



# Mood Boards as a Tool for Studying Emotions as Building Blocks of the Collective Unconscious

Huang-Ming Chang<sup>1</sup>, Leonid Ivonin<sup>2</sup>, Marta Diaz<sup>3</sup>, Andreu Catala<sup>3</sup>,  
and Matthias Rauterberg<sup>4</sup>(✉)

<sup>1</sup> Mendix Technology B.V., Rotterdam, The Netherlands

ahuang17@gmail.com

<sup>2</sup> Keytree Ltd., London, UK

leonid.ivonin@gmail.com

<sup>3</sup> Universitat Politècnica de Catalunya, Vilanova, Spain

{marta.diaz, andreu.catala}@upc.edu

<sup>4</sup> Eindhoven University of Technology, Eindhoven, The Netherlands

g.w.m.rauterberg@tue.nl

**Abstract.** We conducted an empirical study to answer the research question whether designers could generate richer affective content through mood boards when they are primed by archetypal media content, comparing to non-archetypal media content. Mood board making may stimulate more feedback from target users and help designers discover deeper insights about user needs and aspiration towards products. Today, mood board making has become an essential skill for designers. However, this technique did not gain adequate credits in terms of scientific evidence. It is necessary to assess the validity of mood boards to be an effective tool for studying unconscious emotions in design research. Four professional designers were asked to make mood boards for four different TV commercials (2× without archetypal content; 2× with archetypal content). All 16 mood boards are made online available to a group of 141 raters. In a random order all raters had to click on each mood board to view the full-size and give a rating of ‘attractiveness’ [0–100 score]. The GLM results of all ratings indicate that the attractiveness of the mood boards for archetypal media content and non-archetypal media content are significantly different ( $F = 15.674$ ,  $df = 1$ ,  $p < 0.001$ ). The mood boards primed by archetypal media content (Mean = 54.42, SE = 1.55) are significantly more attractive than the mood boards primed by non-archetypal media content (Mean = 51.37, SE = 1.47). We conclude that mood boards are a enough good tool to investigate and use unconscious emotions what is relevant for addressing design challenges in different contexts.

[AOI]

**Keywords:** Mood board · Industrial design · Unconscious emotions · Archetypes

## 1 Introduction

Emotion is an essential part of people’s life. While psychological science strives for exploring the functionality and the ontology of emotion, other fields of study focus on

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how research on emotions can be applied in real-life applications and seek the possibilities to enhance the psychological wellbeing. In the engineer field, ‘affective computing’ was first proposed by Picard [1], who advocates the importance of emotion while the mainstream engineering studies focus more on machines and technologies rather than human perspectives. One of the visions of affective computing is that future computers (or machines) should be capable of sensing human emotions and acting accordingly, and, in an ideal scenario, computers should even be able to deliver emotional expressions to enhance their communication with human users Picard [2]. The current states of affective computing mainly focus on the development of precise and reliable measurements for emotion recognition and emotion modeling using computational algorithms. The obtained models can thus be applied to real-life applications that support a higher-level of human-computer interaction and even enrich human-human communication.

Although affective computing has grown vigorously and has achieved great success in recent years [3], its knowledge has not yet been used to support emotional design activities. This might since most designers rely on experience-based approaches rather than systematic approaches in order to cope with various design challenges. Experience based approaches are based on tacit knowledge that cannot be explicitly described and can only be gained through practices, especially for designers [4]. Experience based approaches are often used to deal with complex problems in which people can hardly solve through logical thinking and thus can only rely on their intuition for decision making [5]. On the contrary, systematic approaches are suitable for well-defined problems and less demanding on designers’ experiences. Therefore, systematic approaches are mostly used for design evaluations rather than design practices [6].

The new challenge for design researchers is to integrate systematic approaches into experience-based approaches. Although experience-based approaches are powerful particularly for design practices, they are prone to biases and less consistency [7]. We have conducted three studies using affective computing techniques to explore the impact of archetypal media content on ‘unconscious’ emotions [8]. There were two primary findings. Firstly, we applied archetypal symbolism to meaning analysis on media content and developed a standard procedure for editing archetypal media content from commercial movies for psychological experiments. Secondly, the results of these three studies suggested that emotions induced by archetypal media content were either too complicated to express through self-reports or inaccessible to conscious awareness, but these emotions can be classified by using the predictive model obtained from the physiological data. Since experience-based design approaches toward emotional design are based on conscious introspection and self-reports, it appears that a wide range of emotions have not yet been discussed in emotional design. Thus, it is necessary to integrate affective computing into experience-based design approaches in order to facilitate emotional design. In this way, the design process would remain flexible and designers could get useful insights provided by scientific studies.

In order to initiate this undertaking, we started with mood board making, which was known as an experience-based technique used for communicating and visualizing emotional qualities. The use of mood boards is versatile. It has long been used for communicating emotional qualities between designers and clients [9]. The process of mood board making also serves as a resource for creative thinking [10]. While mood

board making has become an essential skill for design practice, we have seen its potential to be a research tool specifically for investigating non-verbal emotional experience. In order to use mood board making as a research tool for studying emotions, it is necessary to apply psychological methodologies to verify its validity. This would reveal possible disadvantages of using mood board making for research purposes, but also help discover new opportunities to integrate affective computing into emotional design.

We first review the current development of emotion evaluation tools in design research, and then revisit the procedure of making mood boards from a psychological perspective to formulate a framework of mood board making as a research tool for emotional design. According to this framework, we conducted two experiments to examine the effectiveness of mood boards in expressing emotional qualities across interpretations of design background and non-design-background participants and the validity of mood board making for archetypal and non-archetypal media content. These two studies helped clarify the advantages and disadvantages of using mood board making as a research tool for studying emotion. Next, we developed an application by implementing affective computing technology for supporting the process of mood board making in order to enhance the validity of mood board making and remedy its deficiencies in visualizing the continuous emotional experiences in archetypal media content. A case study was reported for demonstrating the use of this application. Finally, we discuss the implications of this study for emotional design and look forward to future work in this direction.

## 2 Design Research on Emotions<sup>1</sup>

Similar to affective computing, Kansei Engineering is a consumer-oriented approach that is used to quantify emotional qualities particularly in products, and generalize design factors that allow designers to refine the current design and even explore new possibilities for design at the early stage of product development [11]. Researchers in Kansei Engineering intend to investigate the relationship between consumers' psychological feelings and product features, such form, shape, color, and any perceptual qualities. Designers can thus generate new product concepts by manipulating product features. This method can also be used to evaluate qualities of new concept at early stages of the design process [12]. The Japanese word 'Kansei' encompasses broad concepts, referring to all of which are conceived as mental responses to external stimuli, including emotion, senses, and aesthetics [11]. Although Kansei Engineering covered the issues about how customers feel about products, it was developed specifically for aesthetics and product design and did not draw much on psychological theories. This was probably because psychological theories put more emphasis on the functional views of emotions that facilitate the survival of human beings as a species, but rarely discuss non-utilitarian emotions, e.g. aesthetic emotion [13] and emotions in media content [14]. Therefore, design researchers cannot directly apply psychological theories to research on emotional design. This has led to the challenge for design researchers to mediate psychological theories and approaches into the context of design. Research in Kansei Engineering often uses semantic scales

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<sup>1</sup> This paper is based on chapters 7 and 8 of the PhD thesis of H-M. Chang (2014).

with perceptual and emotional qualities, which may give rise to some concerns about cultural differences and product categories [15]. E.g., the expression in Japanese and English on certain perceptual qualities may differ; kitchen appliances and automobiles should use different sets of semantic scales.

The connection between emotion and design has drawn more attention since the term ‘emotional design’ was coined and popularized by Norman [16]. In recent years, pioneering design researchers have taken the initiative to extend existing psychological theories to build models particularly for product emotions [17–20]. Some researchers have shift the focus from physical products to user experience, exploring how emotions influence the overall experience under certain circumstances [16, 20, 21]. Jordan [22] developed a questionnaire specifically for evaluating positive emotional experience about products. This questionnaire encompasses 14 questions about specific emotions, such as entertained, excited, and satisfaction. Considering the feasibility across products and cultures, this questionnaire provided optional open-ended questions that allowed the experimenter and the subject to add new words. While Kansei Engineering and Jordan’s questionnaire focused on physical products, several new evaluation tools for measuring user experience were proposed in recent years. User experience questionnaire (UEQ) [23] used a similar approach to Kansei Engineering but shifted the focus from products to users. Thus, UEQ removed adjectives describing physical appearance of physical products (e.g. shape and color) and included more words for describing cognitive load, emotions and preferences.

While most evaluation tools are intended to derive immediate responses from subjects, a tool called iScale [24] was developed for observing long-term, continuous user experiences. This tool requires users to recall their long-term experiences periodically while using a new product in their daily lives. Unlike other tools using Likert scales, iScale takes a novel approach, asking users to draw a curve to indicate the changes in their emotional experiences related to the product. However, this curve-drawing approach does not aim to acquire exact emotional qualities, but to serve as a reference for tracing pleasant or unpleasant events that occurred, which allows designers to ‘reconstruct’ the past and solve potential problems of the product accordingly. However, the abovementioned evaluation tools are language dependent. Although the interpretations in affective meaning are universal at a certain degree [25], various modalities of emotional responses are universally valid and might benefit non-verbal emotion communications, such as facial expressions [26]. PrEmo [27] was developed based on this assumption, using facial expressions and body gestures with animated cartoon characters to illustrate different emotional qualities. Subjects could thus fill this questionnaire through self-reports as an instrument for measuring consumers’ emotional responses specifically to product appearance. In addition to the abovementioned tools, there are more new tools released in recent years [28, 29]. Most design researchers apply research-based approaches to investigate product emotions [16, 30] and endeavor to develop systematic procedures for evaluating emotional experience. However, how to study emotion in design practice is rarely discussed. Over the past years, designers have been using experience-based tools, such as mood boards, to study emotions. Comparing to systematic tools, experience based tools are usually quick-and-flexible solutions and do not have strict term of use [31]. On the other hand, the validity of experience-based tools is difficult to validate so that this kind of tool is rarely discussed in empirical studies [10, 30].

### 3 Revisit Mood Board Making

Considering integrating affective computing into emotional design, we start with mood board making because it is a design tool particularly for studying emotional qualities [32]. In order to verify the validity of mood board making, it is necessary to revisit its procedure and thereby look for possibilities to improve this experience-based tool using systematic approaches [33].

#### 3.1 A Psychological Perspective

Mood boards are a collection of visual images gathered together to represent an emotional responses to a design brief [34]. It is a visual and sensory instrument for designers to communicate with each other and also with the clients [10]. This tool functions as a non-verbal medium communicating complex and delicate emotional qualities that are difficult to express through languages. The process of mood board making can stimulate insightful discussions, providing inspirations at the early stage of concept development [12]. In order to support mood board making, various modalities of interactive technologies were applied to developing digital mood board [35], which enable designers and clients to co-create mood boards effectively.

Mood board making were developed solely for designers. Since mood board making is technically easy and simple, some researchers have tried to use mood boards as a catalyst in focus groups [36]. Similar to the context-mapping approach [37], mood board making may stimulate more feedback from target users and help designers discover deeper insights about user needs and aspiration towards products. This has shown the potential of mood boards to be used as a tool for capturing emotional experiences in different contexts. Today, mood board making has become an essential skill for designers. Several studies have discussed how to teach and apply this technique in design education [9, 33, 34]. It appears that most designers are trained to translate emotional qualities into mood boards – a visual manifestation that associates with the given content, e.g. products and brands. However, this technique did not gain adequate credits in terms of scientific evidence. It is necessary to assess the validity of mood boards to be an effective tool for studying emotions in design research.

In the early stage of the design process, one of the primary tasks is to define emotional qualities of the new product. To initiate this undertaking, designers usually start with the ‘design theme’ of the given project, such as the brand image of the client and the marketing position of the new product. After a thorough understanding of the theme, designers can thus make mood boards to visualize predefined emotional qualities. These mood boards serve as part of the key references for later stages of product development. Designers must discuss with their clients about the mood boards to identify the common goal of the project, and also talk with target users in order to obtain useful insights. From a psychological perspective, the above process can be decomposed into two stimuli-response processes. The ‘design theme’ of the given project can be conceived as a mutual affective stimulus to both designers and users/clients. After both have been primed with the emotional experience, designers make mood boards as a self-report outcome, and then users/clients provide their evaluation according to their subjective emotional experience. Designers need to modify their mood boards iteratively in order to reach

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a certain consensus among themselves and the target users [38]. If we intend to use mood board making as a research tool, it is necessary to assess the validity of these two processes - the making of mood boards and the evaluation of mood boards - in order to ensure that the final outcome (i.e. mood boards) successfully reflect the emotional qualities in the design theme.

### 3.2 Mood Boards as a Research Tool for Study Emotions

In order to take this initiative, we needed to first verify the validity of the evaluation of mood boards. If designers and target users share universal criteria on evaluating mood boards, the evaluation process would thus serve as the reference for testing the validity of mood board making.

For evaluation, previous studies have revealed that design students share a common perception of mood boards [33]. In this study a group of design students was recruited to create mood boards according to two general terms, ‘masculine’ and ‘feminine’, and asked them to give ratings to the mood boards created by other students depending on how well the mood boards represent the concept of masculine and feminine. The results suggested a consistency for both male and female students in terms of the concept of ‘masculine’ and ‘feminine’. These studies have revealed promising results in this direction, encouraging us to make a step forward and taking into account more critical issues that are related to the validity of the evaluation process on mood boards [39].

First, it is necessary to verify if mood boards are emotionally meaningful for both designers and target users (i.e. individuals who are not trained as a designer). While most designers are trained to make mood boards, they are also experienced in interpreting and justifying mood boards. Although mood boards are assumed to be a non-verbal emotional communication tool, it has not yet clarified if users share the same underlying criteria in justifying mood boards with designers. In order to apply mood boards as a universal tool for evaluating emotions for the general population, it is important to examine whether mood boards can be self-explained affective content to both designers and users.

Second, in the study of McDonagh and Denton [33] the raters (i.e. the design students) also participated in the task of making mood boards. This would lead to a priming effect because the raters had thought attentively about the themes for creating mood boards and would have anticipated what elements might be included in the final mood boards. We propose to include users as the role of rater in order to avoid priming effects, and this setting is also closer to how mood board making is applied in design practices.

Lastly, the stimuli for eliciting emotions in designers and users should be more immersive, emotionally rich, and generic. Most previous studies used static pictures to demonstrate the visual appearance of products, such as keywords, color, shape, and materials [11, 18]. However, this content is too feature-specific, and is not suitable for the early stage of product development. Moreover, the selection of media type should also be considered. Several psychological studies have suggested that film clips are an effective media type for eliciting emotions [40–42]. Film clips are relatively short, intuitively powerful, and easily accessible; the clips and the procedure for viewing them can be standardized across participants [43].

In order to overcome the above-mentioned issues, we chose to use TV commercials as a proper resource for affective stimuli in our research. TV commercials have long

been used in research on emotions specifically for consumer psychology [44]. TV commercials are suitable for our research because affective reactions to TV commercials are highly related to buying behaviors [45] and the symbolic meaning of advertisement is an essential element in visual communications between products and consumers [46]. Moreover, mood board making is closely related to the brand image of the product as it is often used in the early stage of product development [36]. TV commercials represent the spirit of the brand of the company and demonstrate the emotional qualities that the company intend to communicate with their potential customers. More importantly, TV commercials were considered as a fruitful resource of media content that contains represents archetypes [47–50].

While mood boards making is often used in design practice, we propose three research questions about the validity of using mood boards as a research tool for investigating emotions for the general population rather than just designers. The first research question is whether designers and non-design-background people had universal tendencies in judging the qualities of mood boards. In our first study [51] we examined whether design students and non-design students have similar criteria in evaluating mood boards. The results showed that the inter-rater reliability among all participants were considerably high, which suggested that mood boards have enough potential to be used as an evaluation tool for research on emotion.

Since the answer to the first research question is positive, the second research question is to ask whether individual designers could make equal quality of mood boards for different design themes, for example, different categories of archetypal media content. In the meantime, the third research question is to determine whether archetypal media content stimulated designers' creativity in making mood boards that contained richer emotional qualities. In order to answer the above two remaining questions, one additional study is conducted.

## 4 Empirical Comparison Between Archetypal and Non-archetypal Content

The results of our first mood board study [51] have confirmed that design students and non- design students had similar criteria on ranking mood boards. It was concluded that the participating students shared a similar competence in judging the qualities of mood boards even though some of them had no design backgrounds. Next, we proceed to answer the remaining research question - whether professional designers could make equal quality of mood boards for different categories of archetypal media content. Apart from the second research question, the other research question to be answered is whether archetypal media content stimulated designers' creativity in making mood boards that contain richer emotional qualities.

### 4.1 Approach

The archetypes Hero and Anima are widely manifested in stories, movies, and of course advertisements. Archetypes, such as Shadow, are less popular in advertisements (i.e. TV commercials) since they are not triggering positive emotions to stimulate purchasing

behavior. Because of this, we can have more selection options among TV commercials if we focus on Hero and Anima. Two automobile TV commercials with non-archetypal content were selected for comparison. Both two commercials were made by the same advertising agency Wieden and Kennedy. One of the non-archetypal TV commercials, Honda Cog, utilized a chain of colliding parts taken from a disassembled automobile in order to demonstrate the motion qualities of the mechanical objects in an automobile [52]. The other commercial, Honda Everyday, used a series of daily routines behaviors, including driving a car, in order to emphasize the importance of owing a reliable car in modern people's lives [53]. Most of the content in the commercial of Honda Everyday was highly similar to the category of neutral emotions in IAPS and IADS, standardized databases for affective pictures and sounds [54, 55]. Both two commercials were archived on the Internet and received good reviews for their high qualities of aesthetics. Although these two commercials were considered well-made ones, they contained no archetypal symbolic meaning, and thus served as affective stimuli with non-archetypal media content in this study of mood boards.

In order to validate the reliability using mood boards as a research tool, the consistency of the mood board making should be considered. It is important to evaluate whether the designers can make equal quality of mood boards for different commercials. In the previous study, we invited twelve professional designers participated in mood board making. According to the ranking given by the participants, we invited two of the designers who made the top-ranked mood boards (designer E and K in Table 1) and two designers who made the lowest-ranked ones (designer C and I in Table 1) to contribute in this study. Their mood boards for archetypal media content continued to be used in the present study (i.e. mood boards for TV commercials of hero and anima archetypes). The task for these four designers in this study was to make mood boards for non-archetypal media content for comparison, i.e. the TV commercials of Honda Cog and Honda Everyday. Like the previous study, they first viewed one of the two commercials and made a mood board that described their emotions about it, and then repeated the same procedure for the other commercial. The mood boards made by the designers are shown in Figs. 1 and 2 for example; see Appendix D for all the mood boards in [8]. With this experimental design, we can examine whether the designers who made top-ranked mood boards in the previous study could still conduct better performance in this study.

Therefore, we collected 16 mood boards for this study, including mood boards for the hero archetype, the anima archetype, the mechanical object and the daily routines. Next, we conducted an online survey using these mood boards as affective stimuli. Different from the previous study, the primary goal of this study was to examine whether the mood boards for archetypal media content (the commercials of the hero archetype and the anima archetype) induced richer emotions than the mood boards for non-archetypal media content (the commercials of the mechanical object and the daily routines). According to Zajonc [56] and Dijksterhuis [5], it was suggested to use 'preferences' as an essential indicator for retrieving the richness of the emotions and preferences should not be influenced by inferences. In addition, some research also used preferences for evaluating archetypal content [57]. This leads to a key distinction between the present study and

**Table 1.** The results of the descriptive analysis and the post-hoc test for pairwise comparison on the rankings for the mood boards [average rank (standard deviation)]. Twelve designers participated [Identification (ID) is a capital letter from A to L for each designer]. The upper three rows show the highest ranked mood boards, while the lower three rows show the lowest ranked ones for both archetypal primes [rank 1 = highest, rank 12 = lowest].

BMW Commercial (Anima)			Jeep Commercial (Hero)		
ID	Mean (SD)	Post-hoc	ID	Mean (SD)	Post-hoc
K	4.80 (3.23)	K-H: p = 0.003 K-B: p < 0.001 K-C: p < 0.001 E-H: p = 0.006	G	3.65 (2.79)	G-H: p < 0.001 G-I: p < 0.001 G-C: p < 0.001 K-H: p < 0.001
E	4.92 (3.17)		K	3.80 (2.87)	
D	5.22 (3.01)		E	4.33 (3.25)	
H	7.57 (3.13)	E-B: p < 0.001 E-C: p < 0.001 D-H: p = 0.028	H	8.82 (2.45)	K-I: p < 0.001 K-C: p < 0.001 E-H: p < 0.001
B	8.02 (3.25)		I	9.55 (2.60)	
C	8.43 (2.68)	D-B: p = 0.002 D-C: p < 0.001	C	9.88 (2.44)	E-I: p < 0.001 E-C: p < 0.001



**Fig. 1.** One of the mood boards for the prime with the mechanical object commercial (made by designer G, see Table 1).

the previous study. In the previous study, the participants first viewed the TV commercials and used these viewing experiences as references for ranking mood boards, which involved inferences in that they had to compare what they perceived from the stimuli and their own emotional experiences with the mood boards. In order to remove the impact of inferences on the participants' preferences on the mood boards, we decided to exclude the viewing task and asked the participants to report their preferences on the mood boards without any given references. Since the participants were unaware of what content these mood boards were related to, the results would thus allow us to infer whether the mood boards for archetypal media content were more emotionally attractive than the mood boards for non-archetypal media content.



**Fig. 2.** One of the mood boards for the prime with the daily routine commercial (made by designer G, see Table 1).

## 4.2 Procedure

This study was less constrained because the participants did not need to view the commercials in a controlled setting. In order to facilitate data collection, we used webpage questionnaires, which were more accessible and more convenient for recruiting participants from different countries. Nevertheless, it is important to make this online survey similar to a physical one such as the previous experiment (see the right panel in Figure 7.2 on page 123 in [8]), which allows the participants to have an overview of all the mood boards for comparison and look closer at the details of an individual mood board when giving ratings. Therefore, we built an experimental webpage using a jQuery plugin Gridster which enabled participants to drag and drop mood boards in order to rearrange their positions for visual comparison. The participants could also click on a specific mood board to view the full-size of it and then give a rating of ‘attractiveness’ for the given mood board.

The invitation to this online questionnaire was spread out through Internet. Before entering the experimental page, the participant was required to read the informed consent form and provide demographic information (e.g. age, gender, nationality, and design or non-design professionals). The experiment started only if the individual participant agreed with the terms. Next, the participant would be led to a tutorial page with five fruit and vegetable pictures in order to get familiar with the drag-and-drop interface and the rating mechanism (see Figure 7.7 on page 129 in [8]). After the practice, the participant would enter the core part of the experiment—give ratings for all the sixteen mood boards. The initial screen showed an overview of all the sixteen mood boards and the positions of all mood boards were randomized (see Figure 7.8 on page 130 in [8]). The participant could click on one of the mood boards to enlarge the mood board to see the details and give a rating about the attractiveness of the selected one [rating: 0...100].

## 4.3 Results<sup>2</sup>

We applied the analysis on intra-class correlation using a two-way-random, average-measure model. The results indicated that the inter-rater reliability among all rankings

<sup>2</sup> We analyzed our data with IBM SPSS Statistics, version 25.

given by all participants is remarkably high ( $ICC(2, 178) = 0.945$ ,  $F(15, 2655) = 18.3$ ,  $p < 0.001$ , 95% confidence interval for ICC population values:  $0.899 < ICC < 0.977$ ), which indicates that all of the participants had similar criteria in giving ratings on the attractiveness of the mood boards. The results were in accordance with the previous study, again confirmed the validity of using mood boards for communicating emotional qualities. We further investigated whether there were differences between the ratings on attractiveness of the mood boards given by the design-background participants and the non-design-background participants.

In order to validate the reliability using mood boards as a research tool, the consistency of the mood board making should also be considered. In the present study, two designers who made the top-ranked mood boards (designer E and K) and two for the lowest-ranked mood boards (designer C and I) in the previous study were invited to make mood boards for the other two commercials. Thus, we need to test if the mood boards made by designer E and K are more attractive than mood boards made by designer C and I respectively. In accordance with the previous study, we first transfer the ratings into ranking data and thus used the ranking for the following analyses. The same non-parametric repeated-measures analysis of variance, i.e. the Friedman Test [58] was used. The ‘designer who made the mood board’ served as a grouping variable. The results showed a significant effect of the designers on the ratings on attractiveness ( $X^2(3) = 17.438$ ,  $p < 0.001$ ).

Next, we examined whether the mood boards for archetypal media content were more attractive than the mood boards for non-archetypal media content. The data are categorized into two groups ('archetype' as independent variable): archetypal (including the hero archetype and the anima archetype) and non-archetypal (including mechanical object and daily routines) media content. According to the results of a General Linear Model (GLM) analysis with repeated measures the factor 'archetype' is significant ( $F = 15.674$ ,  $df = 1$ ,  $p < 0.001$ ), the mood boards for archetypal media content (mean = 54.42, SE = 1.55) are significantly more attractive than the mood boards for non-archetypal media content (mean = 51.37, SE = 1.47).

Among others, the interaction effect between factor 'designer' and factor 'archetype' is significant too ( $F = 3.248$ ,  $df = 3$ ,  $p < 0.022$ ). We proceeded to post-hoc analyses using the Wilcoxon-Nemenyi-McDonald-Thompson test [59]. This Wilcoxon signed-rank test is considered to be an appropriate statistical analysis for answering the individual differences among the designers [60]. In Table 2 we present the results of our analyses and the pairwise comparisons among the mood boards made by the four professional designers. The results indicate that the mood boards made by designer K are significantly more attractive than all the others and there were no significant differences among the mood boards made by designer E, designer C and designer I. It appeared that designer E performed less well in creating mood boards for non-archetypal media content comparing to the mood boards he made for archetypal media content. These results allow us to answer our third research question, that individual designers might not perform equally well in making mood boards for different design themes. This to some extent reflects the nature of mood board making as an experience-based tool for extracting emotional qualities. Variations in the quality of mood board making still occurred even though these four professional designers were highly experienced.

**Table 2.** The results of the descriptive analyses and the post-hoc test for pairwise comparison on the rankings for the attractiveness of the mood boards [average ranking (standard deviation)]. Four of the twelve designers in the previous study participated in this study. Designer K and E made the top-ranked mood boards in the previous study; designer C and I made the lowest-ranked mood boards in the previous study

Designer	Mean (SD)	Post-hoc
K	7.88 (4.63)	K-E: p < 0.001 ***
E	9.00 (4.34)	K-C: p = 0.013 **
C	8.60 (4.77)	K-I: p = 0.039 *
I	8.53 (4.51)	E-C: p = 0.356 E-I: p = 0.209 C-I: p = 0.991

Furthermore, we conducted the Person's Chi-squared test to examine if there is a significant correlation between the number of the images in a mood board and its ranking. The analysis is showing that there is a significant but negative correlation between the numbers of images and rankings ( $r = -0.046$ ,  $n = 2848$ ,  $p = 0.014$ ). In the previous study, the correlation analysis was meant to determine whether the number of images used in mood boards was correlated to the preciseness of using mood boards to communicate emotional qualities. On the other hand, the correlation analysis in the present study aimed to verify whether the number of images used in mood boards was correlated to the richness of the emotions in mood boards. Both analyses showed significant results, which suggested that designers should consider using more images in mood boards for communicating emotions and meanwhile enhancing the attractiveness of mood boards by exploiting archetypal content.

## 5 Discussion and Conclusion

Designers are usually assumed to be more sensitive to affective content than users and clients because designers are more experienced in visualizing emotional qualities. Although the participants with non-design backgrounds were less experienced in conceptualizing and visualizing emotional qualities, they share similar criteria with the design-background participants for judging the qualities of the mood boards because the inter-rater reliability among all the participants are noticeably high. However, it needs to be noted that these two studies are different in their judging mechanism in terms of psychology. In the first study, the participants were first presented with the TV commercials as references for judging the mood boards. For executing this task, two mental capabilities might get involved in the decision-making process. We assumed that the participants would use associations for judging the quality of the mood boards according to their own emotional experiences. However, it was also possible that the participants made inferences to compare the content of the commercials and the content of the mood boards and did not use their own emotional experience as the primary reference for ranking the mood boards. While inferences are considered to be part of the rational system of human mind, associations belong to the experiential system [7, 61]. It was unclear which of these two

mental capabilities contributed more on their judgment about ranking and rating the quality of the mood boards. In order to clarify this confusion, in the second study the participants' judgment about the quality of the mood boards were solely based on their own preferences about the mood boards without viewing the TV commercials (single blind approach). Since several studies have used preferences as an indicator for measuring emotions in decision making tasks [5, 56], the results further confirm that the participants were utilizing their experiential systems rather than using the rational system for their decision making in the given task.

The results of these two studies have confirmed the validity of using mood boards as a tool for investigating emotional experience among a general population. Furthermore, since the mood boards used in our study were made without adding any text, it has revealed the capability of mood boards to express non-verbal emotional qualities. Traditional research on emotion tends to use direct measurement, such as self-reports on specific emotional qualities 'excited'. Although this approach is effective in most cases, it is prone to filter out trivial emotional qualities that are difficult to express through languages. The results of our studies suggest that mood boards have the potential to be used as an indirect measure using visual images as cues for associating complex, trivial emotional qualities. Since images are language independent, mood boards may overcome the limitation of traditional approaches for studying emotions in design. According to the results of the correlation analysis on the number of the images in the mood boards and the ranking of the mood boards, it is suggested to include more images in one mood board in order to enhance the richness of its emotional qualities. While this finding seems obvious, there are more factors that have not yet been considered, such as the layout of mood boards. The real challenge is to keep the balance between the number of the images and other factors related to mood boards in order to enhance the expressiveness of mood boards.

One of the underlying motivations for the two studies was to determine whether archetypal media content could stimulate designers' creativity in making mood boards with richer emotional qualities. In the second study, the statistical analysis revealed that the mood boards for the archetypal media content are more attractive than those for non-archetypal media content. Therefore, we can conclude that using archetypal media content as stimuli would help designers create emotionally richer content, e.g. mood boards in our study. However, the results of our studies could not answer the question about whether archetypal media content was emotionally richer comparing to non-archetypal media content. As we mentioned earlier, the nature of mood board making is an experience-based tool and the validity of the outcome (i.e. mood boards) would largely depend on the designer's expertise in dealing with various kinds of media content. In the second study, some designers performed equally well in extracting emotional qualities for both archetypal and non-archetypal media content (e.g. designer K) while other designers could not make equal-quality mood boards in both cases (e.g. designer E, C, I). It appears that using mood board making as a research tool for studying emotions requires the supports from systematic approaches such as affective computing.

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**Ethics Statement.** Written consent was acquired from each participant prior to the empirical sessions. This was a non-clinical study without any harming procedure and all data were collected anonymously. Therefore, according to the Netherlands Code of Conduct for Scientific Practice (principle 1.2 on page 5), ethical approval was not sought for execution of this study.

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