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Transition of Aesthetic Emotions in Interactive Environments

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Introduction

With the rapid expansion in interactive environments, the need for more sophisticated cognitive models of aesthetic emotion transition is even more pressing for both academic and industrial applications. As part of our research to develop a model of aesthetic emotions and their patterns of transition, we have conducted two free report experiments concerning an interactive environment (a driving simulation), and have extracted and analyzed emotion words from collected verbal protocol data. In this research, we considered aesthetic emotions to be an overall configuration of cognitive components, and this configuration is a subjective experience of emotions, and thus of a state of mind. The results offer some insights into the mechanisms and structure of aesthetic emotions.

Experimental Method

We conducted two experiments relating to the experience of driving. In Experiment 1, 13 participants (20-50 years old) took part in a driving simulation, while in Experiment 2, conducted for comparative purposes, two participants (who also participated in Experiment 1) actually drove around the course simulated in Experiment 1. The driving simulation in Experiment 1 consisted of driving simulation software, Touge 3 (ATLUS), running on a Playstation 2 (Sony) connected with a driving simulation kit, including steering wheel, driving seat and pedals (Sparco). In Experiments 1, the participants went around the same course four times. The participants were encouraged to report out aloud anything that might come into their minds as they drove around the course. The verbal protocol was video taped, and was subsequently analyzed according to a classification system developed in our laboratory (Tokosumi, A. et al 2000-2003). The classification table included a total of 51 categories. A part of the category table including emotion related categories in shown in Table 1. All protocol data was classified into the defined categories by the same analyzer to preserve consistency of the analysis.

e.g.: aesthetic emotions “This is great”, “Cool”;
negative emotions “I` m scared”, “Dangerous;

The verbal protocol was:

1. manually transcribed preserving intonation and pausing information.
2. divided into appropriate chunks of text (in this study, we chose the clause as our unit of analysis). Missing semantic elements were added to incomplete clauses by the analyzer, such as making pronoun references explicit.
   e.g.: “This is beautiful!” → “This [view] is beautiful”
3. categorized according to a predefined category definition table, which includes categories related to the experience of driving, such as the route, the background, and meta-information.

Table 1: A Part of the Category Definition System

Contents Category		Simulation Frequency	Real Drive Frequency
Movement		798	127
Feeling		89	6
Emotion	Aesthetic Emotions	370	49
	Negative Emotions	637	62
	Other Emotions	444	36
	Sum	1,451	147

Results and Discussion

From Experiment 1, we collected 6,805 utterances from the participants, with a total of 1,451 utterances (21.32% of all utterances) containing emotion words, and within these 370 aesthetic emotions (25.49% of emotion words). We conducted a sequential analysis on the utterances to investigate the transition in emotion during the simulation. The main results are as follows:

1. Emotion utterances tended to be concentrated together.
2. Utterances containing aesthetic emotions are more likely to follow utterances containing other negative emotions (38), course descriptions (29), description of driving techniques (27), and background descriptions (18).
3. Utterances following utterances containing aesthetic emotions are more likely to be positive evaluations of the background (32), and positive evaluations of driving technique (28).

In order to examine the influence of external factors related to the driving course itself, such as its level of difficulty and other characteristics, on the elicitation of aesthetic emotions, we divided the driving circuit into sections, and evaluated these according to various characteristics. The frequency and type of emotion utterances were then examined in terms of these course characteristics. The main results are:

1. Aesthetic emotions are more likely to occur on less difficult parts of circuit (10.42%).
2. Aesthetic emotions are elicited by parts of the course that have changes in terms of background characteristics (7.42%);
3. Aesthetic emotions tend to increase two times during later drives through difficult parts of the course.
4. Although negative emotion utterances tend to be preponderant for difficult parts of the course during the first simulation drive, they tend to decrease to one third during later runs.
5. Negative emotion utterances tend to decrease with respect to course characteristics over the four simulation runs.

From Experiment 2, we collected 1,156 utterances from the two participants, as they actually drove around the course. The data was processed according to the same procedures as for Experiment 1. Analysis of the protocol data from Experiment 2 showed that participant utterances were similar to that obtained in Experiment 1, indicates both accuracy and consistency of our category system.

A cognitive component model of emotions

The proposed computational model is based on our model of literary text appreciation reported in Tokosumi and Matsumoto (2003). It assumes a set of cognitive units particularly related to emotions, including aesthetic emotions. Although the data obtained from the driving experiments doesn't directly support each of those units, we adopt the set as a possible candidate for the complete set of aesthetically oriented cognitive units. Using the framework of cognitive theories of emotion, we can identify cognitive appraisal components underlying the aesthetic emotions:

(a) recognition of quality (completeness: the quality of the expression meets driver's completeness standards?, novelty: the quality meets driver's newness standards?)

(b) meta-awareness of memory / consciousness of explicit memory (first experience: experience the scene for the first time?)

(c) meta-awareness of ability (driving: able to handle with the road / car?)

Similarly, we can also identify action-readiness components:

(d) possession: (want to posses the car?)

(e) re-experience: (want to drive the route again?)

(f) creation: (want to find a similar route / car?)

(g) evangelic (want to tell somebody about the driving?)

Transition of aesthetic experiences

Each cognitive component was implemented as an object (CLOS) in a standard common lisp environment (CLISP). With given set of variables describing the states of outer world (road conditions, visual scenery, car conditions, outcomes of driving maneuvers), the computational model determines corresponding states of every cognitive component, which are to be interpreted as states of mind including aesthetic emotions. The model behaves as a sequence of such discrete states, thus should be understood as a static model.

In the model, the transition of emotions described in previous sections is represented as a transition of activation level of each cognitive component. For instance, drivers tend to concentrate into driving maneuvers in technically difficult part of the circuit. Ordinary problem solving components such as 'action planning' and 'self monitor' which are basically have goal-plan structures dominate major activities of the model and components related to aesthetic emotions remain in relatively lower activation level. Repeated experience however, causes the activation level of problem solving components to decrease and total experience of aesthetics gains relative importance. In the current stage of the development of the model, the activation levels are hand-coded so that the overall states of the model match the experimental findings.

Conclusions

In this project, we formulated a model about the mechanism and structure of aesthetic emotions in an interactive environment. Although closely related to driving simulation, the results offer a significant insight to the general elicitation mechanism of aesthetic emotions and the cognitive appraisal components to be further studied in future work. Future directions include modeling of dynamic transient of emotions, precise mapping to aesthetic experiences.

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