PROPOSAL OF A FRAMEWORK TO SHARE KNOWLEDGE ON CONSUMER'S IMPRESSIONS

Keiichi Muramatsu*
Graduate School of Human Sciences, Waseda University, Shinjuku, Tokyo, Japan

Tatsuo Togawa
Advanced Research Center for Human Sciences, Waseda University, Shinjuku, Tokyo, Japan

Kazuaki Kojima, Tatsunori Matsui
Faculty of Human Sciences, Waseda University, Shinjuku, Tokyo, Japan

Keywords: Impression, Awareness, Aesthetic experience, Ontology engineering.

Abstract: Recently, impressions of web pages formed by visitors have become an important tool to increase the number of repeat visitors to the web page. Therefore, the management of knowledge on consumers' impressions obtained in several study fields is an essential task in current industrial design. However, no methods that realize such knowledge management have been established. Thus, our study proposes and implements a knowledge management method that can effectively provide knowledge of impressions to web designers to help them in building attractive websites. We introduce a framework for the description of impressions that depend on perceptual fluency, which can serve as an useful indicator of pleasure. We can extract the features of objects that affect impressions on the basis of perceptual fluency. We specify the relationship between objects and impressions by modeling the concepts of *awareness*, *perception*, and *self-report* on the basis of an ontology development environment Hozo and a top-level ontology YAMATO. We then instantiate a case where a person has a good impression of a Web page, and we describe the relationship between a perception and a stimulus in such a case. Our approach demonstrates that ontological modeling of impressions helps us to understand the correspondences between affections and physical irritations.

1 INTRODUCTION

1.1 Impressions of Web Pages

Consumers' impression is one of the important factors in current industrial design. Manufacturers are constantly looking for ideas to make a good impression on consumers, because products that are liked by consumers may naturally result in an increase in sales. This fact is true in the domain of Web design as well in the sense that visitors to Web sites can be regarded as consumers of Web pages. If a consumer forms a good impression of the pages contained in a Web site, he or she may visit the Web site again. A good first impression is the key to get more repeat visitors, and the first impression based on the visual appeal of Web pages can be formed within 50 ms (Lindgaard et al., 2006). Therefore, for Web designers, management of knowledge on how to influence consumers at the first glance is an important aspect of building attractive Web sites, which in turn can generate more traffic.

In various research fields, researchers have studied the relationship between characteristics of objects and elements, such as color and shape, and the impression formed by the viewer. While findings in these studies are closely related to each other, these findings remain isolated to their specific study fields. By systematically organizing these findings, useful knowledge that can be shared across fields can be obtained. For example, findings of impressions created by two color combinations in psychology are useful for facade design in architectonics. Therefore, we need a method to collectively manage such knowledge.

*Research Fellow of the Japan Society for the Promotion of Science (JSPS)

Muramatsu K., Togawa T., Kojima K. and Matsui T..
PROPOSAL OF A FRAMEWORK TO SHARE KNOWLEDGE ON CONSUMER'S IMPRESSIONS.
DOI: 10.5220/0003184203880393
In *Proceedings of the 3rd International Conference on Agents and Artificial Intelligence* (ICAART-2011), pages 388-393
ISBN: 978-989-8425-40-9

1.2 Perceptual Fluency

Lindgaard et al. (2006) studied visual appeal from the viewpoint of aesthetics; studies on aesthetic experience can provide helpful insights into understanding the impressions formed by consumers. Aesthetic pleasure is explained by *perceptual fluency*, which is defined as the ease with which stimuli can be physically identified (e.g., symmetry, contrast, prototypicality); fluent processing emotionally evokes positive responses to the stimuli (Reber et al., 2004). For example, a figure with high-contrast components is expected to evoke high fluency, and the stimulus that is fluently perceived elicits a positive reaction from the perceiver. Therefore, perceptual fluency can serve as a useful indicator for exploring impressions. We can see the effects of perceptual fluency in the early stages of a model of aesthetic appreciation (Leder et al., 2004). This model has five stages (perceptual analyses, implicit memory integration, explicit classification, cognitive mastering, and evaluation), and the first two stages are related to perceptual fluency. In the stage of perceptual analyses, processing of perceptual variables such as contrast, complexity, color, and symmetry proceeds quickly, and in the stage of implicit memory integration, aesthetic preferences are affected by features such as familiarity and prototypicality. In this paper, we regard the positive reactions of perceivers facilitated by perceptual fluency during the early stages of human informational processing as a measure of their impressions of Web pages.

1.3 Ontological Engineering

Ontological engineering is one of the methodologies used to describe knowledge systematically. From the viewpoint of knowledge base, "ontology is defined as a theory (system) of concepts/vocabulary used as building blocks of an information processing system" (Mizoguchi et al., 1995). Ontologies are classified into two types according to the nature of the knowledge described (Mizoguchi, 2003). One of them is referred to as *domain ontology*, which describes domain knowledge, and the other is referred to as *task ontology*, which describes knowledge about processes.

In the ontology development environment Hozo[†], each node represents a whole concept and has some slots, each of which represents a part-concept. Each whole concept consists of one or more part concepts with *part-of* or *attribute-of* links (Figure 1). Hozo supports the description of *role concepts* which represent a role that depends on the contents of each whole concept. For example, a human being plays the role

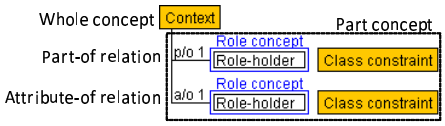

Figure 1: Whole concept and part concepts.

of a teacher only in the context of school and not outside the school. In other words, every part concept in the whole concept has a role to play within a given context. In the context, a class of instances that can play a role is defined by a *class constraint*, and it is called a *role-holder* (Kozaki et al., 2000).

Figure 2 shows the whole structure of a top-level ontology YAMATO[‡]. According to YAMATO, an *entity* is divided into three classes: *physical*, *abstract*, and *semi-abstract*. While instances of physical class need *3D space* and *time* to exist, instances of an abstract class need neither of them. Instances of a semi-abstract class need only time to exist, and the class contains a *mind*, *representation*, *content*, and *representation form*. Representations such as novels, poems, paintings, music, and symbols are distinguished from their proposition and form of representation (Mizoguchi, 2004). A representation has a content role played by a proposition and a form role played by a representation form (Figure 3).

Although it is crucial in design tasks to manage knowledge on impressions, no common method for achieving this purpose has been established. In related research, a model of idea explanation styles for a designer has been proposed; this model enables designers to share their ideas about a new product by adopting the ontological engineering approach (Ogawa et al., 2009). The study did not directly model vague ideas themselves, but modeled the explanation style for these ideas. According to Ogawa's framework, we can practically model consumers' impressions of products, even though they are as vague as ideas are.

In this paper, we introduce a framework to describe consumers' impressions by adopting the ontological engineering approach. As noted above, positive responses to irritations are derived from perceptual fluency; therefore, we model perception and its related concepts: awareness of an object and self-report of impressions. We first ontologically describe awareness, perception, and self-report on the basis of the Hozo and YAMATO environments to construct a framework for sharing impressions. Then, by adapting our framework, we demonstrate an instance of impression derivation during the task of appreciation of Web pages that contains some designed elements.

[†]http://www.hozo.jp/

[‡]http://www.ei.sanken.osaka-u.ac.jp/hozo/onto_library/upperOnto.htm

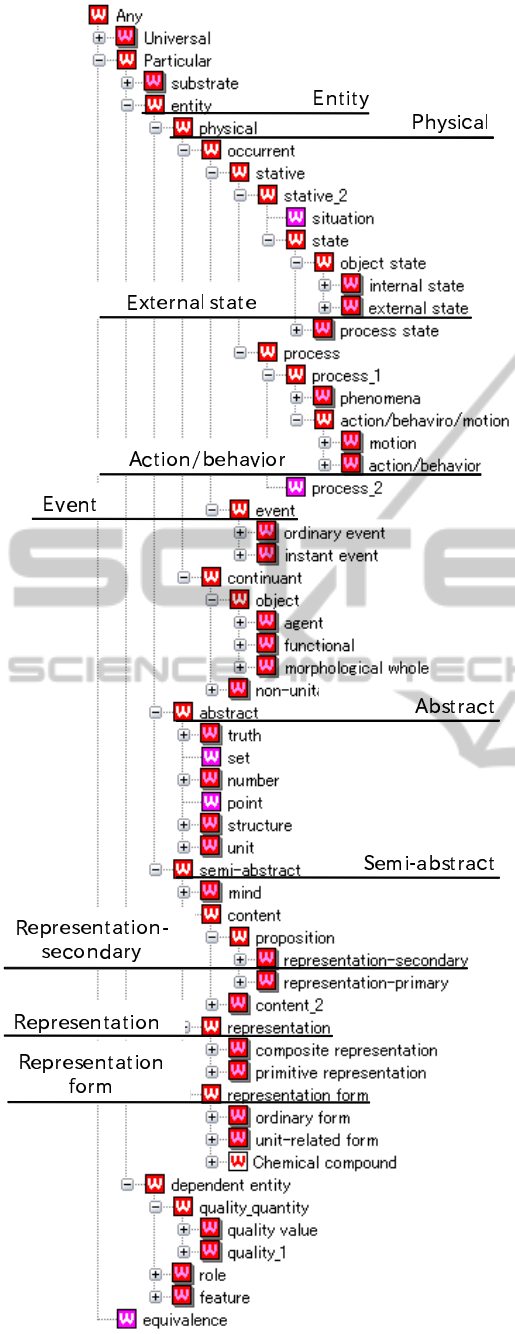

Figure 2: Whole structure of a top-level ontology YAMATO.

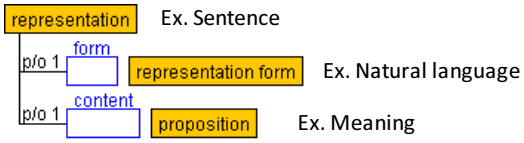

Figure 3: Slot structure of representation.

2 OUR FRAMEWORK FOR IMPRESSIONS

2.1 Description of Awareness

Baruss defined consciousness as "all subjective awareness characterized by intentionality, and the explicit knowledge of one's situation, mental states or actions evidenced behaviorally" (Baruss, 1987). Subjective awareness is referred to as subjective consciousness, that is, "the stream of thoughts, feelings and sensations that occur for a person", and explicit knowledge is referred to as behavioral consciousness (Baruss, 2000). The latter is generated by the operationalization of the former. That is, behavioral consciousness is defined on the basis of operations that infer other people's consciousness during objective studies.

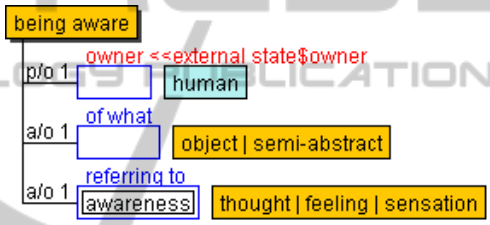

Figure 4: State of being aware and awareness.

These two types of consciousness can be described as a subclass of an external state defined in YAMATO (Figure 4). An *of what* role, which indicates focus of attention, is played by an instance of an *object* or a *semi-abstract* class, a *thought*, *feeling*, or *sensation* class plays a *referring to* role, and *awareness* is specified as a role-holder. YAMATO has two kinds of propositions: *representation-primary* and *representation-secondary*. Both representation-primary and representation-secondary classes necessarily depend on the representation that represents them (Figure 3). However, instances of the representation-secondary class, such as facts, data, and thought, indicate original content even before they are represented. For example, a fact as an event exists before human recognition, which allows the expression of the event as a representation. In this sense, the classes of *feeling* and *sensation* also belong to the representation-secondary class.

2.2 Description of Perception

In YAMATO, the *actor state action* class which focuses on a change in the doer's states, and the *object state action* class, which focuses on a change in

the object's states, are defined. Perception can be regarded as the result of an action by which an object is perceived; this result is reflected as a change in the actor's awareness. We defined the class of *perceive* as a subclass of the actor state action class. The action to *perceive* needs a *doer*, an *object*, and a *result* (Figure 5). The doer in the action to perceive has a *being aware* state. Role-holders of an *object* role in an action to perceive and an *of what* role in a state of *being aware* belong to the same class. Relationships among these concepts represent a situation where a doer is aware of the presence of an object. The action to perceive an object is regarded as an instance of behavioral consciousness, which is described in the previous subsection. Role-holders of a *result* role in an action to *perceive* and a *referring to* role in a state of *being aware* belong to the same class. This indicates that the role-holder of the *result* role represents the awareness of an actor. Thus, perception, which is a result of an action by which an object is perceived, is the instantiation of subjective consciousness, which is described in the previous subsection.

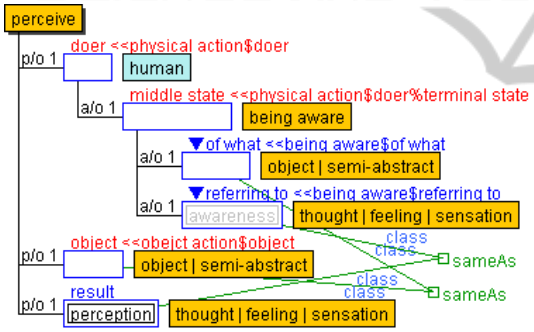

Figure 5: Action to perceive and perception.

Since *thought*, *feeling*, and *sensation* are all subclasses of *proposition*, they require *representation* depending on their contexts. However, any representation such as a mental representation that human being forms in his or her brain is not included here. A possible definition of mental representation is a subjective phenomena, which is referring to *thought*, *feeling*, and *sensation*. This definition can be regarded as a specialization of the *representation* class. We are concerned with the correspondence between individuals in the real world and the contents of consciousness; hence, in our ontology, we do not include contents represented in the brain, but include a *self-report* as an output of the contents. In addition, we can efficiently access the contents of consciousness through verbal reports (Togawa, 2006), and the contents of consciousness are indeed externalized as a linguistic representation in the real world. Because verbal reports focus on the description of the contents of consciousness, we do not define mental representation here. However, we do not deny the existence of mental representation.

2.3 Description of Self-report

We defined an action called *introspect* as a specialization of the *actor state action* class. The *introspect* does not have an *object* but has a *result* (Figure 6). The role-holder of the *result* role of the action is defined as a *self-report*, and its class constraint is *primitive representation*. A *form* role is played by an instance of a *word* or a *natural language* class, and the role-holders of a *content* role and the *referring to* role belong to the same class.

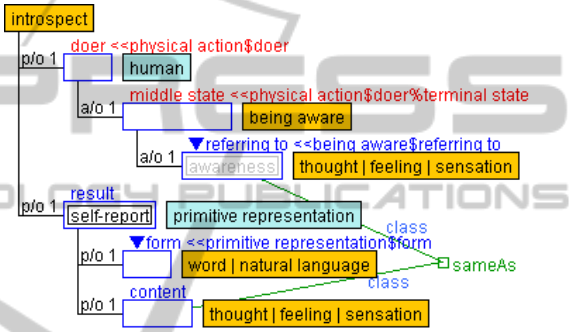

Figure 6: Action to introspect and self-report.

3 DESCRIPTION METHOD FOR WEB DESIGN IMPRESSIONS

3.1 Instances of Impression

Here, we can describe a good impression of a Web page by adopting our framework. For example, an instance where *John has a positive feeling toward a Web page* is shown as Figure 7-a. In this figure, the impression of the Web page is a positive feeling, which is represented as an instance of *perception*. Figure 7-b describes a scene where *a Web page composed of blue text and a highly contrasting white background has the property of high fluency*. Generally, a Web page contains some sentences as a *component*, and it also has the attributes of *text color* and *background color*. Perceptual fluency, which emotionally generates a positive feeling in the perceiver, is represented by the role concept of *fluency* role-concept taking a value of *being high*. After John experiences a positive feeling, a subjective feeling is externalized as a *self-report*. Figure 7-c shows a scene where *John speaks a sentence about his positive feeling*.

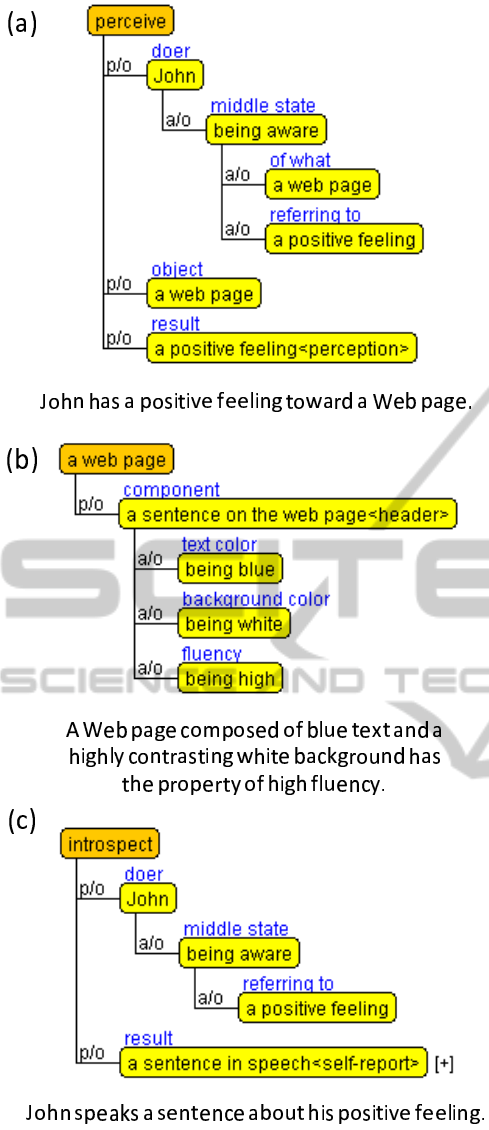

Figure 7: Instances of an impression.

3.2 Affections and Irritations

The description of an impression described above help us to understand the correspondences between affections and irritations. For example, a good feeling described in the *result* of *perceive* is related to the contrast between the *text color* and the *background color*, which is referred to by the *object* of *perceive* in Figure 7.

In our previous study, we proposed a model of task knowledge in aesthetic appreciation (Muramatsu et al., 2010). In this model, aesthetic appreciation is divided into two tasks: representational differentiation and emotional experience. These taskes are distinguished depending on what the perceiver is focus on. However, the model finds it difficult to establish correspondences between physical irritations and the experience of beauty. In other words, beauty is not a simple and direct consequence of physical irritations. By Adopting our framework, we can describe processes involving aesthetic appreciation as an event, and the correspondences can be resolved.

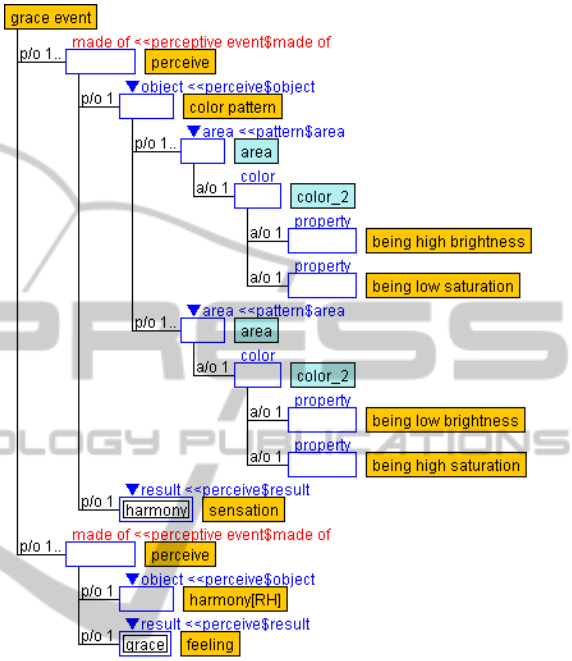

Figure 8: Example of grace event.

The concept of *aesthetics* includes multiple concepts such as grace, sublimity, and ridiculousness. When a perceiver emotionally experiences a positive feeling during aesthetic appreciation, the experience is identified as grace. Figure 8 shows an event where a perceiver experiences grace. This event has two processes as part concepts. Both the processes are actions to perceive but have different objects and results. The first process has an object that is composed of two colored areas and a result that is referred to as *harmony*. This indicates that combining colors result in a sensation of harmony. The second process has an object that is a result of the previous process and a result that is referred to as *grace*. In this manner, we can resolve the correspondences between physical irritations and the experience of beauty.

4 CONCLUSIONS

In this paper, we introduced a framework for describing impressions by adopting the ontological engineering approach. We modeled the concepts of *aware-*

ness, *perception*, and *self-report* on the basis of the top-level ontology. Awareness is defined as a role-holder of the *referred to* role, which is a part concept of the *being aware* state. In a situation where a person perceives an object, the perception is conceptualized as a role-holder of the *result* role, which is a part concept of an action to perceive. In such the action, a doer is *being aware* state, and awareness and perception have the same proposition. The *self-report* is defined as the representation of the proposition. In our framework, we instantiate a case where a person has a good impression of a Web page, and we describe the relationship between a perception and a stimulus in such a case. This helps us to understand correspondences between affections and physical irritations.

The current paper only presents an ontological description method for impressions. We need to study more empirical cases related to impressions by adopting our framework. We believe that such empirical studies would reveal the general rules governing the correspondences between affections and physical irritations. In future work, we intend to expand our ontological descriptions on the basis of the empirical studies. Further research would help in clarifying the fundamental nature of impressions.

REFERENCES

Baruss, I. (1987). Metanalysis of definitions of consciousness. *Imagination, Cognition and Personality*, 6(4):321–329.

Baruss, I. (2000). Overview of consciousness research. *Informatica: An International Journal of Computing and Informatics*, 24(2):269–273.

Kozaki, K., Kitamura, Y., Ikeda, M., and Mizoguchi, R. (2000). Development of an environment for building ontologies which is based on a fundamental consideration of ”relationship” and ”role”. In *Proceedings of the Sixth Pacific Knowledge Acquisition Workshop*, pages 205–221.

Leder, H., Belke, B., Oeberst, A., and Augustin, D. (2004). A model of aesthetic appreciation and aesthetic judgments. *British Journal of Psychology*, 95(4):489–508.

Lindgaard, G., Fernandes, G., Dudek, C., and Brown, J. (2006). Attention web designers: You have 50 milliseconds to make a good first impression! *Behaviour & Information Technology*, 25(2):115–126.

Mizoguchi, R. (2003). Tutorial on ontological engineering - part 1: Introduction to ontological engineering. *New Generation Computing*, 21(4):365–384.

Mizoguchi, R. (2004). Tutorial on ontological engineering - part 3: Advanced course of ontological engineering. *New Generation Computing*, 22(2):193–220.

Mizoguchi, R., Vanwelkenhuysen, J., and Ikeda, M. (1995). Task ontology for reuse of problem solving knowledge. In *Towards Very Large Knowledge Bases: Knowledge Building and Knowledge Sharing*, pages 46–59.

Muramatsu, K., Togawa, T., Kojima, K., and Matsui, T. (2010). Content-oriented approach to knowledge description of aesthetic experience. In *Proceedings of the Kansei Engineering and Emotion Research International Conference 2010*, pages 856–865.

Ogawa, T., Nagai, Y., and Ikeda, M. (2009). An ontological approach to designers' idea explanation style: Towards supporting the sharing of kansei-ideas in textile design. *Advanced Engineering Informatics*, 23(2):157–164.

Reber, R., Schwarz, N., and Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review*, 8(4):364–382.

Togawa, T. (2006). An approach to scientific understanding of mind by defining a set of all possible contents of consciousness. *Biocybernetics and Biomedical Engineering*, 26(1):5–20.