Research for the Information-Device Development using Physiological Information

Shiho NAKAMORI
Toshiaki UCHIYAMA
Toshimasa YAMANAKA*

*University of Tsukuba
Recently, physiological information has attracted attention since it may provide a clue to the elucidation of the kansei process.

We propose an advanced-model design of devices that use physiological information as a media that reflects kansei information.
Background and Aims

To investigate the structural model of kansei information flow.

How such devices use physiological information will be understood from a broader viewpoint.

We will create concepts and come up with new methods for using physiological information in kansei-information devices.
Methods

Structure analysis

DEMATEL method
(The Decision Making Trial and Evaluation Laboratory method)

The KJ method
is used to subjectively evaluate associations among system components,

The ISM method, the DEMATEL method
objectively grasp the structure of systems by having people closely associated with the problems concerned evaluate inter-component associations.
Methods

ISM method

by evaluating the presence or absence of associations among system components.

DEMATEL method

by adding meanings to each system component by adding the relationship intensity to associations among the components.
DEMATEL method objectively evaluate associations among system components and identify the degree of influence of each system component and the degree of association among the components.
Methods

Data were prepared in the order of ...

① the collection of samples
② the selection of items
③ the evaluation of causal relationships
Methods

Collection of samples

- media art works
- products in advanced development
- news sites
- competition sites
- the sites of creators
- manufacturers on the Internet

24 works or products.

DATA AQUETION

① the collection of samples
② the selection of items
③ the evaluation of causal relationships
④ analyze by the DEMATEL method
⑤ Discussion
Methods

Selection of items

Based on the works and products collected, three people with knowledge on information design had discussions and made a list of items.

The samples were narrowed down to 14 by removing those with similar structures.
# Methods

## Items

**Function, action and reaction.** 31 interaction components.

<table>
<thead>
<tr>
<th>Item No.</th>
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<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Person A wearing the device: behaves as usual.</td>
<td>17</td>
<td>Other people: receive impressions from the expressions of Person A wearing the device.</td>
</tr>
<tr>
<td>2</td>
<td>Person A wearing the device: intends (to move something).</td>
<td>18</td>
<td>Person B wearing the device: behaves as usual.</td>
</tr>
<tr>
<td>3</td>
<td>Person A wearing the device: tries to control his/her mood.</td>
<td>19</td>
<td>Person B wearing the device: intends (to move something).</td>
</tr>
<tr>
<td>4</td>
<td>Person A wearing the device: tries to control his/her physiological information (tries to generate alpha waves, etc.)</td>
<td>20</td>
<td>Person B wearing the device: tries to control his/her mood.</td>
</tr>
<tr>
<td>5</td>
<td>The physiological information of Person A wearing the device changes.</td>
<td>21</td>
<td>The physiological information of Person B wearing the device changes.</td>
</tr>
<tr>
<td>6</td>
<td>The device: converts the meanings of the physiological information of Person A wearing the device into expressions for conveying the</td>
<td>22</td>
<td>The device: converts the meanings of the physiological information of Person B wearing the device into expressions for conveying the</td>
</tr>
<tr>
<td>7</td>
<td>The device: converts the physiological information of Person A wearing the device into expressions that do not semantically correspond to the conditions of people.</td>
<td>23</td>
<td>The device: converts the physiological information of Person B wearing the device into expressions that do not semantically correspond to the conditions of people.</td>
</tr>
<tr>
<td>8</td>
<td>The device: generates stimuli to control the physiological information of Person A wearing the device.</td>
<td>24</td>
<td>The device: generates stimuli to control the physiological information of Person B wearing the device.</td>
</tr>
<tr>
<td>9</td>
<td>Person A wearing the device: can confirm his/her physical conditions.</td>
<td>25</td>
<td>Person B wearing the device: can confirm his/her physical conditions.</td>
</tr>
<tr>
<td>10</td>
<td>Person A wearing the device: can know his/her state of mind by analogy.</td>
<td>26</td>
<td>Person B wearing the device: can confirm his/her physical conditions.</td>
</tr>
<tr>
<td>11</td>
<td>Person A wearing the device: receives impressions from his/her expressions.</td>
<td>27</td>
<td>Person B wearing the device: can know his/her state of mind by analogy.</td>
</tr>
<tr>
<td>12</td>
<td>Person A wearing the device: can confirm the physical conditions of Person B wearing the device.</td>
<td>28</td>
<td>Person B wearing the device: receives impressions from the device.</td>
</tr>
<tr>
<td>13</td>
<td>Person A wearing the device: can know the state of mind of Person B wearing the device by analogy.</td>
<td>29</td>
<td>Person B wearing the device: can confirm his/her physical conditions of Person A wearing the device.</td>
</tr>
<tr>
<td>14</td>
<td>Person A wearing the device: receives the impressions of Person B wearing the device.</td>
<td>30</td>
<td>Person B wearing the device: can know the state of mind of Person A wearing the device by analogy.</td>
</tr>
<tr>
<td>15</td>
<td>Other people: can confirm the physical conditions of Person A wearing the device.</td>
<td>31</td>
<td>Person B wearing the device: receives impressions from the expressions of Person A wearing the device.</td>
</tr>
<tr>
<td>16</td>
<td>Other people: can know the state of mind of Person A wearing the device by analogy.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Methods
Methods

Evaluation of causal relationships

We had subjects evaluate the associations among the items.

The subjects:
Four students with knowledge of information design.

DATA AQUEITION

① the collection of samples

② the selection of items

③ the evaluation of causal relationships

④ analyze by the DEMATEL method

⑤ Discussion
Methods
We presented a matrix of the 31 items to the subjects, and asked them to evaluate each combination.

The evaluation criterion
the realization of ai is expected to realize aj. True ------ 1
False ------ 0
Methods

Using the matrix, the subjects evaluated each of the 14 works/products.

The subjects consulted with me, in doing the evaluations, since they were not accustomed to responding this type of survey and also in order to avoid inconsistency in their understanding of the items.
Results

DATA AQUETION

① the collection of samples

② the selection of items

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⑤ Discussion
Results

From a broader viewpoint, individual data were not analyzed.

A matrix was created for analysis by treating figures aggregated for each subject and each sample as the degrees of association.
# Results

**D**: degree of influence  

**R**: degree of being influenced  

**D + R**: The degree of Centrality. The items have relationships with other items  

**D – R**: The degree of Cause: the items have influence over other items

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Items</th>
<th>Degree of influence (D)</th>
<th>Degree of being influenced (R)</th>
<th>Centrality: D + R (X-axis)</th>
<th>Degree of cause: D – R (Y-axis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Person A wearing the device: behaves as</td>
<td>1.01</td>
<td>0.23</td>
<td>1.24</td>
<td>0.78</td>
</tr>
<tr>
<td>2</td>
<td>Person A wearing the device: Intends (to move something).</td>
<td>1.43</td>
<td>0.69</td>
<td>2.12</td>
<td>0.73</td>
</tr>
<tr>
<td>3</td>
<td>Person A wearing the device: tries to control his/her mood. (tries to calm himself/herself down).</td>
<td>1.11</td>
<td>0.75</td>
<td>1.86</td>
<td>0.36</td>
</tr>
<tr>
<td>4</td>
<td>Person A wearing the device: tries to control his/her physiological information (e.g., tries to generate alpha waves)</td>
<td>1.53</td>
<td>0.91</td>
<td>2.45</td>
<td>0.62</td>
</tr>
<tr>
<td>5</td>
<td>The physiological information (e.g., brain waves, heartbeats and electromyogram) of Person A wearing the device changes.</td>
<td>2.61</td>
<td>4.14</td>
<td>6.76</td>
<td>-1.53</td>
</tr>
<tr>
<td>6</td>
<td>The device: converts the meanings of the physiological information of Person A wearing the device into expressions for conveying the meanings (e.g., when the person is in a good mood, expressions are converted to happy ones, and the movements he or she thought are expressed).</td>
<td>1.94</td>
<td>2.23</td>
<td>4.17</td>
<td>-0.28</td>
</tr>
<tr>
<td>7</td>
<td>The device: converts the physiological information of Person A wearing the device into expressions that do not semantically correspond to the conditions of people (to beautiful colors or shapes).</td>
<td>1.81</td>
<td>2.26</td>
<td>4.07</td>
<td>-0.45</td>
</tr>
<tr>
<td>11</td>
<td>Person A wearing the device: receives impressions from his/her expressions.</td>
<td>1.84</td>
<td>1.31</td>
<td>3.16</td>
<td>0.53</td>
</tr>
<tr>
<td>17</td>
<td>Other people: receive impressions from the expressions of Person A wearing the device.</td>
<td>0.06</td>
<td>0.76</td>
<td>0.82</td>
<td>-0.69</td>
</tr>
</tbody>
</table>
Results

D: degree of influence
R: degree of being influenced
D + R: The degree of Centrality, the items have relationships with other items
D – R: The degree of Cause, the items have influence over other items

■ 5, 6, 7 and 11: High centrality

■ The degree of cause was not generally high in these items.

■ The degree of influence and the degree of being influenced were both high in these items.

The inter-item relationship is not one-way but mutual.
Results

- Items whose degree of influence over other items is 0.2 or greater.

- The horizontal axis: D + R

- The vertical axis: D – R

- Bold arrows: 0.3 ~

- Thin arrows: 0.2 ~ 0.3

- The item at the point of origin influences the item at the end point.

D: degree of influence
R: degree of being influenced
D + R: The degree of Centrality: the items have relationships with other items
D – R: The degree of Cause: the items have influence over other items
Results

“Loop A”: formed by [(5)-(6.7)-(11)-(5)]
“Loop B”: formed by [(5)-(6)-(9.10)-(5)]

A general interpretation of the two loops:

- Human physiological information
- Kansei information devices
- Then convert the changes to some kind of expressions
- Human physiological information
Results

“Loop A” : formed by [(5)-(6.7)-(11)-(5)]
“Loop B” : formed by [(5)-(6)-(9.10)-(5)]

Loop B is unique to item 6 among the functions of the devices.

- Item 6: “the meanings of physiological information are converted to expressions for conveying the meanings.”

- Items 9: “physical conditions can be confirmed”

- Item 10: “the state of mind can be known by analogy,”
Discussions and Summary

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Discussions and Summary

Based on evaluations by subjects with knowledge of information design, this study attempted to grasp, from a broader perspective, the structure of the kansei information devices we collected.

- formed a feedback loop
- the items mutually influenced each other.

The structure “brain waves change, which changes the images generated by the device, and brain waves are changed again by the device wearer’s looking at the images” was a typical example.

This may be the result of using the reentry of information, a characteristic of physiological information sensing.
Discussions and Summary

The type of loop differs by the function of the device used.

The samples used in this study were topical and attention-grabbing works and products found in online news sites and other media.

Therefore, the characteristics of the devices identified in this study may be the characteristics of “good” devices, although it is too early to conclude this since we did not have controls.

Then, we try to evaluate samples and investigate which structure is “good”.

Feedback loops may be a phenomenon that occurs when using physiological information, regardless of the intension of designers.

Future issues in the design of new kansei information devices would be to understand how such feedbacks occur and can be utilized.
Thank you very much.

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question in slowly english, please...
Definition

Kansei information device

The devices that use physiological information as a media that reflects kansei information.

physiological information

Brain waves, heart beats, measuring the blood flow in the brain, EMG,

Kansei information

reflect emotion, intuition, prefer, .....