Emotions Geogame: Developing a Game for Mapping Emotions and Evaluating Places

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Abstract. This paper demonstrates the state-of-the-art development of the Emotions Geogame. The main goal of the Emotions Geogame is to motivate users/players to go on an adventure, explore their built environment, socialize with other residents and report about the emotions they feel related to the visited places. This research is based on the three pillars of the previous research, which include research on emotions and their meaning, mapping emotions related to places, and location-based games that inspired this test implementation. The core component of the Emotions Geogame is its invitation to the users/players to record their emotions. It is accomplished in a two-step process. In the first step the user selects the emotion felt at the selected place. In the second step the user can provide a more comprehensive response to the reasons for the recorded feeling that stems from the environment. In the next steps of the implementation, the formal and dramatic elements of the Emotions Geogame will be further developed. The testing and data collection will be organized in the USA, Italy and India. The paper concludes with a discussion and directions for further research and implementation.

Keywords: Geogame · Emotions · Places · Unity · Data Collection

1 Introduction

Humans are emotional beings but often have difficulties expressing the emotions they feel or even finding words that would describe emotions. Studying emotions as this intangible sensation and feeling is complex and rather difficult. It is close to impossible to know if "sad" or "joyful" means the same to different people and how they perceive it. Studies on emotions take on different perspectives. An evolutionary theory on emotions stresses the impact of the survival mechanism. The somatic theory of emotions concentrates on senses and feelings, while the cognitive theory on emotions concentrates on mind and cognition while processing emotions.

This research attempts to link three different aspects and unite them in the form of the Emotions Geogame. These three aspects are places, emotions, and games. It investigates if a game can be created that may encourage residents to play and experiment.

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It is envisioned as a location-based game that takes the player into the environment to explore. It is an adventure game that incorporates the elements of the environment and invites the player to explore this environment; outside the player and inside. The outside environment consists of places that, by definition, have fuzzy boundaries. These places may evoke emotions, and the residents may also visit them when they feel in a particular way. Can these emotions be captured? How should a game be designed to motivate users to visit and explore places and record emotions they feel related to these places? The focus of this research is on exploring how to design a geogame that may help to capture how people actually feel in response to given stimuli and what eliciting factors may be responsible for evoking certain emotions. Understanding inhabitants' perceptions of locations can assist urban planners and designers in interpreting the impact of urban morphologies on residents' well-being. This work builds on the previous research on mapping emotions [1], GIS analysis of places and emotions [2], engaging residents [3], and games related to empathy and emotional conditions such as loneliness and depression [4, 5], and location-based games such as Pokémon Go [6]. The main research challenges include questions related to geogame design and implementation, as well as the integration of a geogame's playfulness with serious aspects of emotions felt at certain places.

The Emotions Game is currently in the pilot phase of completion of the first prototype. It is implemented in the game engine environment Unity which utilizes Open Street Map geospatial data used for navigation in the environment. The game is an adventure and exploration geogame that enables the users to socialize and map emotions related to places they visit. This paper summarizes the main results of the current implementation and concludes with discussion and further research directions.

2 Emotions, Games and Places

2.1 Emotions and Applications

Emotions are difficult to study, and several theories attempt to explain them from their perspective. These theories of emotions include evolutionary, somatic, and cognitive theories. The evolutionary theory suggests that emotions serve as a survival mechanism and may be essential in their protection [7–10]. Ekman particularly studies face and facial expressions associated with emotions. The somatic theory of emotion concentrates on the experience and the senses in the body [11, 12]. The cognitive theory of emotion studies cognitive processes that may generate emotions [13]. Emotions have also been studied in the design research community to address how the understanding of emotions can be used to create designs and conditions for evoking, modulating or prohibiting certain emotions in user experience.

Some applied research, for example by the Apple team, studies how to empower people to live a healthier day by using innovative technologies that may support personal health and self-care to achieve overall well-being [14]. Figure 1 shows the user interface and how users can record how they feel and use the slider to indicate how pleasant this emotion is. The Mood Meter developed by the HopeLab [15, 16] in collaboration with Yale Center for Emotional Intelligence uses an emotions grid, which is then implemented on a mobile application as shown in Fig. 1 on the right. Emotions are organized along

the x-axis indicating pleasantness, and, on the y-axis, indicating the level of energy as shown in Fig. 2. An interesting fact is that HopeLab was co-founded by Pam Omidyar who had an idea to create a video game to help young cancer patients with treatment compliance. At the time she was working as a researcher in an immunology lab and a video game enthusiast.

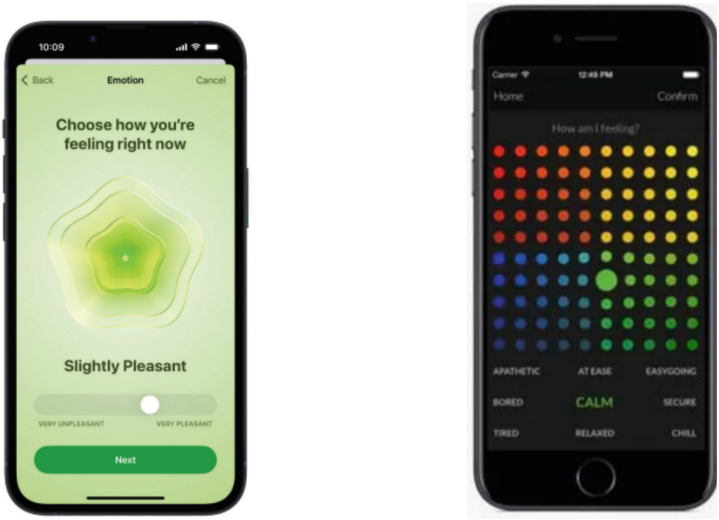

Fig. 1. Apple application (left); HopeLab implementation (right)

Enraged	Panicked	Stressed	Jittery	Shocked	Surprised	Upbeat	Festive	Exhilarated	Ecstatic
Livid	Furious	Frustrated	Tense	Stunned	Hyper	Cheerful	Motivated	Inspired	Elated
Fuming	Frightened	Angry	Nervous	Restless	Energized	Lively	Excited	Optimistic	Enthusiastic
Anxious	Apprehensive	Worried	Irritated	Annoyed	Pleased	Focused	Happy	Proud	Thrilled
Repulsed	Troubled	Concerned	Uneasy	Peeved	Pleasant	Joyful	Hopeful	Playful	Blissful
Disgusted	Glum	Disappointed	Down	Apathetic	At Ease	Easygoing	Content	Loving	Fulfilled
Pessimistic	Morose	Discouraged	Sad	Bored	Calm	Secure	Satisfied	Grateful	Touched
Alienated	Miserable	Lonely	Disheartened	Tired	Relaxed	Chill	Restful	Blessed	Balanced
Despondent	Depressed	Sullen	Exhausted	Fatigued	Mellow	Thoughtful	Peaceful	Comfortable	Carefree
Despairing	Hopeless	Desolate	Spent	Drained	Sleepy	Complacent	Tranquil	Cozy	Serene

High Energy
Low Energy
LOW PLEASANTNESS
HIGH PLEASANTNESS

Fig. 2. Mood Meter (Mood Meter, 2025) [17, 18]

Research on games and emotions mostly concentrates on understanding players' experience of games and how they can be utilized to elicit, evaluate and express emotions [19]. Knutz and Markussen [20] describe the Child Patient Game (CPgame) developed for pediatric patients at a Danish hospital [20]. The players/users are 4 - 6-year-old

hospitalized children who can learn about their emotions and their emotional reactions to medical treatment by using the game which can also inform health personnel about their emotional state.

2.2 Emotions and Places

Places may evoke emotions and residents may also attach emotions to certain places. Out of the whole literature on place and attachment we are selecting publications that are directly related to mapping emotions to places, specifically our previous research on mapping emotions and places. Poplin and her collaborators (Poplin et al. [1]) mapped emotions related to places in Germany, Austria, Iowa (USA) and Brazil. They only concentrated on positive evocative places, places that help residents to feel relaxed and recharged.

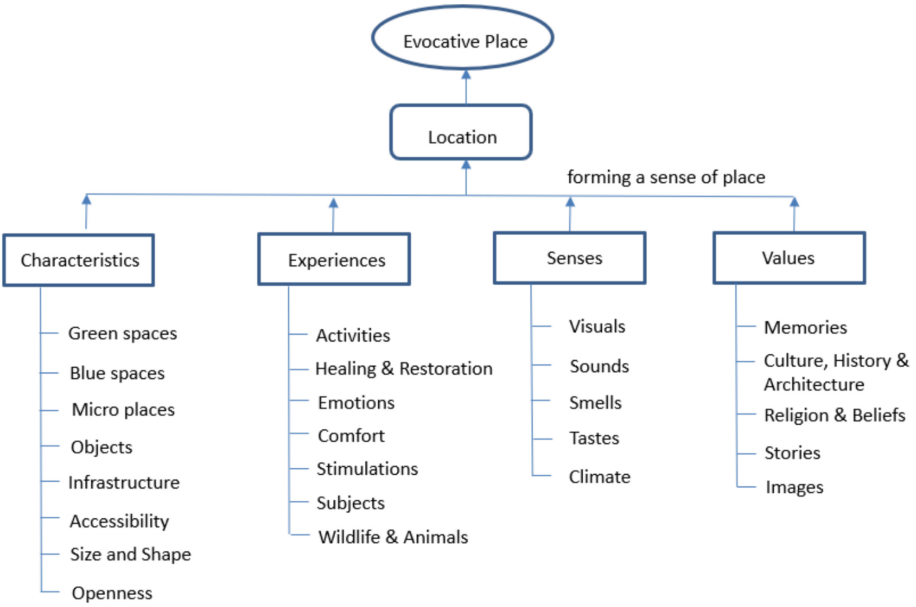

Fig. 3. Conceptual Model of an Evocative Place (Poplin et al. [1])

Figure 3 shows the conceptual model of an evocative place. It summarizes descriptions of evocative places as expressed by the residents in their interviews using paper or online maps and a questionnaire in which the residents described evocative places with three words. A categorization of these descriptions was proposed as a model, verified with a new dataset from Vienna (Austria) which resulted in the version presented in Fig. 3. Evocative places are described with their affordances in terms of physical characteristics of this place, experiences residents may have at this place, what they can sense and remember associated with values.

2.3 Commercial Location-Based Games

Location-based games that use geospatial information and maps and are not serious games include Pokémon Go, Minecraft Earth, Pikmin Bloom, Monster Hunter Now, and Dragon Quest Go, among others.

Pokémon Go First released in 2016, is an augmented reality (AR) game. Players create their own avatar, which is then displayed on a map visualized on their mobile device. As players move in the real world, they also see their moves visualized on the map. They meet characters called Pokémons which can be viewed in AR mode or with a live-rendered background. Technology such as AR using a camera and gyroscope on the player's mobile device helps display characters as if they would appear in the real world. The map on the mobile device also stimulates players to go to certain selected places as indicated on the map.

Minecraft Earth Was released in 2019 as an augmented reality game that utilized OpenStreetMap data and was built on Microsoft Azure. It operated as a sandbox game where players can build and explore the real world with augmented reality objects. Players were encouraged to complete adventures in the form of specific tasks and puzzles to solve or to defeat entities at virtual locations.

Pikmin Bloom Is a 2021 augmented reality game that invites players to play outside. They can wander outside, grow or feed Pikmin creatures, and create a trail of blossoming flowers on the map. Local landmarks can be represented as big flowers or mushrooms. Collaborative events bring players together facing challenges in the game. The player can also take real photographs with virtual Pikmin.

Monster Hunter Now Is a 2023 augmented reality mobile game. It uses the player's real location, who can place an avatar on the gameplay map. The game environment in the form of a map is represented with different options including forest, swamp, and desert. The terrain map is refreshed every 24 h, and available monsters vary depending on the terrain. This game addresses more the "killer" playstyle in which players interact with monsters placed on the map and can initiate fights with them.

3 Research Focus

Based on this brief summary of previous research, the research team decided to explore if it would be possible to create a game that would enable the users to register emotions related to places. The research team summarized the key research questions as follows:

- How to develop a geogame that will invite players to explore places and map emotions?
- How can the geogame be designed to motivate players to keep returning to the game?

The focus of this contribution is in the geogame design and implementation that allows players to log their emotions at specific self-selected locations. The exploration is in the concept of a game, possibility to implement it a game involving real-world geospatial data and the design and inclusion of a module that will enable the user to register emotions.

4 Research Methodology

The research methodology consists of the following steps: literature review, conceptualizations, prototyping and implementations, user testing, data collection, and geospatial analysis. This section summarizes the accomplished in each of these steps. It, in principle, follows Boehm's [21] spiral model of software development, which suggests repeating the cycles from ideation and definition of goals to prototyping and testing in the form of a spiral. Every phase – or loop – results in an improved version of the developed software, resulting in constant improvements and production of new prototypes till the last one satisfies the requirements and specifications. The main research phases composing a research methodology are described as follows.

Literature Review. The initial exploration is in the form of a literature review, which concentrates on understanding emotions and mapping them on smart devices. This phase also includes studying location-based games and their concepts, implementations, and formal elements.

Conceptualization. This phase involved brainstorming online and in person. I included the selection of the platform for implementation. Unity was selected due to the possibility of using OpenStreetMaps for cartographic and spatial visualization. This phase also included initial designs of the game, which included the idea of the game loop. Guardiola defines the game loop as "the set of actions the player will iterate the most, and in which the winning/losing condition are real outcomes" [22]. This idea is then envisioned in ways in which the user/player interacts with the mobile application as she/he visits the places of choice, logs emotion(s), and is then rewarded for this activity. The next design decision was related to the implementation of emotions. The very early prototype was based on six selected emotions, which included joy, tranquility, trust, worry, anger, and regret. Three of them were on the negative spectrum, and three of them were on the positive spectrum. This design choice was then changed as the team discovered the Mood Meter and decided to experiment with its use and implementation in the Emotions Game.

Figure 4 shows the emotions as they appear in the research by Garau and Annunziata [2], and Poplin and her colleagues (Poplin et al. [1]) are mapped on the Mood Meter. The emotions on the gird (Fig. 4) that are marked with circles also appeared in the research on emotions and places as previously explored by Garau, Poplin and their colleagues. This mapping then informed the choice of emotions selected for the implementation of the initial user interface for the Emotions game.

Prototyping and Implementations. The prototyping includes the back-end and front-end prototyping. The map system was implemented in Unity. Figure 5 shows the visualization of maps in the selected game engine. The server-side of the Emotions Geogame (back-end) was written in JavaScript, uses NodeJS, and features the use of CRUD operations to manipulate the data that was then stored in a MySql database. The important information stored in this database includes the geospatial location of the player, date and time, and the answers to the two questions the player answers. Unity then talks to the NodeJS server and uses CRUD operations to add new points players log to the database. Several prototypes were implemented to test a variety of options.

Enraged	Panicked	Stressed	Jittery	Shocked	Surprised	Upbeat	Festive	Exhilarated	Ecstatic
Livid	Furious	Frustrated	Tense	Stunned	Hyper	Cheerful	Motivated	Inspired	Elated
Fuming	Frightened	Angry	Nervous	Restless	Energized	Lively	Excited	Optimistic	Enthusiastic
Anxious	Apprehensive	Worried	Irritated	Annoyed	Pleased	Focused	Happy	Proud	Thrilled
Repulsed	Troubled	Concerned	Uneasy	Peeved	Pleasant	Joyful	Hopeful	Playful	Blissful
Disgusted	Glum	Disappointed	Down	Apathetic	At Ease	Easygoing	Content	Loving	Fulfilled
Pessimistic	Morose	Discouraged	Sad	Bored	Calm	Secure	Satisfied	Grateful	Touched
Alienated	Miserable	Lonely	Disheartened	Tired	Relaxed	Chill	Restful	Blessed	Balanced
Despondent	Depressed	Sullen	Exhausted	Fatigued	Mellow	Thoughtful	Peaceful	Comfortable	Carefree
Despairing	Hopeless	Desolate	Spent	Drained	Sleepy	Complacent	Tranquil	Cozy	Serene

High Energy / Low Energy

LOW PLEASANTNESS — HIGH PLEASANTNESS

Fig. 4. Mapping emotions captured related to places (Poplin et al. [1]) on the Mood Meter

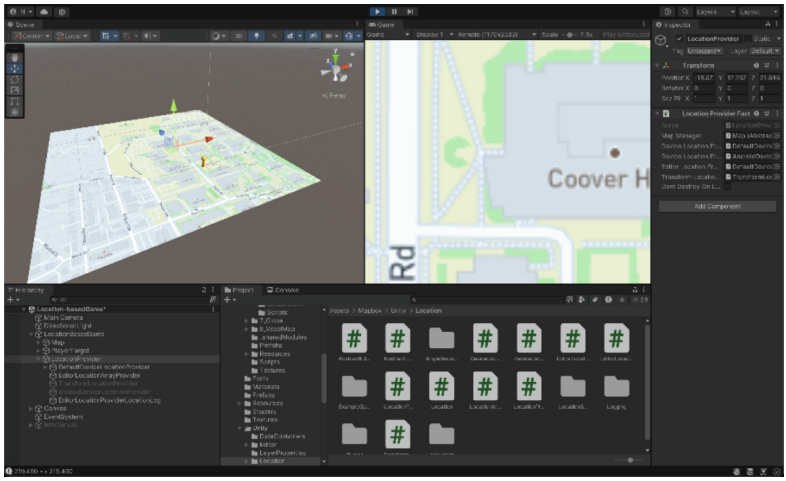

Fig. 5. Use of maps in the game engine Unity

User Testing and Data Collection and Geospatial Analysis. The initial tests of the system were performed after the test implementation. The data collected were first exported from Unity and then fed into the backend server created for data management. A Python script was used to convert the JSON data file taken from the server into a GeoJSON format, which can then be imported into a geographic information systems (GIS) software. Once the team implements the final version of the game, more comprehensive user testing is planned. The data collected will then be imported into a geographic information system and used for geospatial analysis of places in the selected cities.

5 The Concept of the Emotions Geogame

The Emotions Geogame is designed as an adventure and exploration game. Users/players go on a quest to explore their environment. A socializing component will add excitement for players who want to meet at certain places, socialize and visit those places, or meet other people. They will go on quests and missions.

Mapping emotions within the Emotions Geogame is currently concentrated on two main questions. The first question inquires how this place makes the user/player feel. The second question explores what in the environment makes the user/player feel this way. The implementation and the initial mock-ups for the mapping emotions part of the game are illustrated in Fig. 6.

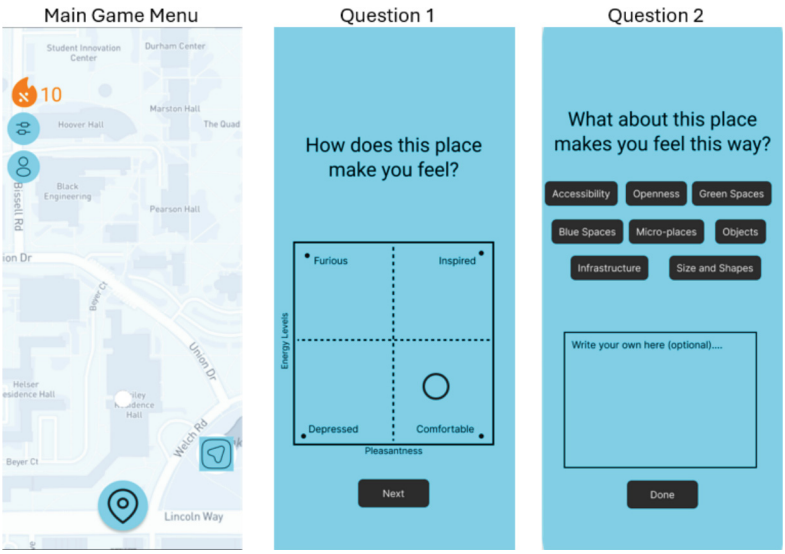

Fig. 6. Initial mock-up user interface for the Emotions Game

Question 1: How does this place make you feel?

The first question will present a grid with an x and y axis to the player. The x-axis will be "pleasantness," and the y-axis will be "energy levels". Four "landmark emotions" will be given to the player at four of the extremes on the graph as a way to orient themselves. The x-axis is scaled from (−25, 0) to (25, 0), while the y-axis is scaled from (0, −25) to (0, 25).

Question 2: What about this place makes you feel this way?

The second question will give the player the ability to understand why they feel the way they do, as well as give us the data to understand why they feel in a specific way. The user will also have the ability to input their own answer in a textbox if the provided answers are not enough.

In the further brainstorming about the implementation two additional ideas to Question 1 emerged. They are visualized on Fig. 7. On the left-hand side: Adding a

grid for easier navigation in indicating emotions on the unpleasant – pleasant and low energy – high energy axes. On the right-hand side: Writing words for emotions that were most often expressed based on the previous research.

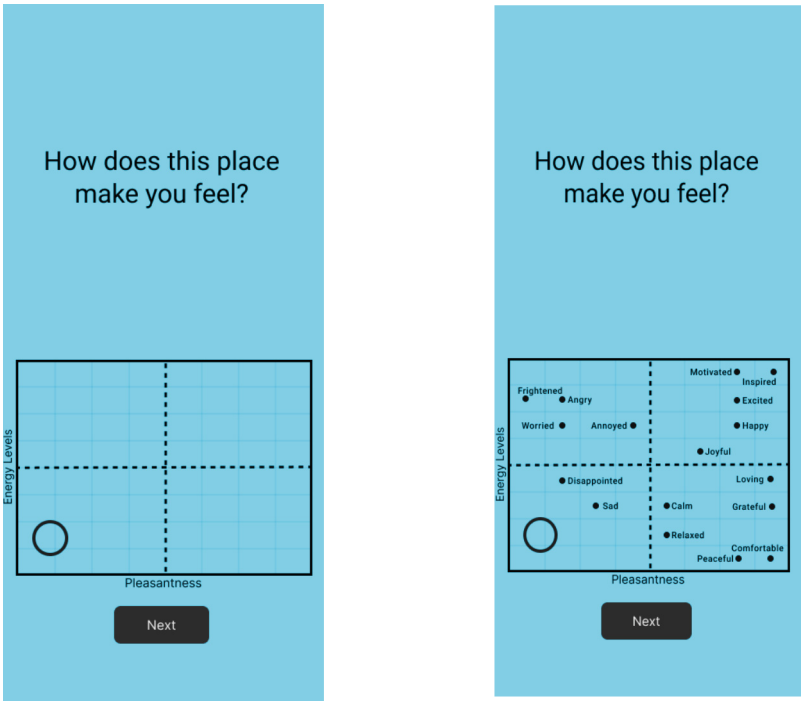

Fig. 7. Adding a grid and extracted words expanding the user interface of the Emotions Game

6 Conclusions and Further Research

This paper overviews the current state of the development and implementation of the Emotions Game, game designed to engage users/players in exploring their city, meet other residents, and take on an adventure. The Emotions Geogame also aims to motivate them to record their emotions related to places they visit. It is being developed in a collaboration of researchers from the USA, Italy and India in fruitful and regular project meetings.

The main concept was first developed for the section on emotions and mapping emotions. A set of location-based games served as inspiration for a mobile game. Previous research on emotions and mapping emotions and places inspired this implementation. The Emotions Geogame is still in its experimental phase and further development and implementation will be needed. More work needs to be invested in defining the main goals and missions/quests of the game. They are particularly important as they may significantly impact users/players' retention and the willingness and motivation to return to the game and play it repeatedly.

The game engine Unity was selected for its implementation due to its ability to integrate real-world data in the form of interactive maps. The map layer is provided by the Open Street Map organization, which unites mappers from around the world to create a geospatial database of places. The users of the Emotions Game can view these maps, use them for navigation, and search for places. The main motivation behind the development is the idea that a game can be a very motivating and attractive tool for community engagement. Through this engagement with the game the residents can explore their living environment, visit their preferred and favorite places, and also share their emotions related to the places visited. The Emotions Geogame aims to enable its users/players to capture their longitude and latitude, date and time, and an emotion ID representing the x and y of the point chosen on the graph and the reasons for feeling this emotion. A Python script was developed to convert these collected data into GeoJSON format that can be directly imported into a geographic information system. This data will then be further analyzed and combined with other geospatial data depending on the goals of the analysis.

In the further steps of research, the final version of the user interface and its implementation will be selected. The concept of the Emotions Game needs to be expanded and more clearly defined. This will include the definitions of the formal and dramatic geogame elements and a more specific premise of the game. The research team intends to complete the implementation and organize testing in the cities of the countries from which the team originates, including the USA, Italy, and India. The further goal of this research is to contribute to a better understanding of the living environments and how they affect the emotional states and well-being of their citizens. This data should further inform urban designers, architects, and planners of the characteristics of built environments and help create places that result in well-being and positive emotions for their residents and, with that, a better-built environment for everyone.

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References

1. Poplin, A., Duffer, E., Gartner, G.: Well-being evocative places: validating the conceptual model of an evocative place (CMEP) based on the inter-rater reliability test. Int. Cartograph. J. **9**(1) (2022). Taylor and Francis. https://doi.org/10.1080/23729333.2022.2091740
2. Garau, C., Annunziata, A.: Supporting children's independent activities in smart and playable public places. Sustainability **12**(20), 8352 (2020)

3. Stembert, N., Mulder, I.J.: Love your city! An interactive platform empowering citizens to turn the public domain into a participatory domain. In: International Conference Using ICT, Social Media and Mobile Technologies to Foster Self-Organisation in Urban and Neighbourhood Governance, Delft, The Netherlands (2013)
4. Cheng, Z., Greenwood, B.N., Pavlou, P.A.: Location-based mobile gaming and local depression trends: a study of Pokémon Go. J. Manag. Inf. Syst. **39**(1), 68–101 (2022). https://doi.org/10.1080/07421222.2021.2023407. Accessed 12 Jan 2025
5. Karpouzikis, K., Yannakakis, G.N. (eds.): Emotion in Games: Theory and Praxis. Springer, Cham (2016)
6. Wang, A.I., Skjervold, A.: Health and social impacts of playing Pokémon Go on various player groups. Entertain. Comput. **39**, 100443 (2021). https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2984964. Accessed 27 Jan 2025
7. Plutchik, R.: A general psychoevolutionary theory of emotion. In: Plutchik, R., Kellerman, H. (eds.) Emotion: Theory, Research and Experience, Theories of Emotion, vol. 1, pp. 3–33. Academic Press, New York (1980)
8. Plutchik, R.: A psychoevolutionary theory of emotions. Soc. Sci. Inf. **21**(4–5), 529–533 (1982). https://doi.org/10.1177/053901882021004003.S2CID144109550
9. Tomkins, S.: Affect Imagery Consciousness: Cognition, vol. 4. Springer, New York (1992). 9780826104458
10. Ekman, P.: Facial expression and emotion. Am. Psychol. **48**(4), 384–392 (1993). https://doi.org/10.1037/0003-066X.48.4.384
11. Lang, P.J.: The varieties of emotional experience: a meditation on james-lange theory. Psychol. Rev. **101**(2), 211–221 (1994). https://doi.org/10.1037/0033-295x.101.2.211
12. Damasio, A.: Descartes' Error: Emotion, Reason, and the Human Brain, Putnam (1994). ISBN 0-399-13894-3
13. Arnold, M.B.: Memory and the Brain. L. Erlbaum Associates, Hillsdale, N.J. (1984). ISBN 0-89859-290-9. OCLC 10275461
14. Apple: Empowering people to live a healthier day Innovation using Apple technology to support personal health, research, and care (2022). https://www.apple.com/newsroom/pdfs/Health-Report-October-2023.pdf. Accessed 12 Feb 2025
15. HopeLab: Mood Meter development In partnership with Yale Center for Emotional Intelligence (2025). https://hopelab.org/case-study/mood-meter/. Accessed 20 Mar 2025
16. YCEI: Yale Center for Emotional Intelligence (2025). https://medicine.yale.edu/childstudy/services/community-and-schools-programs/center-for-emotional-intelligence/. Accessed 18 Mar 2025
17. Mood Meter: Mood Meter (2025). https://unhconnect.unh.edu/s/1518/images/gid4/editor_documents/moodmeter-2020.pdf?gid=4&pgid=61&sessionid=1bb73457-5514-4c64-9482-329849e69901&cc=1. Accessed 25 Mar 2025
18. Hernandez, J., Hoque, M., Drevo, W., Picard, R.W.: Mood meter. In: Proceedings of the 2012 ACM Conference on Ubiquitous Computing – UbiComp '12, 5–8 September 2012. ACM, Pittsburgh, USA (2012)
19. Yannakakis, G.N., Paiva, A.: The Oxford Handbook of Affective Computing. Oxford University Press (2015)
20. Knutz, E., Markussen, T.: Measuring and communicating emotions through game design. In: Proceedings of Design and Emotion: Proceedings of the 7th International Conference on Design and Emotion (2010). http://www.id.iit.edu/de2010/index.html. Accessed 12 Feb 2025
21. Boehm, B.: A spiral model of software development and enhancement. IEEE Comput. **21**(5), 62–72 (1988)
22. Guardiola, E.: The gameplay loop: a player activity model for game design and analysis. In: Proceedings of the 13th International Conference on Advances in Computer Entertainment Technology, pp. 1–7. ACM, New York, NY, USA (2016)