bacon, 1999; Challenger et al., 2010a; Challenger et al., 2010b; Kemp et al., 2010). So far, a lot of efforts have been devoted to monitor the crowds and prepare for the possible wrong situations. Numerous computer simulation models have been built to represent crowd dynamics, and to identify and predict potential safety problems. Products for managing crowds are usually coercive instead of respecting people's autonomy.

According to the study results of crowd well-being in this article, it is promising that designing for crowd well-being should pay more attention to improve people's higher level needs rather than merely focus on guaranteeing the crowd safety. For instance, the rapid development of pervasive computing and wireless sensor networking (WSN) could be a solid technological support for sustaining the connectedness or relatedness in the crowds. Perhaps, WSN could also generate crowd proximity graphs, key-words map and even mood maps, depending on the sensors used in the crowds. This information can help crowd members be aware of the situation and always well prepared for possible wrong things. So they would feel autonomic and competent instead of blindly following others. Mood map and key-word map



can provide clues for crowd members before they choose to join a group, which sounds appealing to the conference crowds.

Adding event moments in a non-event crowd could also help. For example, when people are waiting impatiently, some surprising performances or activities will distract them and enrich their waiting experience.

7. LIMITATION AND FUTURE DIRECTIONS

The whole study only uses qualitative research and generates plenty of chaotic-but-rich qualitative data. Mention frequency is used as the criterion for interpreting most of the data, which can definitely point out a trend that “the most mentioned” factors should be “the most considered” factors so that they are relatively important. However, in order to see the real relative importance of each need for supporting crowd well-being, a quantitative study must be conducted. For instance, using quantitative experiment to see whether relatedness is more essential than autonomy for crowd well-being.

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