Kansei Research and Design

An introduction by Bianca Beuttel

Kansei Research and Design

An introduction by Bianca Beuttel

筑波大学
University of Tsukuba

Preface

Kansei is an advanced function of the brain that can be the source of emotion, inspiration, intuition, pleasure/displeasure, taste, curiosity, aesthetics and creation. At the University of Tsukuba, we are working on research to understand those functions of mind through experimental work as well as practical design works. An extremely wide range of disciplines collaborate together not only on how to measure the state of mind and the physical qualities of products, but also on understanding the Kansei as brain and neural function.

The approach also includes the effort of defining the Kansei. The Evoked Metaphor (which is not explained here, but resources for further information can be found in the appendix) offers a new comprehension of Kansei processes. Other aspects such as creativity, feelings, intuitive cognition, the asobi gap in communication, and delay are also relevant to understand this subconscious brain function.

But first of all, the importance of our research lies in the fact that our entire life is influenced by Kansei processes. Therefore we would like to introduce the concept to a broader international audience and start the discussion.

In this small introduction book, the author looks at this cross disciplinary research from a designer's viewpoint. I appreciate Ms. Beuttel's elegant observation and friendly writing that illustrates how Kansei research can be connected to our daily life. A worthwhile reading.

T. Yamanaka, University of Tsukuba

Outline

1. Introduction—9
1.1. Scenario with 'cololo'—9
1.2. Description of Kansei—9
1.3. Purpose of this paper—12

2. Getting started:
Nanami Mizutani's research on 'Playful Food'—15
2.1. Initial point of interest—15
2.2. Choice of stimuli—16
2.3. Measuring methods—16
2.4. Course of experiment—17
2.5. Evaluation and result of analysis—17
2.6. Conclusion and outlook—18

3. Measuring Kansei—21

4. Using Near-Infrared Spectroscopy (NIRS):
Yusuke Nagamori's research on creative brain activity—25
4.1. Initial point of interest—25
4.2. Choice of the measuring device—26
4.3. Choice of tasks—26
4.4. Course of experiment—27
4.5. Evaluation and result of analysis—28
4.6. Conclusion and conceivable applications—28

5. Surprising results:
Miho Kyoya's finding that 'delay is not necessarily faulty'—33
5.1. Inspiring moments—33
5.2. Experiment setup—34
5.3. Measuring methods—34
5.4. Course of experiment—34
5.5. Evaluation and result of analysis—35
5.6. Conclusion—35

6. Enhance Kansei Value—37

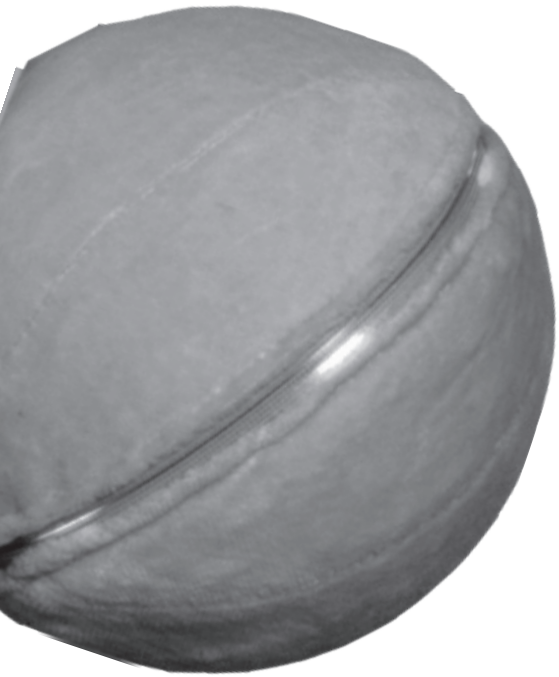
7. 'Beacon' – An Interface for Socio-musical Interaction—39
7.1. Scenario with 'beacon'—39
7.2. What is 'beacon'?—40

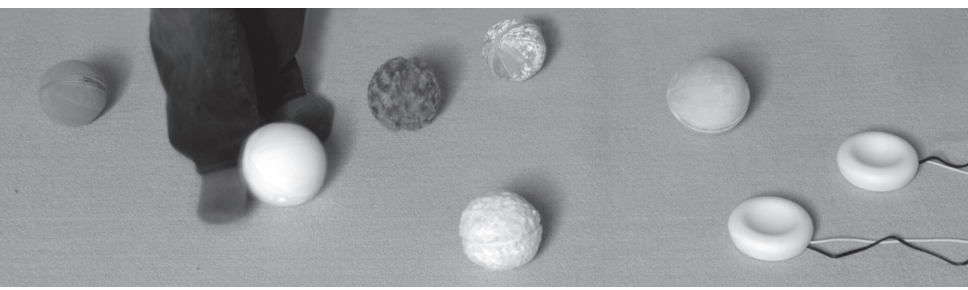
8. Shiho Nakamori's Eye-beam Project:
From an analysis device to a communication device—43
8.1. Inspiring moments—43
8.2. From idea through research to design—44
8.3. Analysis of 25 psycho-physiological information devices—44
8.3.1. Method—44
8.3.2. Result—44
8.3.3. Conclusions—45
8.4. Questionnaire survey on communication in group discussions—45
8.4.1. Questionnaire form—45
8.4.2. Evaluation and result of analysis—46
8.4.2.1. Relevant aspects of group discussions—46
8.4.2.2. Possible effects of eye-gaze visualization—47
8.4.3. Interim conclusion—48
8.5. Application scenario—48

9. Kansei and tacit knowledge—51
9.1. Kansei and tacit knowledge—51
9.2. Asobi—52

10. Closing Remarks—53

11. Bibliography—55





1. Introduction

1.1. Scenario with 'cololo'

> *After a long day of important and finally successful business meetings, David is in his hotel room. His tension gets released. He wants to take a shower and opens his suitcase. On the top is a small ball, he plays with it for a moment and then lays it on the bed. He picks some fresh casual clothes and goes into the bathroom. When he opens the bathroom door again, he finds the ball on the floor, the lights of the LED stripe around it are twinkling. He smiles and gently rolls the ball back and forth with his feet. Then he gets himself a beverage from the minibar. The ball starts spinning and blinking. He moves it to a comfy chair, sits down and while he is sipping his drink, he thinks about Helen, his fiancée: her smile and the great day out on the beach recently… Like a response to his thoughts, the small ball rotates again.*

What would you do in a similar situation? Give your loved one a telephone call?

Actually, David is already communicating with Helen. It is that cute little ball. She also has one and both balls are wirelessly connected. When one of his mates plays with the ball, the companion piece will start to rotate and its LEDs twinkle. It touchingly expresses, "I am thinking of you!" This small ball is a communication device, to be exact, a Kansei communication device. It is called 'cololo' and it is the graduate work of Makiko Hoshikawa supervised by Toshiaki Uchiyama, Assistant Professor at the Graduate School of Comprehensive Human Science / Master's and Doctoral Program in Kansei, Behavioral and Brain Sciences at the University of Tsukuba.

By introducing the subject of this report – Kansei research and design – with this scenario, a vivid example is provided to refer to when we venture into further explanation.

1.2. Description of Kansei

In his papers "On Kansei and Kansei Design – a Description of Japanese Design Approach" and "Explaining Kansei Design Studies" Pierre Lévy describes Kansei as a complex inner process of human beings that involves several mental operations like sensation, perception, and cognition:

- "Kansei process gathers the functions related to emotions, sensitivity, feelings, experience, and intuition… (i.e. sensory qualities related functions […]), including interactions between them."
- "Kansei means are all the senses (sight, hearing, taste, smell, touch, balance, recognition...) and – probably – other internal factors (such as personality, mood, experience, and so on)."

- "Kansei result is the fruit of Kansei process (i.e. of these function processes and of their interactions). It appears to be a unified perception providing a qualitative meaning and value of one's direct environment. In other words, Kansei result is how one perceives qualitatively one's environment. Therefore, Kansei result is a synthesis of sensory qualities."

In addition to this, Lévy points out that "Kansei is intrinsically linked to one's environment and experience. In other words, when one's environment and experience change, one's Kansei changes too. Consequently, Kansei evolves permanently."

Professor Toshimasa Yamanaka, Academic Advisor at the Graduate School of Comprehensive Human Science / Master's and Doctoral Program in Kansei, Behavioral and Brain Sciences at the University of Tsukuba, therefore likes to use the term "Kansei status", which emphasizes its fragile, temporary state.

The immense complexity becomes obvious when we transfer this description to the situation of telecommunication between the above introduced David and Helen. Here, not only the inter-human relationship itself matters, but also the impact of the transmitting device.

Let's look at their situation when using a common telecommunication device, the mobile phone. David is in a cheerful mood after his success, he wants to share his feelings with Helen, have a relaxed talk, maybe make some plans for the weekend and enjoy the anticipation. To reach her, there is a kind of magic device: the mobile phone promises the immediate fulfillment of his desire to talk to her.

One characteristic of telecommunication is that we can't evaluate the situation of our dialogue partner before we actually get through to her or him. When David wants to call Helen, he actually has no idea where she is, what she is doing and how she is feeling at that moment. Being far away, his Kansei means can't perceive relevant information about that. He can only rely on his experience and information. What does she usually do at that time? How is her schedule? Is she busy with something right now?

This leads to another point: the person calling is the one who acts, he or she is mentally prepared to talk. However, the person receiving the call can only react and is not necessarily prepared. The very moment of an incoming call is a surprise. It might be a long expected call, useful information just in time , or an annoyance that distracts from work or interrupts a conversation. This perception is influenced by the feelings toward the person who calls. Helen will appreciate a call from David almost anytime, but might be annoyed by a marketing telephone survey disturbing her while concentrating on a task.

The telephone demands an immediate and spontaneous response from the person who receives the call, no matter what he or she is doing in that moment –

perhaps cushioned only by activating the answering machine. For the person making the call, the scheme of communication is: idea to contact a person > use the phone. For the person who receives the call the scheme is vice versa: suddenly ringing phone > identification of the calling person.

David will balance his desire to talk with Helen against the possibility of disturbing her, but in fact, he can only try to call her and find out. Maybe he gets the answering machine, so all he can do is leave a message. Later, when Helen listens to his message and calls back, David might be at dinner with his colleagues, a situation where he may not be able to talk freely. Or maybe she answers the phone, but he can tell from the tone of her voice, the volume, the background noise, and also from her words, that she is busy or in a situation where she can't speak openly. So they briefly exchange news and agree to call again later.

As mentioned before, Kansei status changes along with the situation, hence, David's feelings will be influenced depending on whether his expectations are fulfilled or not. In both cases above his expectation isn't met and that will dampen his mood a bit.

There is also a huge probability that they will have a nice chat, however, we all have experienced situations of mismatched telecommunication and the resulting disappointment – the telephone often neglects its promise of immediate connection. Therefore the concept of 'cololo' is instantly comprehensible and emotional appealing.

Its name 'cololo' implies the Japanese words kokoro/kokolo （心）, which means "heart", "mind", and the onomatopoeia koro koro/kolo kolo （コロコロ） for the rolling sound of circular objects (the spelling depends on the method used to transcribe Japanese into Roman letters) and means, "Your heartfelt mind is expressed by the turning ball." It is a bit like a heart-to-heart communication without words. Actually, in communication between couples, families, and friends there are often situations where words are not so necessary and 'cololo' transports those mutual feelings of love and care over distance.

Its appearance with LEDs and covers of different designs makes it appealing to men and women as well as children and adults, also its very simple interface – designed to be operated with the feet – is easily graspable and barrier-free.

Even without an instant response, playing with the ball itself is pleasant. Intensified by the imagination that any movement of the own ball causes the fellow ball to change its location and lets the LED stripe twinkle, leaving its very special message, "I am so happy that you are in the world!"

1.3. Purpose of this paper

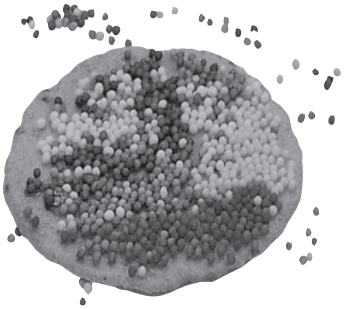
'Cololo' is one example of how research on Kansei can offer valuable inspiration and good reasons to improve existing products, services and interfaces or develop

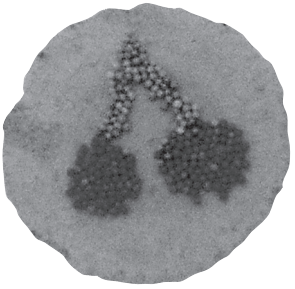
new ones.

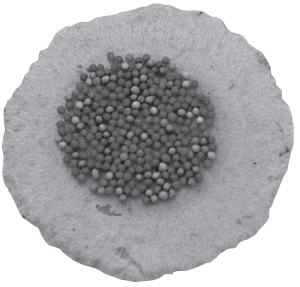
A design that manages to integrate the complexities of human behavior in an appropriate and convincing way increases its chances to succeed.

Based on several examples of research pursued by the Laboratory of Kansei Information Science at the University of Tsukuba, this paper attempts to provide an insight on:

- What kind of interests and questions trigger a Kansei research idea?
- How to start Kansei research, choose methods and devices, set up an experiment?
- How to relate the findings to design issues?







2. Getting started: Nanami Mizutani's research on 'Playful Food'

The Master's and Doctoral Program in Kansei, Behavioral and Brain Sciences of the Graduate School of Comprehensive Human Science at the University of Tsukuba offer unique research facilities. Located in one building, faculties of Neuroscience, Psychology, Science of Mental Disorder as well as Art and Design all work together to elucidate Kansei. Experts, researchers, and students of these fields benefit from this affiliation: they exchange knowledge and advice with each other, interdisciplinary research is conducted and high-end psycho-physiological measurement devices are at hand – like Near-Infrared Spectroscopy (NIRS) to measure cerebral blood flow and Electroencephalography (EEG) to measure brainwave activity.

However, to pursue a Kansei experiment, the use of this high-end equipment is not mandatory. A revealing example is Nanami Mizutani's experiment on 'Playful Food'

2.1. Initial point of interest

Nanami Mizutani is a 3rd year doctor course student who dedicated her research and design activity to food. Mizutani is not alone in her fascination with food design. Food increasingly gains attention among product designers worldwide. The focus of interest is not so much taste, aroma, and texture or recipes and ingredients, but rather visual appearances, rituals of food consumption, and the emotional/mental impacts of eating. As an essential part of our everyday life, food is an attractive medium for designers to enhance quality of life as well as to comment on our food habits or social contexts of food.

Mizutani's starting point merges two observations: the appeal of witty and often surprising products that transcend mere practical functionality; and the increasing interest people have in eating well, enjoying food and gaining connoisseurship. She wants to explore how eating can be influenced by positive feelings like fun, surprise, delight, and pleasure. A term that could summarize these emotions is "playfulness", *asobi gokoro,* 遊び心.

Combining playfulness with food is nothing unusual, particularly not in Japan, where food with playful details are very well appreciated.

Mizutani distinguishes two types of playfulness:

- 'Playfulness as an action' can be described as the activity of creating and making something with your hands. There are no rules, just experimenting with the material, trying things out and having fun. Examples from the food sector are baking cookies and decorating them, building a gingerbread house, making edible figures, etc.
- 'Playfulness as a concept' can be described as a kind of humor. A new and unexpected connection between the object and another item or idea provides

a shift to an unusual and interesting point of view, implies an ironic comment or is just funny nonsense. Examples from the food sector are all kinds of shapes or decorations that are not related to food in its primary meaning like pictures of cute characters or animals.

Ensuing from that, the concise experimental question is: What are the interactions between food and playfulness? Can playfulness make eating time more enjoyable? If yes, in which way? And can playfulness make food tastier?

2.2. Choice of stimuli

One of the most crucial points to explore a phenomenon of human emotion or behavior is to find an appropriate experiment with stimuli that suit the purpose and allow comparison.

To investigate the influence of playfulness on food's taste and pleasure, Mizutani chose *rakugaki sembei* （落書きせんべい）, which means "doodle rice-cracker": drawing pictures on rice crackers with colored sugar. It is a popular activity at Japanese shrine festivals. We can assume that *rakugaki sembei* is associated with feelings of fun, joy, happiness, and recalls the nostalgia of the childhood.

Referring to the above introduced types of playfulness, 3 different stimuli were tested:

- Stimulus 1: Classical *rakugaki sembei*: Test persons decorate the rice-crackers on their own – this stimulus refers to both, 'playfulness as a concept' as well as 'playfulness as an action'.
- Stimulus 2: Pre-decorated rice-crackers with the picture of a cherry – this stimulus refers to 'playfulness as a concept'.
- Stimulus 3: Pre-decorated rice-crackers with an abstract pattern, a circle of different colors – this stimulus refers neither to 'playfulness as an action' nor to 'playfulness as a concept'.

2.3. Measuring methods

Mizutani employed the following methods to measure the impact of these stimuli:

- Brief questionnaire with two 7-point-scales about the extend of deliciousness (美味しさ) and pleasure (楽しさ).
- Conversation analysis with special attention to the amount of utterance, the topics coming up in the conversation, and the amount of *aizuchi* (あいづち) – words or sounds articulated by the listener to signal attentiveness and comprehension, very characteristic for Japanese communication. Incidentally, the latter is a very interesting example for how cultural patterns

of communication can be used as measuring indicators.

For this purpose, the talk of the test persons during the experiment was filmed and recorded.

- POMS (Profile of Mood States) questionnaire, before and after the experiment. POMS is a frequently used method to evaluate present mood states of the test persons, and a before-after comparison can indicate whether the stimulus has caused some mood changes.

2.4. Course of experiment

The test persons in this experiment were twelve women between 20 and 30 years old, divided into four groups of three.

When experimenting with food, it is necessary to take in consideration that test persons will be satiated after eating some of the stimuli and get tired of them, which might influence their reaction to the stimulus. Therefore, the consumption of the 3 stimuli in Mizutani's experiment has been split up into 3 sessions.

In order to gain reliable data, it is very important to keep comparable conditions. Here, in every experiment session, the groups were not only invited to the same room, but also at the same time of day. Moreover, the experiment environment was carefully kept in the same manner with all the equipment needed for *rakugaki sembei* and included also a bottle of tea for each test person.

The experiment ran as follows:

ca. 5 min: POMS questionnaire
ca. 10 min: Stimulus
ca. 5 min: POMS questionnaire and 7-point-scale questionnaire

2.5. Evaluation and result of analysis

The data obtained by the measurements were statistically evaluated and the significance of the results were verified.

The before-after comparison of the POMS questionnaire indicates that the *rakugaki sembei* (stimulus 1) caused a significant mood change: The activity raised the "liveliness" of the test persons.

This correlates to the evaluation of the 7-point-scale measuring the degree of pleasure: *Rakugaki sembei* showed significant higher scores than stimulus 2 and 3. However, the result revealed no observable relation between playfulness and deliciousness.

When looking at the result of the conversation analysis, again stimulus 1 offers interesting insights. All groups showed a significant decrease in the amount of utterance during the *rakugaki sembei*-activity. They didn't talk so much, because

they were concentrating on the action of doodling. In relation to that, the amount of *aizuchi*, sounds of attentiveness, also decreased.

And when conversation was resumed, the main topic – in all groups more than 50% – was the stimulus itself: they talked all about the drawing of pictures on rice crackers with colored sugar.

Frequent topics of conversations in all sessions were "the experiment", "the current stimuli", and "food in general". However, while eating the rice-crackers with an abstract pattern (stimulus 3), test persons talked about everything and anything apart from the above listed topics – with a significant percentage of almost 60%.

2.6. Conclusion and outlook

Let's call to mind the key question of the experiment. What kind of influence does playfulness have on pleasure and the taste of food? Two kinds of playfulness were described and the three stimuli were categorized among them. The stimulus with the most significant results is the one providing the *rakugaki sembei*-activity (stimulus 1). This stimulus was characterized as an example for both 'playfulness as an action' and 'playfulness as a concept'. Since the pre-decorated rice-cracker with the picture of a cherry (stimulus 2) – which was described as an example for 'playfulness as a concept' – remained without significant results, we can conclude, that it is rather 'playfulness as an action' that produced the feelings of pleasure and the increase in liveliness.

Then, 'playfulness as an action' also seems to bring the attention to the present activity, which can be inferred by the decrease of both utterance and *aizuchi*.

This experiment could not prove a relation between playfulness and deliciousness. However, one test person mentioned that food with pictures is more delicious than food without pictures.

Although not significant for all groups, the cherry-decorated rice-cracker (stimulus 2) triggered a conversation about food topics in general – averagely about a quarter of the entire conversation.

These inconclusive results prompt the questions Mizutani wants to address in her further exploration of the subject:

- From food-related pictures to non-food-related pictures to abstract patterns: do different kinds of pictures on food produce different perceptions of food? And if so, what significance belongs to 'playfulness as a concept'?
- How to measure deliciousness and taste? Is a 7-point-scale appropriate? And how to evaluate whether playfulness has an impact on it or not.

Kansei research is not done with a single experiment. Conducting an experiment

provides not only findings but also new questions. The research idea needs to be approached from various angles by a series of experiments using different stimuli and measuring methods.

Nevertheless, we can already learn from Mizutani's experiment. The playful *rakugaki sembei*-activity involved the test persons actively: decide what to draw, in which colors, and then put it into practice – they had to include their own ideas. This resulted in a lot of fun, with the additional effect of being engaging. The test persons paid full attention to their current activity and the food they ate at that moment.

It doesn't seem inadequate to apply this insight to serious issues of food consumption in today's advanced economies like diseases caused by bad eating habits or alienation from food production and food preparation – to name but a few. When tackling these problems, 'playfulness as an action' is a considerable strategy. What motivates people more to prepare and eat healthy meals than having fun while doing it?
And to develop suitable products and services is a matter of design.

3. Measuring Kansei

The above description of a Kansei experiment setup is a good opportunity to explain some basic principles of measuring Kansei.
In her experiment, Mizutani has obtained two kinds of data: conscious and unconscious information.

- Conscious information can be obtained by interviews, questionnaires, and any other measuring methods allowing the test persons to consciously decide how they estimate their impressions and feelings about a subject. Examples from the above experiment are the two 7-point-scales about the extent of deliciousness and pleasure.
- Unconscious information is obtained by e. g. Electro-encephalography (EEG), Near-Infrared Spectroscopy (NIRS), Eye-tracker, and others methods measuring the test person's neuro-physiological or behavioral reaction to a specific stimulus. Here, test persons can not consciously control the data output.

  But there are more simple methods to gain unconscious information as well. In the above experiment, the conversation of the test persons during the consumption of the stimuli was filmed and recorded – unbeknownst to the test persons. A microphone was placed under the table and a video camera behind a two-way-mirror.

  It is important to mention that the respectful and ethical treatment of test persons is of highest priority. At the University of Tsukuba, experiments involving human test subjects must be approved by an ethical committee. To meet this requirement in Mizutani's experiment, all test persons were afterwards informed about the recording and asked for permission to evaluate it.

  Moreover, keeping any obtained personal information confidential goes without saying.

For research on Kansei processes it is necessary to obtain and evaluate both kinds of information, conscious and unconscious information. But why?

It is easily imaginable that the conversation of the test persons won't be as relaxed and free when they know about the recording beforehand. They might be more cautious about what they say, a circumstance that distorts their natural expression and behavior – which is actually the core of interest. Thus, unconscious information is more objective within context, and helps to secure the result's reliability.

Professor Yamanaka explains this a bit further. Kansei research aims to obtain significant data about processes in the human heart and mind, however, they are not easy to examine. Humans often can't really explain how they feel, can't find the

right words or omit certain aspects. Statements in questionnaires or interviews are inherently subjective, limiting the insights that can be gained. Therefore, at the University of Tsukuba, methods of neuroscience are applied as well, to find out more about hidden emotions. By using measuring devices of the above-mentioned kind, a person's immediate emotional reaction to a certain stimulus becomes visible and measurable. Together with other obtained data, conclusions on the person's Kansei status during the experiment can be drawn. The evaluation of similar data from several persons leads towards the goal of Kansei research: to deduce general principles of human Kansei status, how an *environment is qualitatively perceived* in a particular situation. This information, then, can be applied to improve existing designs and to evolve new design solutions.

However, the methods of neuroscience have advantages and disadvantages, as Lévy points out, "Kansei is a mental process complex enough not to be measured directly, even with intrusive methods (such as fMRI): what is observed is not Kansei but consequences of Kansei […]. Therefore Kansei can be measured only indirectly or partially, by measuring psycho-physiological and behavioral responses."

One major difficulty is the interpretation of data generated by the measurement devices. Some parts of the output still remain uninterpretable (e. g. the contextual meanings of many graphs are not clarified yet), while well understood output is prone to over-interpretation. It requires some sensitivity to deal with the complexity of the data and to conclude a valuable result.

Let's look at an instructive example of an experiment using Near-Infrared Spectroscopy (NIRS).

4. Using Near-Infrared Spectroscopy (NIRS): Yusuke Nagamori's research on creative brain activity

4.1. Initial point of interest

One mental process addressed by the *rakugaki sembei*-activity is creativity – and creativity is the subject 5th-year doctor course student Yusuke Nagamori is researching on.

Nagamori's attention was attracted by the fact that matters of creativity are comparatively less explored. One reason for this might be the difficulty to measure these light-bulb moments of creativity that result from complex interactions between people's thoughts, their experiences, and their environment.

> *What sparks inspiration? Where do new ideas come from? And what impulses make the process evolve?*
> *Likewise, when an artist revises his or her work or a part of it, he or she will examine what is conveyed and compare this with the intended expression.*
> *Then, why is a creative person convinced of an idea or why does he or she continue looking for a better solution?*

This description of creativity as a complex process appears to have much in common with the complexity of Kansei processes explained in the introduction. And indeed, creativity is a process tied to Kansei – actually an important one. Hence, Kansei research is not only interested in the perceived experience users or consumers have with environments, situations or objects, but also in the creative processes of artists and designers.

High-end psycho-physiological measurement devices have made complex inner processes, like Kansei processes, more accessible for examination. That way, creativity can be measured as well. But Nagamori doesn't intent to evaluate the value of a creative work. The process of creativity and its subjective experience are of value themselves and ought to be distinguished from the output. In this way, an increased understanding of the creative process itself can lead to new strategies and methods to support creativity.

To reduce the complexity of questions like "What happens in the brain during creative acts?" and "What environments and conditions produce creative ideas?" Nagamori focuses on the different levels of creativity and describes three major ones:

- *Imitation* actually requires little creative thinking
- *Arrangement* combines existing ideas or objects into something new
- *Creation* generates a new and original idea seemingly out of the blue

4.2. Choice of the measuring device

In the case of Nagamori's experiment on creativity, it is evident that the experimental setup requires the possibility for the test persons to create something – at least virtually on a computer screen.

The decision about which measuring device to use for such an experiment is another example for advantages and disadvantages of psycho-physiological measuring devices. Besides the above mentioned difficulty of data interpretation, the measurement devices themselves have inherent limitations. Although functional Magnetic Resonance Imaging (fMRI) seems to be applicable for Nagamori's purpose, as it can measure activity throughout the brain, fMRI requires lying down in a narrow tube, which is an extremely unfamiliar environment and might, therefore, negatively affect creative thinking. Near-Infrared Spectroscopy (NIRS), in contrast, is a measuring method that allows a variety of activities in every-day-like situations: while sitting at a desk or in an easy chair, test persons only have to wear a cap with probes. But there are also limitations, e. g. the brain activity being measured is only from the surface of the cortex and not from the deeper areas of the brain.

4.3. Choice of tasks

Within the broad field of creativity, Nagamori favored color arrangement as an appropriate task for this experiment. Different to modeling and drawing, color arrangement is a task, that doesn't require special training, on the contrary, combining colors is familiar to everybody and we do it in many daily life activities, e. g. matching clothes. Thus, also test persons without formal training in design can participate freely.

The color arrangement tasks consist primarily of arranging three colors in such way that their combination creates a specific mood, associated to given adjectives. Three different mood schemata were defined: *soft and warm*, *soft and cold,* and *cold and hard*.

To investigate whether there is a difference in the brain activity related to the above mentioned different levels of creativity, Nagamori formulated the following 4 tasks varying in degree of required creativity:

- Task 0 – control task
  Test persons were asked to select the exact same color combination as displayed in the instruction window from a palette of colors. Here, no mood schema was given, a simple imitation task requiring no creativity at all. However, this task is relevant for calibration: the NIRS device records any brain activities, thus also those related to movements, e. g. the hand operating the mouse. Data of this non-creative control task has to be compared with the data of the creative tasks to distinguish between motor brain activity and

creative brain activity.

- Task 1 – creative task, requiring a low degree of creativity
  Test persons were asked to select the exact same two colors as displayed in the instruction window for both ends of the array and arrange them with one color of their choice in the center – according to the given mood schema *soft and warm*, *soft and cold* or *cold and hard*.
- Task 2 – creative task, requiring a medium degree of creativity
  Test persons were asked to select the exact same color as displayed in the instruction window for the center of the array and arrange it with two colors of their choice at both ends – according to the given mood schema.
- Task 3 – creative task, requiring a high degree of creativity
  Test persons were asked to choose and arrange all three colors by themselves – according to the given mood schema.

To avoid any influences due to previous tasks, the mood schemata of the tasks appeared in random order. For each of the three mood schemata there were 30 patterns available in task 1 and 10 patterns in task 2.

Some books were consulted to select the colors of the palette and matching colors for the various patterns of task 1 and 2.

4.4. Course of experiment

The participants in this experiment were 14 persons, aged between 24 and 34, all right-handers. 7 persons were educated in design while 7 persons had no training in design.

The detail of right-handedness and the fact that the test persons had to pass the Standard Color Vision Test, to make sure they don't suffer from color blindness, are again some examples of influencing factors that need to be taken into consideration cautiously when conducting an experiment.

The color arrangement tasks were conducted on a computer screen by using the mouse. The screen layout of this experiment consisted of 3 parts:

- A palette of 57 colors, defined by RGB values.
- The instruction window, where the specific instructions about the current task were displayed.
- The arrangement area, where the test persons should compose their solution of the given color arrangement task, with a submit button at the bottom.

  Additionally, a neutral gray screen with the request to relax was interposed between each task.

In order to get familiar with the experiment's tasks, test persons first practiced

all tasks in a sample session. In the actual experiment, test persons were given 60 seconds for each task. Each task was followed by a 30 second period of rest (gray screen). The 4 tasks were clustered into one set and repeated 2 times. The test screens were operated in an automatic sequence, no matter whether the task was completed or not.

4.5. **Evaluation and result of analysis**

The NIRS device – to put it simply – measures changes in the concentration of oxygenated hemoglobin (*oxy-Hb*) in the brain's blood flow. An increased amount of oxy-hemoglobin indicates an increase in brain activity in that area. Based on the detected changes, conclusions can be drawn.

In order to make the obtained data comparable, the data of the control task was subtracted from the data of each creative task: task 1 – task 0; task 2 – task 0 and task 3 – task 0. Then, tasks were compared with each other in pairs: task 1-0 versus task 2-0; task 1-0 versus task 3-0 and task 2-0 versus task 3-0.

The two points of interest in this experiment were whether there are any differences in the concentration of oxy-hemoglobin between design-trained test persons and non-design-trained test persons as well as between the 4 tasks due to the increase of required creativity.

When divided into design-trained and non-design-trained test persons, the data of the non-design-trained persons generally showed more significant changes in brain activity than design-trained persons. Furthermore, wider areas of the brains of the non-design-trained persons were activated while solving the tasks.

When comparing the different tasks, significant differences in all comparisons were found for the non-design-trained test persons: compared with task 1 and task 3, more brain activity occurred while performing task 2 – the task requiring a medium degree of creativity.

For the design-trained persons, in contrast, only the comparison of task 1 versus task 2 showed significant differences in brain activity with higher activity in task 1 – the task which required a low degree of creativity.

There is another finding that may be interesting. In popular understanding, creativity is assigned to the right hemisphere of the brain, whereas logics are assigned to the left hemisphere. Scientifically, this description may be inaccurate or too simplifying. However, significant changes in the concentration of oxy-hemoglobin were measured mostly for channels located on the right hemisphere of the participant's brains. Nevertheless, Nagamori recommends caution on over-interpreting this result.

4.6. **Conclusion and conceivable applications**

In this experiment – opposite to expectation – changes in brain activity weren't

congruent with the stepwise increase of freedom in creativity. Significant differences in brain activity appeared during solving task 1 (design-trained test persons) and task 2 (non-design-trained test persons), both tasks require only little or medium creativity.

So far, the tasks have been described by their degree of creativity, but they can be characterized by constraint as well: task 1 had the most constraints attached to it and task 3 the least.

Indeed. Three professional designers were consulted concerning this result. In their opinion, task 1 and 2 had been the most difficult tasks, because starting from zero is much easier. However, since task 1 requires only one color to choose, it seems more accomplishable, while task 2 appears really difficult: although two colors can be freely chosen, they have to be matched with the given one.

Thus, the significant increase of brain activity recorded for the non-design-trained group might be caused by the difficult constraint of task 2. But Nagamori points out that the data obtained by the NIRS device does not provide information whether the task was perceived as complicated and challenging.

Nevertheless, design-trained test persons used their brain more efficiently than the not trained persons. Changes in brain activity were observed in much smaller areas of their brain. Moreover, there was a broad diversity in the way in which brain activity changed, and it is therefore likely that each person has developed individual methods of creative problem solving.

So, why were significant differences in the brain activity of the design-trained test persons triggered by task 1? A possible interpretation is related to the saying, "Constraint stimulates creativity". Maybe task 1 inspired their ambition to create something unique from the one color they could choose.

The result of this experiment shows that brain activity during creative problem solving differs depending on the degree of constraint in the given tasks, and is furthermore influenced by whether or not a person received education in design. Creative processes seem to respond to training, and designers develop this kind of expertise. The subsequent difference between design-trained people and non-design-trained people has to be taken into account when conceiving new strategies and methods to support creativity. Asking Nagamori about possible uses of this insight, he emphasizes that research is still in an early stage, and that further experiments are necessary. Currently, he is conducting tests with chair-building tasks using LEGO bricks.

Basic research like this takes time and requires diligence, but it is dedicated basic research – without a later application in mind – that can lead to unexpected insights, inspiration, and real innovation.

In a sense, even though their research was not related, Nagamori's experiment complements the experiment of Mizutani. While Mizutani's results showed that

encouraging people to be creative has an energizing effect, his experiment revealed the expertise of trained designers. This also sheds light on the limits of creative involvement. Even if we fail drawing a nice picture on a rice cracker, it won't be a disaster. We just eat it up and no one will ever see it. There is no risk. But the situation is completely different when it comes to longer lasting products, for example, *bespoke design* and *customized products*. Who wants to exercise in the park wearing sneakers in mismatching colors?

Customization services have gained notable popularity since they can provide customers with unique products that fulfill their specific needs and wishes. When reflecting on Nagamori's experiment, however, non-design-trained people might feel uncertain about the quality of their customized design. Thus, a conceivable application would be to offer customization customers a 'design consulting' as an optional service. A designer will have a look at the design preview of the customized product, comment on it, and give advice regarding some improvements. In this way, the customer will feel reassured and happy – even a bit more proud of his or her own creation.

How creativity and Kansei are linked will be further illustrated by the following research.

5. Surprising results: Miho Kyoya's finding that 'delay is not necessarily faulty'

5.1. **Inspiring moments**

> *After midnight. Bright beams and booming beats. People move their bodies to the music. On the walls behind them emerge colors, patterns, pictures and drawings – constantly evolving and changing.*

This is the surrounding Miho Kyoya experiences during her activity as a VJ (Visual Jockey) at clubs. She creates those patterns and drawings, spontaneously inspired by the sound of the music and the atmosphere of the evening.

> *There was it again! From time to time she notices a funny sound effect. She starts to anticipate that sound and snaps her fingers when she expects it. Where does it come from? From the computer equipment, yes, but this sound is somehow delayed, can't be related to a certain process…*

In Kyoya s mind, her knowledge and her experiences on *music*, *sound*, *rhythm*, *grove*, *interaction*, and *joy* get connected, and a subconscious process starts.

Back to daylight, Kyoya returns to her studies at the University of Tsukuba. *Design*, *interaction*, and *usability* are the topics she addresses for her graduation thesis.

In interaction design, feedback sounds are a common method to improve the usability of man machine interfaces. A feedback sound reassures the user that the application has performed the intended action. However, to avoid confusion, the feedback sound ought to be triggered as immediately as possible, to be unambiguously connected with the action. Studies have shown that a delayed feedback sound decreases learning performance and increases stress.

> *Is that really so? Under all circumstances?*

Kyoya begins to question that and wonders whether there are conditions that suspend this usability principle. Like this sound effect she experienced in the club. That time, she didn t feel any stress at all. She tries to recall the characteristics of this sound. Its delay was somehow… matching the rhythm of the music… like putting an accent on the backbeat.

Rhythm has a strong physical effect. The human body responds to a rhythm with the synchronization of its movements. We all have experienced it: when listening to music, we often spontaneously start to tap our feet or snap our fingers.

Why shouldn t this powerful mechanism affect usability in some way, too? And so, encouraged by her supervisor Assistant Professor Uchiyama, Kyoya pursued the following experiment for her graduation thesis.

5.2. Experiment setup

Kyoya chose a computer game to examine how the timing of a feedback sound in combination with background music influences the usability.

Game The game used in this experiment is a simple Pong-type game, inspired by table tennis. Players move a paddle right or left to bounce a ball. Here, the paddle was controlled with the left and right cursor keys.

Sound of the game The background music of the game was in the manner of a metronome, pulsing at 100 beats per minute (bpm). The ball's speed corresponded with these beats at a moderate tempo.

When the paddle hit the ball, a sound was triggered as feedback.

Delay of the feedback sound The same game was tested with 4 differently delayed feedback sounds:

Game A: No delay of the feedback sound
Game B: 100 mSec – little delay of the feedback sound
Game C: 300 mSec – medium delay of the feedback sound
Game D: 500 mSec – huge delay of the feedback sound

The feedback sound in game A adds an accent on the downbeat while the feedback sound in game C adds an accent on the backbeat of the background music – they both were matching the rhythm. The feedback sounds in game B and D weren't matching the rhythm of the background music.

5.3. Measuring methods

To measure the objective usability of each game, the scores were recorded.

In order to obtain subjective information about the usability, a 10 item 5-point semantic differential questionnaire was developed.

First, a great number of terms were collected from books about usability and computer game magazines. These were then reduced to the 10 most relevant terms concerning a Pong-type game – by using the KJ-method (a context-oriented structuring method developed by Jiro Kawakita). The 10 terms were: "easy" （簡単）, "I can immerse myself in the game" （没頭できる）, "is thrilling" （スリルがある）, "no feeling of discomfort" （違和感がない）, "originalg" （斬新）, "shows class" （センスがある）, "pleasant" （快適）, "familiar" （親しみやすい）, "good tempo" （テンポがよい）, and their opposite terms.

5.4. Course of experiment

30 test persons – all university students, 12 men and 18 women – participated in the experiment. They played all of the 4 different games several times, and all scores were recorded. After playing each game, each test person filled in the

semantic differential questionnaire.

5.5. Evaluation and result of analysis

At first, to assess statistical significance, an Analysis of Variance (ANOVA) of the obtained data was carried out.

High score The game in which the test persons achieved the highest average score was game C – the game with the second longest delayed feedback sound, followed by game A – the one with the undelayed feedback sound.

Questionnaire To evaluate the semantic differential questionnaire, additionally, a Principal Component Analysis (PCA) was run on the data. Principal Component Analysis distils complex data into a fewer relevant main elements, the principal components.

According to PCA, 4 items of the questionnaire – "no feeling of discomfort" （違和感がない）, "pleasant" （快適）, "familiar" （親しみやすい）, and "good tempo" (テンポがよい) – can be subsumed under the term "usability" （操作性）. The best results concerning usability showed game A. Among the games with delayed sound effects, game C was rated the most easy to operate.

Another principal component emerged, "excitement" （ドキドキ感）, in which the item "original" （斬新） is comprised. Here, when comparing the games that match the rhythm of the background music, the one with the delayed feedback sound (game C) was judged better than the one without delay (game A).

5.6. Conclusion

Despite the fact that the feedback sound in game C was the second longest delayed one of the experiment, game C shows the best overall result, objectively and subjectively. Players achieved the highest scores, it was exciting, and ranks in the second place concerning usability.

Delay is not necessarily faulty, on the contrary, the delayed sound effect here, matching the rhythm of the background music, provided an emotional enhancement that led to an even better performance of the test persons playing this game. It added a unique value to the game – an effect that can be used for other suitable applications as well.

This finding is also particularly interesting since it is technically difficult to exactly synchronize an operation with a feedback sound. Delay shouldn't be perceived as merely a technical malfunction: put into the right shape, delay can be part of an intelligent design.

So, all in all, we can call this surprising and useful result *the Kansei way of solving a (technical) problem*.

6. Enhance Kansei Value

Kyoya's research appears like a storybook example, she transformed a personal Kansei experience into successful Kansei research. This triggers the question how to generate valuable Kansei research ideas in general?

Professor Yamanaka suggests to seek out experiences that are as rich as possible, *broadly* – from manifold areas – and *deeply* – with as many details as possible. To explain how to handle them, he likes to use the metaphor of a "drawer cabinet" in which these experiences are gathered and stored. "But don't put each experience in a 'drawer', label the 'drawer', and then close it – keep it open, keep the contents connected!"

And this is what Kyoya did. She experienced a delayed sound effect that was not disturbing. It happened during her VJ activity at a club, not at university while studying – this refers to *seeking broadly*. She put this experience in a "drawer", which means she consciously dealt with it as something worthwhile remembering. Maybe she also "stored" other details she noticed, like "that sound was somehow matching the rhythm of the music" – this refers to *seeking deeply*. Due to her studies and other interests, the "drawer cabinet of her mind" is already filled with a lot of knowledge, many other ideas, thoughts, and experiences. Luckily, the setting of this "cabinet" allowed a creative process to start. Creative processes are characterized as free unrestricted thinking processes in which various information – the content of the "drawers" – becomes connected in an unusual, even rule breaking way. These new associations incubate new thoughts and ideas. This is meant by "keep it open", to enable this kind of process. It is a Kansei process, creative processes are – as mentioned above Kansei tied processes. We are not aware of this process, Kyoya wasn't as well. But when it has ended, she pulled out some "items" from different "drawers" and formulated her research idea. She *felt* and *knew* that it is a good idea, that there is something worthwhile exploring.

Many Kansei experiences may not reach this state and are not processed further by creative thinking. They are given no consideration because they seem too personal, neither significant to a larger group, nor to mention applicable to mass marketed products. But who knows? Although it is a bit like digging for gold, relying on one's own Kansei experiences – however unconventional they may seem – and keeping them accessible for subconscious inspiration processes is key to enhance the value of Kansei Research.

7. 'Beacon' – An Interface for Socio-musical Interaction

The above research was the theoretical part of Kyoya's graduation thesis. Although the result turned out to be very promising, she didn't design a computer game or other suitable software application using this effect of delay. Nevertheless, her practical graduation work is also about feedback sound and music, taking it to a new stage: the feedback sound itself becomes music. Assistant Professor Uchiyama and Assistant Professor Kenji Suzuki (Department of Intelligent Interaction Technologies) supervised the project. Its result, 'beacon', is a unique music instrument that is currently getting attention at international exhibitions.

7.1. Scenario with 'beacon'

Let's have a look what could happen at these exhibitions.

Peter was sitting on a bench in the exhibition hall and felt so frustrated. On one of his favorite internet sites he read about this exhibition which featured many electronic gadgets and devices, digital music instruments and computer games – all the things Peter was interested in. He spent almost all his spare time after school on making music on his computer or playing games.

The exhibition was quite popular, and although visitors were allowed to try and experience everything, Peter hadn't a chance to check out a single exhibit. People were shoving and pushing – and he just couldn't assert himself.

In a darkened part of the room was a boy moving back and forward around a silvery cylindrical-shaped device. It was emitting a rotating red laser beam. Every time the beam hit the feet of the boy, a sound was generated. The pitch varied depending on the distance to the center, nearer produced lower tones, remoter produced higher tones.

Peter watched the boy explore this device. He put his feet lengthwise into the beam and created a legato-like sound. Next, he turned his feet, the toes towards the device in the center and caused staccato-like sounds.

Then, while the boy stood there with his legs apart, it happened that a visitor passed by, and his foot was hit by the laser beam in the exact moment between when each of the boy's two feet were hit. A nice chord played: low – high – low. The visitor didn't notice it, but the boy was inspired and tried now to play similar chords, stretching out his hand to the floor in order to trigger additional sounds. His attempts looked really funny and when he suddenly lost balance and fell down, Peter couldn't help laughing out loud. The very next moment he put his hand over his mouth, upset and embarrassed.

The boy turned towards him. Peter looked down to the floor, avoiding his angry glance.

"Stop laughing and play with me! Together we can create harmony."

Me??? Peter raised his eyes. The boy was not angry. Friendly?

"Come on!" he insisted.

Slowly, almost hesitantly, Peter approached closer. He placed himself at the edge of the radius, and when the beam came around, he heard two high tones. The boy adapted his position to Peter's, and the next beam played a chord.

"Not bad," he said and took a step back to try another configuration.

Soon Peter also wanted to try more. First he changed his positions, then he started to interact with the boy, and before long they were jumping and dancing around the device.

Other visitors were attracted by their lively playing and gathered around them. Some of them joined in the fun, intuitively understanding how it worked.

But suddenly Peter was baffled by his own courage. "I have to go now!" he said and left.

On the next day, Peter went to the exhibition again. He hoped that there were fewer people today and he could look at the objects undisturbed.

"I'm so glad you came!"

Peter turned around. There was the boy again. He pulled a bunch of chewing gum packages out of his pocket, "I'm Martin. I thought to build a kind of musical clock playing a real melody… You know, with this device. The packages are the 'spikes'…"

Peter was too surprised to say anything.

"I can get more of these… My mother owns the kiosk in the basement." Martin was a bit confused by Peter's silence. "The flea waltz! It's easy!"

Peter slowly nodded. They sat down on the floor and started placing some of the chewing gum packages within the radius of the device. When the laser beam came around, they carefully listened, moved the packages, and waited for the next beam, adjusted and checked, adjusted and checked. After a while of doing so, the first bars of the piece took shape, and finally the famous tune was vividly played.

Hand clapping and cheers. "Hey, you guys did an awesome job!" Totally immersed in their play, they didn't realize that some visitors were watching them, fascinated by their idea.

Martin smiled at Peter, "Will you come again tomorrow? The exhibition runs until next Sunday. I can't wait to try more things with this device."

Peter also smiled. … "Yes."

7.2. What is 'beacon'?

'Beacon' is a completely new device and difficult to categorize. Certainly, 'beacon' is a full functional music instrument with major, minor, and chromatic scales available as well as Japanese, Chinese, Indian, and other scales, also it has a built-in synthesizer that allows setting of various timbres, from piano to percussion. However, to call it simply a "digital music instrument" wouldn't live up to its entire potential.

As Assistant Professor Uchiyama suggests, "physical" is an important keyword. Making music has become more and more digital, composing and sampling all alone in front of a computer, hardly moving. But not so 'beacon'. Its rotating beams – their number can be set from 1 to 4 – encourage people to use their whole body,

to jump and dance, in order to play a melody… encourage to explore this new device, to be curious and creative, to find new ways of playing it… and encourage people to join in, to cooperate with each other, to play and perform together.

> *The dancers are the musicians, and the musicians are the composers – and together they are a team.*

And so, 'beacon' can also illustrate a remark by Professor Yamanaka, "Design an opportunity for communication – not the button of a so-called communication device!" He would like to see more designs that go beyond the basics of style and functionality, that focus also on the quality of communication itself and provide situations in which people can enjoy each other's company.

8. Shiho Nakamori's Eye-beam Project: From an analysis device to a communication device

New devices beyond current categories are nothing unusual for the Laboratory of Kansei Information Science at the University of Tsukuba. 4th year doctor course student Shiho Nakamori is also setting off on an unprecedented piece of equipment, evolving around the eye's gaze, loops of communication, and tacit knowledge. The project, pursued by interdisciplinary teamwork, illustrates the process of a substantial Kansei research in order to craft an innovative design.

8.1. Inspiring moments

Three experiences and moments of inspiration respectively are crucial sources of the idea:

- Over the years of studying, Nakamori has gained expertise in using eye-tracking methods for Kansei experiments. She observed the path of eye-movement – where the eyes fixate, where they move to – e. g. when people view representational art and non-representational (abstract) art, or the original work and its reproduction.
- As part of her studies, Nakamori attends many lectures and presentations. In these presentations, the lecturers often show pictures and refer to some details in them, explaining important topics. However, even if the lecturer uses a laser pointer, Nakamori sometimes experiences a feeling of uncertainty:

  Did I get it right? Is the detail I look at really the one the lecturer talked about?

- Also, Nakamori's attention was captured by media art, games, product systems, etc. that use psycho-physiological measurement devices beyond science and medicine.

These three quite different occurrences are not directly related, but Nakamori connected and shaped them into the following idea:

> *If psycho-physiological measuring methods are applied to artworks, then why not apply them to design? … Out of all these measuring methods, why not use eye-tracking? … Maybe, gaze-position and eye-movement data can be transformed into easily comprehensible information that improves communication … To convey more of the speaker's knowledge and thinking to the audience … Or in other situations as well … Isn't there that Japanese saying, "The eyes are more eloquent than the mouth （目は口ほどにものを言う。）"?*

8.2. From idea through research to design

Nakamori's idea is both an experienced problem and a starting point for a solution, raising a lot of questions:

- What characterizes the interaction process with a psycho-physiological information device?
- In what way can the visualization of eye-tracker information change communication?
- What is conveyed by gaze-points and eye-movement? Can it reveal too much?
- What kind of information is appropriate, useful, and effective?
- How do people interpret eye gaze locations? Are they certain about their understanding of it?
- Does it promote discussion and information exchange?
- What do people think about other people whose gaze points are conveyed?
- …

To tackle these questions, Nakamori is pursuing several surveys and experiments. Based on the findings and inspiration gained in this process, she will start to design a communication tool. Her research is still in progress. The results and conclusions so far will be described in the following section.

8.3. Analysis of 25 psycho-physiological information devices

At first, Nakamori analyzed the process structure of action and reaction in various media artworks and product systems that use psycho-physiological measurement.

Through internet search, she gathered 25 devices. Among them were for example 'Wave UFO' by Mariko Mori and 'Mindball Game' by Interactive Productline AB, both using brainwave data (EEG, Electroencephalography). In 'Mindball Game', for instance, the objective is to "move" the ball into the opponent's goal by being more relaxed. Therefore, the player's alpha- and theta-brainwaves – which indicate relaxation – are measured by electrodes in a headband. Connected to the interactive play table, this data makes a ball on the table top move like magic.

8.3.1. Method

The DEMATEL (DEcision MAking Trial and Evaluation Laboratory) method was used to analyze the interaction process of the 25 devices. DEMATEL is a structuring method that provides a visual model of cause-effect relationships among the components in a complex system, including the intensity of these relations.

8.3.2. Result

By analyzing the information devices, the DEMATEL model extracted twelve stages of interaction that repeat in a loop/spiral pattern. But not all devices show all twelve stages, the most frequent sequences of interaction are:

- *Users try to control themselves* > *a psycho-physiological reaction occurs*. In the 'Mindball Game', for example, the attempt of the players to relax results in a brainwave change.
- *A psycho-physiological reaction occurs* > *feedback is produced by the device*. In the 'Mindball Game', again, a brainwave change will cause the device to move the ball.

Hence, the most common loop of interaction can be characterized as a process of *think* > *result* > *realize* > *(re-)think*. "(Re-)think" marks the start of the next loop, whereby the result of one cycle is the cue for the next. This continuing loop/spiral process can be illustrated by 'Wave UFO'. Three at a time visitors are invited to take a seat inside the UFO-like cabin. They have electrodes attached to their foreheads which gather brainwave data. Based on this data, computer generated imagery is projected into the dome of the 'Wave UFO'. While the visitors look at it, they respond by becoming excited or calm, which implies a change in their brain activity. This, in turn, will instantly transform the projection. And so the imagery constantly changes.

8.3.3. Conclusions

A striking detail is that none of the twelve stages in the interaction process of the analyzed devices reveals any information about the underlying thinking process. We can only perceive visible feedback, but not the actual cause which led to the change.

From her experience with eye-tracking systems, Nakamori assumes that the use of an eye-tracker would offer the possibility to externalize a part of the thinking process. Eye-tracker information is tacit/implicit information, it conveys what a person almost unconsciously looks at. Its simplified visualization could therefore provide hints to understand the result.

8.4. Questionnaire survey on communication in group discussions

As a next step, Nakamori wanted to find out more about the relevant aspects of group discussions and possible effects of eye-gaze visualization. She decided to start with conducting a questionnaire survey, an effective way to obtain data from many people and gain initial insights. The results will provide clues for the next step: to conduct a more complex experiment with a small number of test persons – this step-by-step approach is a common research procedure.

8.4.1. Questionnaire form

The questionnaire consisted of two parts. Both parts contained multiple choice and free response questions:

- In the first part, the participants were asked about their experience of and attitude towards group discussions, what role do they usually take in a group discussion, what do they care about, etc.?
- In the second part, a group discussion situation was simulated. To be exact, a meeting at the beginning of a design project during which team members present their ideas. The questionnaire contained 6 different photographs, and participants were requested to regard them as discussion material for the meeting. 3 of the photographs were unmodified while in 3 others the presenter's most looked-at area of the picture was indicated with a red circle. For each of the 6 pictures, participants were asked whether they can anticipate the idea of the sender, whether they are interested in the idea and the sender itself, whether their own thoughts about the picture seems to coincide with the thoughts of the sender, and how they rate the picture itself.

  The circle, indicating the eye-gaze, was placed randomly on the pictures. Also, the order of the 6 photographs in the questionnaire was random.

  For comparison purpose, both versions of each photograph – with and without eye-gaze indication – were evenly represented in the questionnaire, determined by a distribution pattern.

8.4.2. Evaluation and result of analysis

Nakamori obtained data from 89 questionnaires, filled in by university students with experience in group discussions – 40 men and 49 women of an average age of 22 years.

8.4.2.1. Relevant aspects of group discussions

Roles The majority of the participants, 41%, takes the role of a "listener" （聞き役）, followed by the role of a "director" （問題を指摘する役）, who points to problems/questions, with 24%. Other roles were "energizer" （盛り上げ役）, who encourages the discussion, with 16%, and "leader" （リーダー役）, with 14%.

Attitudes Almost two thirds of participants, 63%, made statements about what they pay attention to in group discussions. Nakamori analyzed these free response statements in three steps:

- Extraction of 97 morphemes from all responses. Morphemes are the smallest units of language that have semantic meaning. They can be independent words

(nouns, verbs, adjectives), but also affixes like "un-" or "-able" in English. These morphemes are necessary for the next step.

- Generate a network-like 'Keygraph'. 'Keygraph' is a technique to visualize the relationships among keywords in complex text-based data. First, the frequent morphemes/words are collected and placed within the graph's space. Then, those terms that frequently co-occur in the sentences of the data are linked with each other. And finally, the less frequent words are included.

  The 'Keygraph'-network of this research showed two clusters. A huge one with the terms "speak" （話す）, "participation" （参加）, and "understanding" (理解) in the center, and a very small one comprising "dispute" （喧嘩）.
- Identification of relevant statements. The terms with the most links are "speak" （話す）, "everyone" （全員）, and "participation" （参加）. However, they merely describe the general concept of a group discussion. To discover more relevant statements, those terms with less links were gathered and counted according to their frequency of occurrence in the text responses. The most numerous term was "not reject (an opinion)" （否定しない）, followed by "listen" （聞く）.

To sum up, the attitudes towards group discussions can be described as follows: participants want to respect the opinions of others and understand the others' points of view and intensions.

Since all participants in this survey have a background in art and design and are familiar with brainstorming, Nakamori assumes that the result is possibly influenced by the rules of this technique, i.e. not to criticize and dismiss any expressed idea.

8.4.2.2. Possible effects of eye-gaze visualization

The data of this part was standardized and analyzed by a two-factor ANOVA (Analysis of Variance): 1. the gaze point (indicated / not indicated) and 2. the photographs (6 conditions).

The questions and results of the second part can be grouped into four sections.

Understanding – "Can you imagine or anticipate the idea of the sender?" – There was no significant difference between photographs with and without eye-gaze indication concerning the understanding of the sender's idea.

Interest – "Do you want to know more about the idea of the sender, about the person itself? Do you want to know why the sender chose this picture?" – The overall interest in the sender decreases significantly for pictures with eye-gaze indication.

Relationship between the thoughts of the sender and the receiver – "What do you think the sender thinks about the picture? What do you think about the picture?

To what extent are these thoughts similar?" – Participants regarded their own thoughts about the photograph as more similar to the sender's thoughts when the photograph had no eye-gaze indication.

Rating of photographs – "Are you interested in the photograph itself? Do you like it?" – The ratings of the photographs differed depending on the scene. However, pictures with eye-gaze indication were generally rated lower than those without. Nakamori assumes that the red circle may be perceived as disturbing and plans to revise the design.

The evaluation of the free responses is expected to provide more detailed information when analysis is complete.

8.4.3. Interim conclusion

Eye-tracker information can be assumed to convey additional information. There are two evidence points that support this hypothesis:

- Literally confronted with another person's "point of view", participants received information that made them realize the diversity in thinking and perspective. Being aware of this, they can't proceed on the assumption that their own thoughts are similar to the sender's thoughts.
- Decreased interest means that some information has already been exchanged. Take the simple example of your favorite magazine. First, you are very excited and interested in the new issue. You browse through the pages to get a first impression – and the initial excitement has decreased. After you read the cover story, your interest in the magazine starts to fade. The next days, you read other articles – and then the magazine is lying on the coffee table, before it gets archived.

  Of course, communication between people is more complex and dynamic, however, the example illustrates that the more we receive information from an information source the less our interest in the information source becomes. Consequently, when pictures with eye-gaze indication reduced the interest in the sender, i. e. the information source, we can conclude that they can convey more information than pictures without eye-gaze indication.

8.5. Application scenario

Although research is still in progress, Nakamori already has a possible application in mind. Nothing concrete, to avoid being biased in interpreting research results, but nevertheless, eye-tracker information seems to be advantageous in the area of telecommunication. The possibility to exchange tacit information – in addition to the explicit information – can, for instance, enrich the communication and collaboration of geographically distributed project team members.

Let's imagine how an eye-tracker augmented teleconference would be like. The imagined device in this scenario provides not only information about gaze points and eye-movement, but also about emotional attitudes, based on the pupil size. A widened pupil indicates interest and attraction, whereas a contracted pupil can be a sign of disgust and rejection. Nakamori is also considering this function as an option.

A reminder pops up on Jane's computer screen, "14:00 - Tele-meeting with Petra."

5 minutes to go. Jane plugs in her headset and turns on the 'EyeBeam'-device, located below her computer monitor. Then she starts the 'EyeBeam'-teleconference software and drags the design renderings into the main window of the interface.

"Hi Jane, how is country life going?" Petra appears in the webcam window.

"Hi Petra, I am wonderfully busy with my garden. It's so inspiring!"

"Indeed, it seems like that. I've already had a look at the designs that you've sent and was quite impressed."

A window pops up, "EyeBeam-system now ready."

"Ah, here we go!" Petra can now also view the renderings: refillable bottles for a water dispenser system. The activated 'EyeBeam'-system keeps Jane's and Petra's screens synchronized to each other. It continually measures gaze-position, eye-movement, and pupil size of the dialog partners and generates the corresponding feedback information visible on their screens. That's why Jane can see the appreciation before Petra expresses it, "In my opinion, the designs in the upper row, the one in middle, and the one on the right, really communicate the message of the product. Each in their unique way. And I also think that the design on the left has potential, but…"

"Ok, let's zoom in."

"Particularly, the part of the bottle neck needs some improvement." While Petra is speaking, the 'EyeBeam'-system on Jane's monitor displays red markings overlaying the bottle neck. "Red" signifies negative feelings and disapproval. Jane clicks the right mouse button and additional areas become highlighted, representing those gaze points that are close related to the most looked-at area. Jane thinks for a moment, then she proposes, "How about some changes in the proportion of the bottle neck and the edge of shoulder and body? It's not really well balanced there. What do you think, Petra?"

"Ah, you are right. It is difficult to perceive it as a unit. Could you please try that?"

"Sure."

"And now for the presentation," Petra zooms out again until all renderings are visible, "I want to generate rapid prototyping models of the two bottles that I

mentioned at the beginning, and one of the revised designs."

"Ok. What about the bottle below on the right? I receive positive signals at the bottle's bottom…"

"Oh! … That was an instant message…"

Jane laughs, "Hey, hey, so much positive feedback… A date tonight?"

"You have a fertile imagination, Jane! … Sorry for the interruption, but now back to the presentation! Can you have the new renderings done by the day after tomorrow? By then, at the latest, we have to run rapid prototyping."

"I'll do my best."

"Otherwise we present the renderings, no problem!"

"The meeting is next Tuesday. At what time do you want me to come?"

"Clients arrive at 11 o'clock, how about half past nine?"

"Fine, but I haven't been to the new office yet. Can you give me the directions?"

"Oh, yes, of course!"Petra drags a map in her main window. "Actually, it is very easy to find! Take the West exit of the station, go right and follow the main street until you reach the Post Office, turn left…"

"Petra? Do you take this route?"

"Um… no! Why?"

"There is a positive feedback hitting the area along the river."

"Hey, that's true! I prefer to walk along the river. The directions are not that easy to understand, and it takes a bit longer, but it is really lovely. There are shady trees and it's much quieter..."

"Nice! I will try this route."

"You will love it, I'm sure!" Petra describes her alternative route to the office.

"But Petra, actually, I wonder if it wouldn't be better to communicate with the clients by using the 'EyeBeam'-device... It works great, don't you think?"

"You are kidding! Do you really think it's a good idea? What if they find out that you don't like their tie?"

Certainly, the most challenging part is to design an interface that provides a guiding framework to interpret the conveyed eye-tracker information appropriately. Receiving feedback about another person's thoughts is a completely new way of interaction, something that we have to learn to deal with. It requires openness to another person's opinion and also being open to the criticism of one's own ideas.

9. Kansei and tacit knowledge

9.1. Kansei and tacit knowledge

In the previous passage, a particular expression – tacit knowledge – has emerged several times. The term comes from "tacit knowing", a concept developed by Michael Polanyi, a Hungarian-British scientist and philosopher (1891 – 1976). In his book *The Tacit Dimension*, he describes a situation that resembles Nakamori's experience mentioned above. A lecturer, a teacher can tell his knowledge "only by relying on the pupil's intelligent co-operation for catching the meaning of the demonstration." Both, the student and the lecturer experience a feeling of uncertainty, '*Did I get it right?*' and '*Did they get it right?*' respectively. In the act of defining and pointing to an external thing remains "a gap to be bridged by an intelligent effort on the part of the person to whom we want to tell what the word means. Our message had left something behind that we could not tell, and its reception must rely on it that the person addressed will discover that which we have not been able to communicate."

Lecturers are experts in their subject, why can't they communicate their knowledge completely? Basically, there a two kinds of knowledge:

- Descriptive/explicit knowledge = think, plan, independent
- Tacit/implicit knowledge = feel, aware, interrelated

Our tacit knowledge contains a lot of useful and important information – ideas, thoughts, feelings, memories, experiences, know-how about using tools, skills of pattern recognition, etc. But since synonyms for *tacit* are "unspoken", "unstated" and "implied", we sometimes just can't find the right words to express this kind of information. Tacit knowledge is not necessarily unconscious, we are aware of many of its contents, but it is difficult to properly describe them. Polanyi puts this in a nutshell, "We can know more than we can tell."

Nevertheless, tacit knowledge can be shared – and Kansei processes substantially contribute to make communication of tacit knowledge possible.

Professor Yamanaka describes three ways of exchanging information with the environment:

- The descriptive/explicit knowledge – consisting of words and numbers – is communicated by *explaining and understanding* its logically structured information
- The previous way can also be used to communicate tacit knowledge – indirectly: Descriptive knowledge and tacit knowledge are not separated from each other, they are interconnected by internal Kansei processes. These Kansei processes work on the transformation of tacit knowledge into descriptive knowledge. Once made explicit, it can be *explained and understood.*

Examples for these processes are the moments of inspiration when we are convinced of an idea – like Miho Kyoya's delay research.

- The way to directly convey tacit knowledge involves, again, Kansei processes: They *express* implicit information in a *cognizable form* that can be received from, for example, the experience of interacting with each other or the impression of music, literature, art and design.

  The 'EyeBeam'-device will function like a Kansei process of this kind. Its visualization of implicit information creates an *expression* that is *experienced* and *recognized* by the dialog partner. In this sense, it will be a true Kansei communication device.

9.2. Asobi

Nakamori's Kansei device seeks to bridge the gap in communication by also providing tacit knowledge. However, we don't need to be afraid of this gap. On the contrary, we should come to appreciate it. Professor Yamanaka likes to call this gap *asobi* – "play". He encourages allowing the recipient to interpret our message in another way and allowing the message to deviate from its original form. *Asobi* doesn't want to be definite, it wants to leave room for developing thoughts, and it is curious about this process.

10. Closing Remarks

Kansei processes are something we have all experienced, but yet Kansei is often difficult to explain – paraphrasing Polanyi, we understand more than we can tell.

Besides providing basic information about how to do research on Kansei, this paper tried to sketch the relationship between Kansei Research and Design by addressing both, the descriptive and the tacit knowledge, with simple and clear explanations alternating with narrative passages and storytelling.

A mix of these two components is also worth considering for design. Most products are "programmed", are explicitly defined in every detail – from practical functions to semantic aspects. However, people will perceive and use the products also with their tacit knowledge in an indefinable way. A challenge that many products will fail, causing disappointment or even annoyance.
Therefore, Professor Yamanaka is certain that design offices and product development departments of companies will increasingly require experts who understand what is going on in the hearts and minds of humans and can apply this to design projects. Kansei Research offers inspiration as well as important scientific evidence about human behavior. Its objective data can help to explain and justify unconventional design decisions.

As long as there are no alternatives available, we resign ourselves to disappointing products – and therein lies the opportunity: A product that can convincingly deal with the complex inner processes of the user – Kansei – will become more successful, because it is more valuable.

11. Bibliography

1. Introduction

"cololo" is an One-bit communication device designed by M. Hoshikawa, advised by F. Ogaki, T. Uchiyama and K. Suzuki, 2008

K. Suzuki; 1bit Signal Communication, Institute of Electronics, IEICE Technical Report, 105(564) pp.49-50 2006

P. Levy, S. Nakamori, T. Yamanaka; Explaining Kansei Design Studies, Proceeding of the Design and Emotion Conference, 2008

P. Levy, T. Yamanaka; Towards a definition of Kansei, proceeding of the 2006 Design Research Society International Conference, Wonderground 2006, Lisbon, 2006

T. Yamanaka, P. Levy; Kansei Science and Kansei Value Creation through Kansei, Behavioral and Brain Sciences, Cosmetic Stage vol.4 No.3, pp.1-11, 2010

2. Getting started: 'Playful Food'

N. Mizutani, M. Okamoto, Y. Yamaguchi, I. Dan, T. Yamanaka; Package images modulate flavor perception of fruit juices, Chemical Senses (submitted).

N. Mizutani, T. Yamanaka; Effect of drawing and seeing pictures on food on conversation and feeling, 4th Spring Conference on Kansei Engineering, Japan Society of Kansei Engineering, 2008

3. Measuring Kansei

H. Ogino, Y. Nagamori, T. Yamanaka; The Effects of Unconscious Intermediate on Behavior and Mind in Communication in the Case of "Tea", Congress of International Association of Societies of Design Researches, 2007

L. Shi, S. Nakamori, T. Yamanaka; Comparing Effects of User's Kansei Excited by Color Information of Interface, Kansei Engineering International Journal vol. 9, No.1, 2009

N. Kang, T. Yamanaka; Behavioral Characteristics while Searching Information thanks to Tangible Media - Kansei Evaluation and Behavioral Analysis on E-Paper, Paper and Touch-panel -, proceedings of the 2006 Design Research Society International Conference, Wonderground 2006, Lisbon, 2006

O. Tomico, E. Karapanos, P. Levy, N. Mizutani, T. Yamanaka; The Repertory Grid Technique as a Method for the Study of Cultural Differences, International Journal of Design, Vol 3, No 3, pp.55-63, 2009

P. Levy, T. Yamanaka; Kansei Studies Description and Mapping through Kansei Study Keywords, Kansei Engineering International Journal vol.8, No. 2, 2009

T. Yamanaka , O. Tomico b, N. Mizutani, T. Yokoi, Y. Cho and and P. Levy; Combining Kansei-Physiological Measurements and Constructivist-Psychological Explorations through the Repertory Grid technique, International Symposium on Emotion and Sensibility, 2008

T. Yamanaka, K. Tamura; The relationship of environment to communication in case of 'Tea-friend', Journal of the Asian Design International Conference Vol.1, G-03, 2003

4. Using Near-Infrared Spectroscopy

Y. Nagamori, M. Nakajima, T. Yokoi, T. Yamanaka; Analysis of the Brain Activity at the Chair Design Task with Lego Blocks,
Journal of Japan Society of Kansei Engineering vol.9 No.1, pp.51-60, 2009

Y. Nagamori, S. Nakamori, N. Mizutani, T. Uchiyama, T. Yamanaka; The Analysis of Brain Activity in Creative Tasks -A Case Study of Color Arrangement Task-, 3rd Spring Symposium of Japan Society of Kansei Engineering B12, 2007

Y. Nagamori, S. Nakamori, N. Mizutani, T. Uchiyama, T. Yamanaka; Measurement of Cerebral Blood Flow at Creative Activities, PROCEEDINGS OF THE 54TH ANNUAL CONFERENCE OF JSSD, Japanese Society for the Science of Design, 2007

Y. Nagamori, K. Kakiyama, A. Harada, "A Trial of Interface Evaluation by Kansei Information Extraction Using Face Recognition System", Proceedings of

International Design Congress 2005 CD-ROM (8 pages) 2006

5. Surprising results: Miho Kyoya's finding that 'delay is not necessarily faulty'

T. Uchiyama, M. Kyoya, S. Nakamori; EFFECT OF TIMING OF SOUND FEEDBACK ON OPERATION PERFORMANCE, Journal of Japan Society of Kansei Engineering vol.8 No.2, pp.749-758, 2009

6. Enhance Kansei Value

P. Levy, T. Yamanaka; Interdisciplinary Workgroup Methodology Based on Intuition -Application to a Communication Tool Design Based on Kansei Information Approach-, Journal of Japan Society of Kansei Engineering Vol. 5 No. 4, pp31-40, 2006

7. 'Beacon' – An Interface for Socio-musical Interaction

"beacon" is an Embodied Sound Media Environment for Socio-Musical Interaction, Designed by M. Kyoya, advised by T. Kamatani, T. Uchiyama and K. Suzuki, 2008

K. Suzuki, M. Kyoya, T. Kamatani, T. Uchiyama; "beacon: Embodied Sound Media Environment for Socio-Musical Interaction," Proc. of 8th Intl. Conf. on New Interfaces for Musical Expression (NIME2008) pp.360-361, Genoa, Italy, 2008

8. Shiho Nakamori's Eye-beam Project: From an analysis device to a communication device

F. Shuto, T. Horaguchi, N. Ohshima, S. Inoue, S. Nakamori, T. Omuka, T. Yamanaka, S. Hisano; Intuitive Prefrontal Brain Activity while Appreciation Application of Representative and Abstract Paintings, Third Spring Conference of Japan Society of Kansei Engineering E45, 2007

N. Mizutani, S. Nakamori, Y. Nagamori, Y. Mihaji, N. Saito, T. Yamanaka; Fundamental Funermental Research on Application to the Unconscious Interest of Users -2-, 54th Conference of Japanese Society for the Science of Design G06, 2007

S. Nakamori, S. Lee, T. Yamanaka; The trial research in physiology Index to objectively evaluate the activity of KANSEI about impression, Third Spring Conference of Japan Society of Kansei Engineering C21, 2007

S. Nakamori, N. Mizutani, Y. Nagamori, Y. Mihaji, N. Saito, T. Yamanaka; Fundamental Funermental Research on Application to the Unconscious Interest of Users -1-, 54th Conference of Japanese Society for the Science of Design G06, 2007

T. Horaguchi, F. Shuto, N. Oshima, S. Inoue, S. Nakamori, T. Omuka, T. Yamanaka, S. Hisano; Prefrontal activity while appreciating abstract and representational paintings: A NIRS study, Neuroscience Research(0168-0102) vol.55 Suppl.1 PageS134(2006.07)

9. Kansei and tacit knowledge, and others

I. Park, S. Lee and T. Yamanaka; The possibility of 'Kansei' evaluation on preference through a human face, Congress of International Association of Societies of Design Researches, 2007

J. Zhang, L. Shi, T. Yamanaka, A. Harada; Driver`s Comfortableness and Vehicle's Characteristics in Linear Movement, Kansei Engineering International Journal, Vol.6, No.1, pp.61-68, 2006

J. C. Sanabria, K. Kakiyama, T. Yamanaka, A. Harada; CYBER-RATES - a platform for understanding designer's kansei, proceeding of DRS Conference Future Ground, 2004

K. Miyazawa, T. Yamanaka; Relationship between the simplicity and reaction in children, Bulletin of the 5th Asian Design Symposium, P-06, 2001

K. Miyazawa, Y. Komamiya, P.J. Stappers, T. Yamanaka; GUI Usability Development Tool with Dynamic Kansei Labeling –Kansei Evaluation Method

for Understanding the UI Process-, Journal of the Asian Design International Conference Vol.1 G-46, 2003

L. Shi, J. Zhang, T. Yamanaka, A. Harada; Evaluating Driver Comfortableness via Frontal Alpha Waves -A Study of Driver's Moods in Curvilinear Motion, Bulletin of Japanese Society for Science of Design 53(5) pp.21-28 2007

N. Kang, T. Yamanaka; Research on Product and Preference by Kansei information, Bulletin of the International Design Congress - IASDR2005, 2005

N. Kang, T. Yamanaka; Research on the method of measuring a user's Taste-KANSEI --Consideration through the classification of a bench, Journal of the Asian Design International Conference Vol.1, E-22 (8p), 2003

P. Levy, T. Yamanaka; Kansei information approach for an interdisciplinary design method proposal based on intuition, in proceeding of International Design Conference 2006, Dubrovnik, 2006

P. Levy, T. Yamanaka; Introducing Matik Service - Proposition For A New It Communication System Through An Approach In Kansei, proceeding of DRS Conference Future Ground2004, 2004

S. Kim, S.Lee, T. Yamanaka; Relationship between evocation and choice using dairy objects, Proceedings of International Symposium of emotion and Sensibility, 2008

S. NAKAMORI, T. Uchiyama, T. Yamanaka; The Baseline Study for the Development of Information-Devices That Use Physiological Information (1)-The Results of a Current Situation Survey, The International Conference on Kansei Engineering and Emotion Research 2007, 2007

T. Sakurai, B. Park, T. Yamanaka; Analysis of terms used by occupational therapists and physical therapists in medical charts to provide a comprehensive understanding of the overall picture in palliative care rehabilitation: analysis using text mining software, Journal of Japan Society of Kansei Engineering 8(2) (22) pp.347-353, 2009

T. SONDA, T. Yamanaka; Development of a hypothesis exploration application by Kansei Information approach, Bulletin of the International Design Congress - IASDR2005, 2005

T. Yamanaka, K. Miyazawa, Y. Komamiya; Interactive Data Structuring tool with Dynamic Kansei Labeling, Korea-Japan Joint Symposium for Kansei Engineering, 2004

T. Sonda, T. Yamanaka; A Fundamental Study on Complementary Application Method of Nomothetic and Idiographic Approaches on Impression Evaluation, Journal of the Asian Design International Conference Vol.1, E-43 (11p), 2003

T. Yamanaka, T. Uchiyama, A. Hirotomi, E. Honjo, S. Hiramatsu; Design Experience System for Customers of Tombstones, DBWeb 2003, S5-3, 2002

T. Yamanaka, T. Uchiyama, E. Honjo, S. Hiramatsu; Image Database System based on Readers' Kansei Character, Bulletin of the 5th Asian Design Symposium, A-05, 2001

T. Hanazato, T. Toda, T. Yamanaka; NoNoJi house, Annual design review of Japanese Society for the Science of Design 7(7) pp.30-33 2001

T. Uchiyama, Y. Nagano, Y. Shinohara, Y. Takamoto, H. Tosaka, K. Takahashi; Development of Web Accessibility Diagnosis Tool, Annual design review of Japanese Society for the Science of Design 11(11) pp.28-31 2006

T. Suzuki, T. Uchiyama, Y. Saka; A new visual-user-interface for WWW search, Journal of the Asian Design International Conference, P-79 (CD-ROM), 2003

T. Yamanaka; Keynote Speech 'Kansei Science and Design Process', International Symposium of Korean Society of Basic Design and Art, 2008

T. Yamanaka; Difference of the Vibrational Characteristics between the Human's arm holding and Baby Buggies' as a reference for design based on riding feeling: Sense for Riding in Infants in the Vibrational Environment -2-, pp.175-185, 1999

T. Yamanaka; Vibrational Characteristics of the Baby Buggy and Subjective Factors for the Feel of Ride: Sense for Riding in Infants in the Vibrational Environment -1-, pp.11-18, 1998

Y. H.T. LAM, K. Lee, G. Liu, T. Yamanaka, M. Woo, Project "Chopsticks" - An Asian Life-style Study in Domestic Culinary Habits for Design, Bulletin of the

International Design Congress - IASDR2005, 2005

W. Yang, T. Yamanaka; Relationship between experience and color expressing behavior, Kansei Engineering International Journal vol.8, No. 2, 2009

W. Yang, T. Yamanaka; Relationship between experience and color expressing behavior, International Symposium of Emotion and Sensibility, 2008

For easier access, a portal page on the internet provides links to the papers quoted in this report as well as to videos of 'cololo', 'beacon' and further information: ***www.kansei.info***

Kansei Research and Design

An introduction by Bianca Beuttel

28 Feb, 2010
ISBN: 978 4 924843 60 8

Author:
Bianca Beuttel [Diplom Designer(dipl. des)]
bbianca@gmx.net
Tel: +75 708 7423
150 703, Manjuji cho, Shimogyo ku, Kyoto shi, Kyoto, Japan 600 8104
www.bbianca.net

Research works are:
Toshimasa Yamanaka, Prof., University of Tsukuba
Toshiaki Uchiyama, Assistant Prof., University of Tsukuba
Pierre D. Levy, Assistant Prof., Eindhoven University of Technology
Yusuke Nagamori, Assistant Prof., Tsukuba University of Technology
Shiho Nakamori, University of Tsukuba
Nanami Mizutani, University of Tsukuba
Miho Kyoya, University of Tsukuba(2008)
Makiko Hoshikawa, University of Tsukuba(2008)

Planning and publishing:
Kansei Information Laboratory
Toshimasa Yamanaka, tyam@geijutsu.tsukuba.ac.jp
Toshiaki Uchiyama, uchi@kansei.tsukuba.ac.jp
Doctoral Program in Kansei, Behavioral and Brain Sciences,
Graduate School of Comprehensive Human Sciences
1 1 1, Tennodai, Tsukuba shi, Ibaraki, Japan 305 8577
www.kansei.tsukuba.ac.jp

Editorial Design: Bianca Beuttel, Yusuke Nagamori
Cover Design: Fumika Ando (Tsukuba University of Technology)

筑波大学
University of Tsukuba

ISBN: 978-4-924843-60-8