



Designing a Visualization based on Emotion Log with Multiple Aspects of Life Quality

金庭潤¹⁾, 楊期蘭¹⁾, 竹内俊貴¹⁾, 鳴海拓志¹⁾

Jungyun KIM, Chi-Lan YANG, Toshiki TAKEUCHI and Takuji NARUMI

1) 東京大学大学院 情報理工学系研究科 (〒113-8656 東京都文京区本郷 7-3-1)

Abstract: This study proposes a new visualization design that reflects multiple life aspects, by visualizing users' perceived happiness and stress levels of their daily activities. With the proposed visualization, we expect individuals to develop self-awareness and quality of life.

Keywords: Visualization, Lifelog, Emotion

1. Introduction

Self-awareness is being aware of individuals' own characteristics such as emotions, behaviors and thoughts [1]. It enables individuals to better evaluate physical and emotional activities, discover individuals' hidden aspects, and identify the quality of life. Within self-awareness, happiness and stress are one of the important aspects because these emotional states are heavily involved in human life [2]. Individuals have their own standard of happiness and stress, and thus understanding such standards support self-awareness development and discern life quality [3].

Developing self-awareness is important for any individuals in society [4], as it is related to their quality of life. However, it can be challenging because self-awareness is an invisible element of self. Individuals are generally more motivated with visible elements such as building high social status or becoming professionals [5]. Furthermore, the quality of life is influenced by the combination of various daily activities [6], and it is difficult for individuals to discover a suitable combination for themselves and keep a balanced lifestyle. Although self-reflection is one of the classic methods for self-awareness development [7], a busy daily routine becomes an obstacle by reducing time for individuals to look into themselves. To enhance self-awareness development, we expect that a simple approach including visuals is required. Previous studies have attempted to develop self-awareness with a questionnaire and visualizing happiness and stress based on certain daily routine activities. However, such studies reflect a single life aspect, making it problematic for individuals to understand their overall lifestyle which involves multiple life aspects [8].

In this study, we propose a new visualization design with multiple life aspects to support self-awareness development. The multiple life aspects are represented by visualizing users' perceived happiness and stress levels of their daily activities, using data collected from a lifelogging mobile application. Users can perform self-reflection by reviewing and monitoring their daily activities and emotional states. They can also change the visualization design through interaction with the visualization. With the proposed visualization, we expect users to be better aware of their emotional states and their life quality, leading to positive behavioral change.

2. Related Work

Understanding individuals' own standards and levels of happiness and stress are essential in self-awareness development because these emotional states support structuring individuals' identity, enrich their life quality perceptions, and promote a balanced lifestyle. A continuous monitoring of happiness and stress is required to obtain such understanding, as these emotional states change frequently depending on individuals' daily routines and behavior. The Oxford Happiness Questionnaire enables individuals to measure their happiness levels regularly by asking about perception and satisfaction of life, personality and social environment [9]. Individuals can answer by selecting from a six-point Likert scale, and one is the lowest and six is the highest. A score with the same scale is provided at the end, representing the overall happiness level. They are also encouraged to compare the score over time, reflect on their lifestyle, and seek improvements. From the questionnaire, we learned the importance of scale selection when

measuring emotional states because ambiguous values such as midpoint for neutrality may not obtain precise analysis on perceived emotional states, thus less contributing to self-awareness development. We also discovered that there is always a possibility of individuals losing interest or forgetting about responding to the questionnaire if conducted long-term. Therefore, we think keeping individuals motivated is crucial as lifelogging inevitably involves long-term monitoring.

The benefits of self-reflection by visualized emotional states on self-awareness development are verified in MoodMap and Emotical. MoodMap is a web application which supports individuals to become self-aware at work by reflecting their emotions visualized as scatter plot and providing triggers to solve workplace problems [10]. Individuals can use it to record and monitor their emotions and compare with others to understand themselves and their colleagues. Four weeks of field study demonstrated that MoodMap developed individuals' emotional self-awareness, increased work performance and fostered team communication because it enables managers to promptly take action when employees feel stressed unconsciously from work-related reasons, lowering the risk of mental disorders. Emotical is a web and mobile application that continuously tracks and visualizes past and future moods as a line graph to promote self-reflection and improve emotional self-awareness [11]. It generates a two-day forecast of users' overall mood based on their data on mood and activities conducted in the past, with recommendations for future behaviors. From three weeks of controlled experiment, it was discovered that viewing the visualization of individuals' own emotions provided an opportunity to learn more about themselves, contributing to self-awareness development. It also demonstrated that visualization showed more impact in building self-awareness compared to raw data.

However, visualization presented in MoodMap and Emotical have limitations in displaying diverse life aspects, and it is difficult for individuals to deepen self-awareness and discover optimal lifestyle balance. For example, MoodMap focused explicitly on work settings, and thus individuals do not have an opportunity to reflect their emotional states from different sectors of daily routine such as leisure and socialization with friends and family. Although Emotical attempted to convey multiple life aspects by encouraging users to add detailed notes on their daily activities, it became a cumbersome workload, decreasing their motivation to add data. The visualization in Emotical focused on delivering accurate results rather than building connections with the individuals, thus they might be not engaged in using this application. Therefore, we think the visualization should allow individuals to feel connected through its design and convert their insights into actions. Moreover, the workload required for data collection should be minimized for higher motivation to interact

with the visualization.

3. Proposed Visualization

This study proposes a new type of visualization in the form of a house. The metaphor of home being used to represent individuals' identity [12], which allows individuals to engage with the visualization easily. We used eight design strategies [13] for supporting behavior change as a reference to ensure that the visualization encourages individuals to reflect on themselves.

The design of the visualization is shown in Figure 1, 2, 3 and 4. It conveys the causes of happiness and stress from individuals' daily activities using different house components such as a roof or windows. This is to reflect multiple aspects of life quality using a wide range of daily activities, as related work focuses on reflecting a single aspect of life quality by visualizing emotions from certain activities of a daily routine [10]. The categories of daily activities are from the survey conducted by us in 2020 [14], and its details are shown in Table 1. The number of activities determines the color variation in visualization, and more activities create a colorful house. The size and shape of the house are generated from the level of happiness and stress, and a higher happiness and stress level creates a larger house. Individuals start with a bland house and gradually change it through interaction, creating a unique design for themselves.

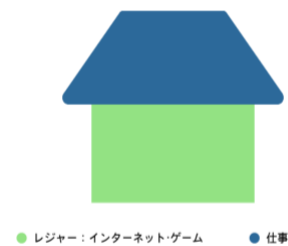


Figure 1: Example of a house with low variation of daily activities and low level of happiness and stress.

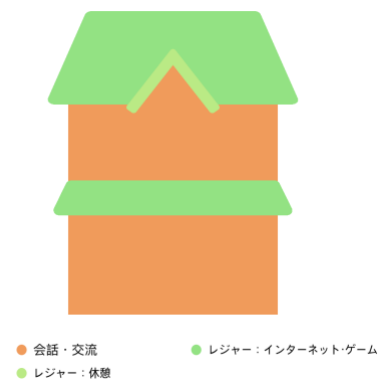


Figure 2: Example of a house with low variation of daily activities and high level of happiness and stress.



Figure 3: Example of a house with high variation of daily activities and low level of happiness and stress.



Figure 4: Example of a house with high variation of daily activities and high level of happiness and stress.

4. Prototype: How Are You

We developed an iOS mobile application, ‘How Are You’ that enables users to review their happiness and stress levels in real-time. They can perform self-reflection through two types of visualization; one is a house of happiness, and the other is a house of stress, for self-awareness development. They can also compare their visualization with others and use it as an inspiration for further design development. The details of the user interface are shown in Figure 5. The data used to design visualization is collected using Google Forms. It requires users to select their current activity and corresponding happiness and stress level using the same scale in The Oxford Happiness Questionnaire, which is on a scale of one to six where one is the lowest and six is the highest. The data from Google Forms is transferred to Google Sheets and uploaded to Firebase after calculating the average happiness and stress level. ‘How Are You’ retrieves and arranges the data in descending order as an array and decides the size of a house based on the first index. This also applies when deciding the size of other house components. Moreover, the number of indexes within the array represents the number of components, and a higher number generates a broader range in design by adding trees or window

frames.



Figure 5: The user interface of ‘How Are You.’

5. Pilot Experiment

The pilot experiment aimed to compare the effects of current visualization with proposed visualization for understanding causes of happiness and stress. We chose a bar and pie chart to compare with the proposed visualization because these are one of the most commonly used visualization techniques [15]. It was conducted for one week with six participants, where three are male and three are female. Participants were asked to complete a pre-survey on quality of life [16] and download an existing diary mobile application. They typed at least five activities conducted during the day and rated happiness and stress for those. After this, they answered a post-survey that includes the same questions as the pre-survey and feedback on their own and other participants’ visualization created from the data. We did not use ‘How Are You’ in pilot experiment because this experiment was to examine if a house is appropriate for self-awareness development.

As a result, three participants showed a slight increase in their overall life quality, however as the experiment was only conducted for one week, it was difficult to identify what mostly contributed to life quality development at this stage. Participants answered that the bar chart was the easiest to understand. However, as shown in Table 2, there was no significant difference in ranking when calculating its average. In terms of the interpretation, the house showed the greatest consistency. When participants were asked to interpret and describe other participants’ visualization, they showed different results of the same visualization, especially in bar and pie charts. For example, A thinks B is an extrovert, but C thinks B is an introvert. This demonstrated that although commonly used visualizations were easier to comprehend, the difference in interpretation may impact the level of enhancement in self-awareness development thus it is important for the visualization to deliver consistent meaning.

Table 1: Categories of daily activities.

Main Category	Subcategory
Socialization	None
Leisure	Rest Internet/Game TV/Movie Art/Music Shopping Sports Other
Eating	None
Sleeping	None
Studying	None
Working	None
Other	None

Table 2: An excerpt from the post-survey of pilot experiment.

Which visualization was the easiest to understand? (average ranking)		
1st	2nd	3rd
Bar chart (1.5)	House (1.7)	Pie (2.8)

6. Conclusion and Future Work

This study focuses on developing self-awareness by visualizing happiness and stress as a house, which portrays multiple aspects of life quality. From the pilot experiment, we discovered that consistency in interpreting the visualization affects the level of self-awareness development. Based on the feedback from the pilot experiment, we made improvements to the visualization by adjusting the number of house components and revising colors. Future work involves verifying the impact of the proposed visualization on enhancing self-awareness development and quality of life by comparing with the commonly used visualization in the main experiment.

References

- [1] Goleman, D. (1998). Working with emotional intelligence.
- [2] Seligman, M. E., & Csikszentmihalyi, M. (2014). Positive psychology: An introduction. In *Flow and the foundations of positive psychology* (pp. 279-298). Springer, Dordrecht.
- [3] Tay, L., Kuykendall, L., & Diener, E. (2015). Satisfaction and happiness—the bright side of quality of life. In *Global handbook of quality of life* (pp. 839-853). Springer, Dordrecht.
- [4] Eurich, T. (2018). What self-awareness really is (and how to cultivate it). *Harvard Business Review*.
- [5] Urdang, E. (2010). Awareness of self—A critical tool. *Social Work Education*, 29(5), 523-538.
- [6] Inoguchi, T. (2015). Multiple modes of wellbeing in Asia. In *Global handbook of quality of life* (pp. 597-607). Springer, Dordrecht.
- [7] Dishon, N., Oldmeadow, J. A., Critchley, C., & Kaufman, J. (2017). The effect of trait self-awareness, self-reflection, and perceptions of choice meaningfulness on indicators of social identity within a decision-making context. *Frontiers in psychology*, 8, 2034.
- [8] Di Lascio, E. (2018, October). Emotion-Aware Systems for Promoting Human Well-being. In Proceedings of the 2018 ACM International Joint Conference and 2018 International Symposium on Pervasive and Ubiquitous Computing and Wearable Computers (pp. 529-534).
- [9] Hills, P., & Argyle, M. (2002). The Oxford Happiness Questionnaire: a compact scale for the measurement of psychological well-being. *Personality and individual differences*, 33(7), 1073-1082.
- [10] Rivera-Pelayo, V., Fessl, A., Müller, L., & Pammer, V. (2017). Introducing mood self-tracking at work: Empirical insights from call centers. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 24(1), 1-28.
- [11] Hollis, V., Konrad, A., Springer, A., Antoun, M., Antoun, C., Martin, R., & Whittaker, S. (2017). What does all this data mean for my future mood? Actionable analytics and targeted reflection for emotional well-being. *Human-Computer Interaction*, 32(5-6), 208-267.
- [12] Coolen, H., & Meesters, J. (2012). Editorial special issue: House, home and dwelling.
- [13] Consolvo, S., McDonald, D. W., & Landay, J. A. (2009, April). Theory-driven design strategies for technologies that support behavior change in everyday life. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 405-414).
- [14] Kim, J., Takeuchi, T., Tanikawa, T., Narumi, T., Kuzuoka, H., & Hirose, M. (2020, July). A Study on Self-awareness Development by Logging and Gamification of Daily Emotions. In *International Conference on Human-Computer Interaction* (pp. 194-201). Springer, Cham.
- [15] Sadiku, M., Shadare, A. E., Musa, S. M., Akujuobi, C. M., & Perry, R. (2016). Data visualization. *International Journal of Engineering Research And Advanced Technology (IJERAT)*, 2(12), 11-16.
- [16] 田崎美弥子, & 中根允文. (1998). 健康関連 「生活の質」 評価としての WHOQOL. *行動計量学*, 25(2), 76-80.