

COMPARATIVE ANALYSIS OF USERS' KANSEI EVOLUTIONS DURING THE LIFECYCLE OF THEIR SHORT-LIVED AND LONG-LIVED PRODUCTS

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ABSTRACT

This research deals with the circumstances of subjective or psychological lifetime of products. Most scholar works concerning psychological lifetime of products have regarded user-product attachment as the only means being effective for extending the subjective lifetime of products. Aiming to find out the other possible effective means in this regard, here, we have conducted a comparative and analytical study on the evolution of users' *Kansei* toward a short-lived and long-lived product during the entire lifecycles of those two kinds of product. As *Kansei* embraces all subjective issues of product, this research is based on *Kansei* Engineering approach. In this research, the product lifecycle from user perspective is divided into three different stages including purchasing/choosing, keeping/using and replacing/throwing away the product. The assigned short-lived and long-lived products for investigation are respectively mobile phone and private passenger car. Two groups of subjects, as the user or owner of mobile phone or private passenger car, are investigated and the changes of their *Kansei* toward their mobile phones or cars are analyzed. The outcome of this analysis will be the *Kansei* factors associating with the investigated groups of subjects' rationale when purchasing, keeping/using and replacing their mobile phones or private passenger cars. Finally, the extracted patterns and trends of the *Kansei* evolution of those two groups regarding their mobile phones or cars during the lifecycle stages of those products are compared.

Keywords: Product, Psychological Lifetime, Kansei Changes, Mobile Phone, Car.

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1. INTRODUCTION

The key challenge of “subjective environmental aspects of products and processes” has been discussed in design research since the last decade [1]. The given importance to the subjective issues of sustainability within the design researches is increasing theoretically and empirically. The topic of enhancing sustainability through human-factors design is also receiving growing attention, as the current studies of affective engineering systems, tools and methods, aimed generally at the more effective design of appealing products, would be relevant to design for sustainability [2]. Practically, the main focus of design researches concerning the subjective issues of sustainability is on ‘lifetime optimization of products’ [3]. On the basis of the results of analysis of the factors influencing the users’ decision for product replacement, Nes and Cramer propose five design strategies for product longevity including: design for reliability and robustness; design for repair and maintenance; design for upgradeability; design for product attachment and design for variability. They emphasize that “the main challenge in design for longevity lies in achieving an enduring satisfaction with the product, rather than only meeting the momentary desires of today” [4].

‘Product attachment’ simply is defined as “the emotional bond experienced with a product” [5]. Many design researchers argue that extending the psychological life span of durables as well as increasing the degree of consumer-product attachment could be instrumental to reduce the demand for scarce resources and the rate of solid waste disposal and may contribute to a more sustainable society; because a stronger emotional bond between a consumer and his/her product will decrease the consumer’s tendency to dispose it and hence may result in a decrease of unnecessary waste and in a decreased use of limited resources of energy and materials [5,6,7,8]. The strategy to enhance product attachment is however the most uncertain in actually enhancing longevity. As this strategy is based on the fact that the disposal of products is made harder when one feels attached to the product, it brings so many questionable points and challenges implying that it should be well considered and applied delicately [4]. Furthermore, it seems that product attachment is just one of the means for extending the psychological lifetime of products or optimizing product lifetime subjectively (ie affectively, emotionally and/or aesthetically). A product, even a very personal one like mobile phone device, may be emotionally pleasurable, aesthetically appealing and/or functionally comfortable during its expected short/long lifespan while there may not be any strong user-product-attachment. Moreover, durability of users’ satisfaction and emotional pleasure regarding a product and its appeal may be eventuated to attachment but not necessarily. Thus, user-product-attachment may be just a part of the product subjective issues including the user’s total attitude, feeling, affection, emotion and/or appreciation, which could be called *Kansei* about a product. Therefore, there is seemingly a room for an open concept or wide expression to comprehensively encompass the product subjective issues influencing product psychological lifetime and pleasurable longevity, for instance ‘product subjective sustainability’.

2. OUTLINE AND METHOD

To cover all subjective issues, the survey and analysis in this research would be based on *Kansei* Engineering approach [9]. Here, the entire lifecycle of product from user perspective is divided into three main stages including: Purchase (P); Keep/Use (KU); and end, throw away or Replace (R). The designated short-lived product type for this analytical study is mobile phone, since its subjective issues are more considerable than the other kinds of product due to the users’ very close/personal relation with it despite being a short-life product [10,11]. Furthermore, user’s

emotional attachment to mobile phone – rather than the other kinds of product – is reflected in numerous scholarly works [12,13,14,15]. But as an approximately long-lived product type, the private passenger car is designated. There is an especial relation between a user and his/her private passenger car registering his/her individual character and social class. Nevertheless, these two designated product types (mobile phone and car) completely vary when considering their scales beside user and their functional natures.

Aiming at finding out and classifying two groups of subjects' responded *Kansei* descriptive words regarding each lifecycle stage of their mobile phones or private cars and thereupon extracting the various patterns of the subjects' *Kansei* evolutions during the lifecycle of those two product types, this analytical study has been accomplished within three main steps. In the first step, survey, two groups of subjects (as user of mobile phone or owner of passenger car) are investigated through the definite and extensive-descriptive questionnaire. The second step is the process and analysis of the data derived from the questionnaires by using KJ Method, Quantification Theory Type III (QT3) and Cluster Analysis. Last, the results of analysis are interpreted and compared in the third step.

The first group of subjects, as the users of mobile phone, includes 19 Japanese students of Chiba University ranging from 21 to 24 years. The second group of subjects includes 18 private car owners, 7 professors of Chiba University and 11 students' parents, ranging from 40 to 60 years. Those two groups are investigated about their feeling, emotion or *Kansei* regarding their mobile phones or passenger cars in each of the three lifecycle stages of P, KU and R separately within three different questions. The *Kansei* descriptive words responded by the subjects are summarized by using KJ Method through a discussion meeting held by the authors. To identify the *Kansei* items' grouping and also the subjects' grouping on the basis of their *Kansei* regarding their mobile phones in the three lifecycle stages, the method of Cluster Analysis is used. The various patterns of the subjects' *Kansei* evolution are also extracted from their groupings when considering the lifecycle stages.

3. RESULTS

3.1. Investigation of Users of Mobile Phone

3.1.1. Derived *Kansei* Items Groupings

The subjects have totally responded 349 different Japanese keywords for their *Kansei*, emotion or feeling about their mobile phone in its different lifecycle stages; 56 ones for R stage, 153 ones for P stage and 140 ones for KU stage. All these 349 keywords are summarized into 43 *Kansei* items or descriptive words through KJ Method. The subjects' responded *Kansei* keywords regarding all three lifecycle stages are adapted to these 43 *Kansei* items and processed by using QT3. The overall output distribution of the 43 *Kansei* items in the lifecycle stages of mobile phone is shown into two graphs (X-Y and X-Z) in Figure 1. Using the resulted X, Y and Z dimensions, the chosen cut-off for the clustering algorithm has yielded seven clusters marked from *C.1* to *C.7* in the X-Y graph and four clusters marked from *C.1* to *C.4* in the X-Z one. This choice of cut-off is carefully made in order to arrive at the most meaningful groupings for understanding of the relationship between various *Kansei* items. The items belonging to each cluster of those two graphs are introduced respectively in Tables 1 and 2. To illustrate the lifecycle stage (P, KU or R) each item associates with rather than the other stages, the different point shapes and colors are used in the graphs. This suggested association is decided in the basis of the frequencies of each item in the lifecycle stages. The directions of the three axis of X, Y and Z are respectively named

as 'Active Emotion-Passive Affection', 'Emotional-Rational' and 'Edgily/Affected-Lively/Pleased'. The highlighted clusters (C.1 to C.7) in the X-Y graph can be characterized respectively as Fond, Attached, Ally (or Partner), Fresh-feel, Valid, Joy, and Bother. Similarly, the ones of the X-Z graph (C.1 to C.4) can be characterized respectively as Attached, Joy/Fresh, Ally and Concerns. These given names are based on the context and distribution of the items in the graphs. As the graphs show, the items having more association with the lifecycle stage of P or R are located respectively in the left or right sides.

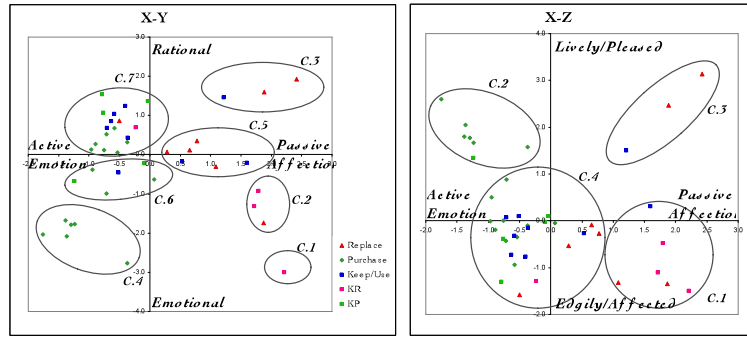


Figure 1: Distribution graphs (X-Y and X-Z) and groupings of the *Kansei* items of Mobile Phone

Table 1: The *Kansei* items belonging to each cluster in the graph X-Y of Mobile Phone (Fig. 1)

C.1	C.2	C.5	C.4	C.5	C.6	C.7	
Idol Lovely	Attachment Familiarity Nostalgic	Appreciation Partner Tattered	Cheap Discovery Excite Power Impress Refresh Surprise	Accustom Cherished Important Longevity Lost Regret-Waste	Curiosity Desire Easy Good-look Pleasure Toy	Anger Anxiety Boring Complain Complication Dislike Dreary Flaw Functional	GUI Novelty Old Style Puzzled Reasonable Superfluous Temporary Uniqueness

Table 2: The *Kansei* items belonging to each cluster in the graph X-Z of Mobile Phone (Fig. 1)

C.1	C.2	C.3	C.4		
Attachment Cherished Familiarity Idol Lost Lovely Nostalgic	Cheap Discovery Excite Power Impress Refresh Surprise Toy	Appreciation Partner Tattered	Accustom Anger Anxiety Boring Complain Complication Curiosity Desire Dislike	Dreary Easy Flaw Functional Good-look GUI Important Longevity Novelty	Old Style Pleasure Puzzled Reasonable Regret-Waste Superfluous Temporary Uniqueness

3.1.2. Subjects' *Kansei* Evolution during their Mobile Phones Lifecycle

This part of the analysis is to delineate the changes of the subjects' *Kansei* toward their mobile phone during its P, KU and R lifecycle stages. The resulted graphs of distribution of the subjects in X-Y and X-Z axis are shown in Figure 2. These distribution graphs and the ones of *Kansei* items grouping (shown before in Figure 1) are built on the basis of the "sample score" and "category score" of the same output of QT3 analysis on the same input data, and hence can be overlapped. The same names are therefore given to the directions of X, Y and Z axis in both sets of distribution graphs. The purposely chosen cut-off lines for clustering within the resulted X-Y and X-Z dimensions have yielded respectively five clusters marked from A to E and four clusters marked from F to I in the graphs. According to the items responded by majority of subjects

belonging to each cluster, the highlighted clusters (*A* to *E*) in the X-Y graph can be characterized respectively as Bother, Valid, Joy/Fresh, Ally, and Attached. Similarly, the ones of the X-Z graph (*F* to *I*) can be characterized respectively as Concerns, Joy/Fresh, Attached and Ally.

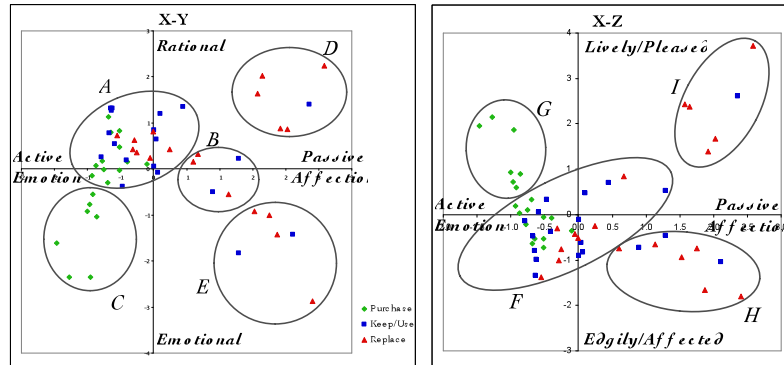


Figure 2: Distribution graphs (X-Y and X-Z) and groupings of the subjects using Mobile Phone

Table 3: Clusters to which a subject belongs in each lifecycle stage of his/her Mobile Phone

	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈	S ₉	S ₁₀	S ₁₁	S ₁₂	S ₁₃	S ₁₄	S ₁₅	S ₁₆	S ₁₇	S ₁₈	S ₁₉
P	CG	CG	AF	CG	CG	CG	AF	AF	AF	CG	AF	AF	CG	AF	AF	AF	AF	AF	AF
KU	EH	AF	AF	BH	AF	EH	AF	AF	AF	AF	AF	DI	AF	AF	AF	AF	AF	BF	AF
R	EH	AF	BH	DI	DI	EH	AF	AF	EH	DI	AF	DI	AF	EH	AF	DI	AF	BH	BF

These graphs (Figure 2) show the evolution of the subjects' *Kansei* statuses during the entire lifecycle of their mobile phones. Each point represents a subject's *Kansei* status in each of the three lifecycle stages, which are discernible by three different colors and shapes in the graphs. The subjects' *Kansei* statuses in P stage are almost located in the left side of the graphs. To extract the various patterns of subjects' *Kansei* evolution, the clusters, in which each subject (S_i) is laid during each stage (P, KU or R), are listed in Table 3. The resulted clusters (Figure 2) indicate each subject's *Kansei* statuses in the three lifecycle stages of his/her mobile phone. Considering the changes of the subjects' *Kansei* statuses in the three lifecycle stages, the subjects can be set into various types.

3.2. Investigation of Owners of Private Passenger Car

3.2.1. Derived *Kansei* Items Groupings

The subjects have totally responded 430 Japanese keywords for their *Kansei*, emotion or feeling about their passenger car in its different lifecycle stages; 132 ones for R stage, 135 ones for P stage; and 163 ones for KU stage. These 430 keywords are summarized into 47 *Kansei* items or descriptive words through KJ Method. The subjects' responded *Kansei* keywords regarding all three lifecycle stages are adapted to these 47 *Kansei* items and processed by using QT3. The overall output distribution of the 47 *Kansei* items in the lifecycle stages of private passenger car is shown into two graphs (X-Y and X-Z) in Figure 3. The purposely chosen cut-off for the clustering algorithm has yielded seven clusters marked from C.1 to C.7 in each graph. The items belonging to each cluster of those two graphs are introduced respectively in Tables 4 and 5. The directions of the three axis of X, Y and Z are respectively named as 'Active Emotion-Passive Affection', 'Satisfaction-Dissatisfaction' and 'Rational/Dissociate-Emotional/Associate'. The highlighted clusters (C.1 to C.7) in the X-Y graph can be characterized respectively as Lively

Pleased, Lonely Grateful, Valid Object, Attached, Foreign, Displeasing and Trouble. The ones of the X-Z graph (C.1 to C.7) can also be characterized respectively as Attached, Affected, Valid, Practical Relation, Concerned, Joy/Fresh and Sorrowful Parting. These given names are based on the context and distribution of the items in the graphs. As the graphs show, the items having more association with the lifecycle stage of P or R are located respectively in the left or right sides.

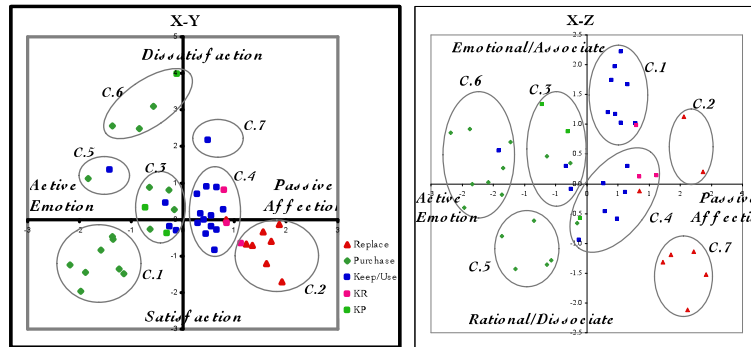


Figure 3: Distribution graphs (X-Y and X-Z) and groupings of the *Kansei* items of private Car

Table 4: The *Kansei* items belonging to each cluster in the graph X-Y of private Car (Fig. 3)

C.1	C.2	C.3	C.4	C.5	C.6	C.7
Curiosity	Appreciate	Beauty/Interest	Accustomed	No-accustomed	Anxiety	Trouble
Enjoyed	Indebted	Comfort	Apology/Shy	Strange/Odd	Fastidious	
Exaltation	Lost	Func-Features	Attachment		Pout	
Excited	Nostalgic	Habitual	Communicating		Uncomforted	
Freshness	Painful	Important	Defect/Flaw			
Happy	Poor	Individuality	Family/Relation			
Novelty	Regret	Positive	Longevity			
Satisfied	Wasteful	Solidarity	Memories			
		Strong-feel	No-unpleasant			
			Old			
			Partner			
			Pet			
			Repair			
			Tattered			
			Utility			

Table 5: The *Kansei* items belonging to each cluster in the graph X-Z of private Car (Fig. 3)

C.1	C.2	C.3	C.4	C.5	C.6	C.7
Attachment	Nostalgic	Individuality	Apology/Shy	Uncomforted	Exaltation	Regret
Repair	Indebted	Important	Tattered	Func-Features	Freshness	Appreciate
No-unpleasant		Beauty/Interest	Memories	Satisfied	Excited	Lost
Accustomed		Habitual	Defect/Flaw	Anxiety	Strange/Odd	Painful
Old		Solidarity	Poor	Fastidious	Enjoyed	Too good
Family/Relation		Strong-feel	Positive		Happy	
Communicating			Pout		No-accustomed	
Partner			Comfort-ability		Novelty	
Pet			Utility		Curiosity	
			Trouble			
			Longevity			

3.2.2. Subjects *Kansei* Evolution during their Cars Lifecycle

The resulted graphs of distribution of the subjects in X-Y and X-Z axis are shown in Figure 4. As these distribution graphs and the ones of *Kansei* items grouping (shown before in Figure 3) can be overlapped, the same names are given to the directions of X, Y and Z axis in both sets of

distribution graphs. The purposely chosen cut-off lines for clustering within the resulted X-Y and X-Z dimensions have yielded respectively six clusters marked from *A* to *F* and five clusters marked from *G* to *K* in the graphs. According to the items responded by majority of subjects belonging to each cluster, the highlighted clusters (*A* to *F*) in the X-Y graph can be characterized respectively as Attached, Lonely Grateful, Lively Satisfied, Pleasant Valid, Displeased and Concerned. Similarly, the ones of the X-Z graph (*G* to *K*) can be characterized respectively as Appreciated Utility, Satisfying Utility, Lively Valid, Affective Relation (Attachment) and Sorrowful Parting/Appreciation.

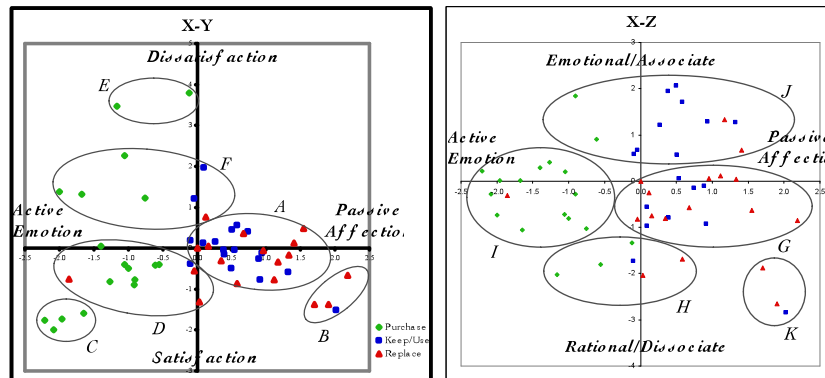


Figure 4: Distribution graphs (X-Y and X-Z) and groupings of the subjects using Car

Table 6: Clusters to which a subject belongs in each lifecycle stage of his/her private Car

	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
P	DI	CI	DJ	DI	FI	DI	DI	CI	DJ	DI	FI	EH	DH	FI	FI	CI	EH	CI
KU	FJ	AJ	AJ	AG	AG	AJ	AJ	BK	AJ	AJ	AJ	DH	AG	AG	AG	AJ	FG	AG
R	AG	BK	AG	FG	AG	AJ	AG	BK	AG	AG	AG	DH	AG	DI	DG	AJ	AH	BG

4. INTERPRETATION

According to the distributions graphs of both groups of subjects and the clusters they belong in three lifecycle stages of their mobile phones (Fig. 2 and Table 3) or private cars (Fig. 4 and Table 6), the subjects' *Kansei* evaluations relevant to mobile phone and car are simply visualized into two models respectively shown in Figures 5 and 6. Each colored line between the clusters in the models represents a subject. The patterns of various types of *Kansei* evaluations are extracted and shown in the right sides of each model. In both models the stage of P associates with *Active Emotion* whereas the stage of R associates with *Passive Affection*. It should be mentioned that the subjects' *Kansei* in the stage of R is indeed about their last mobile phones or cars, which are replaced, and is chronologically happened before P and KU stages. However, the derived models depict the probable trends of evolution of user's *Kansei* toward a mobile phone or car during its lifecycle.

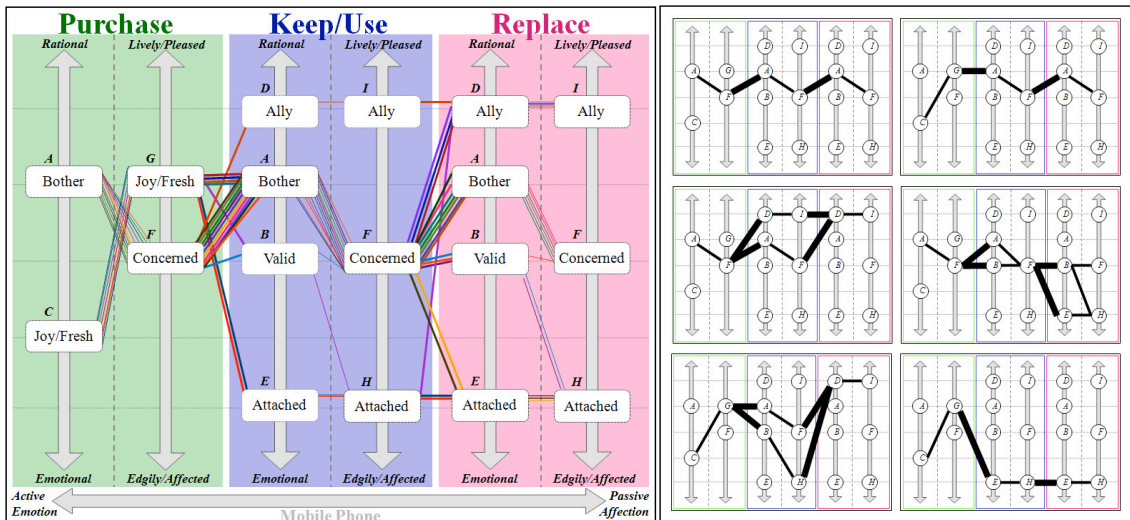


Figure 5: Various types of subjects' *Kansei* evolution during lifecycle of their Mobile Phone

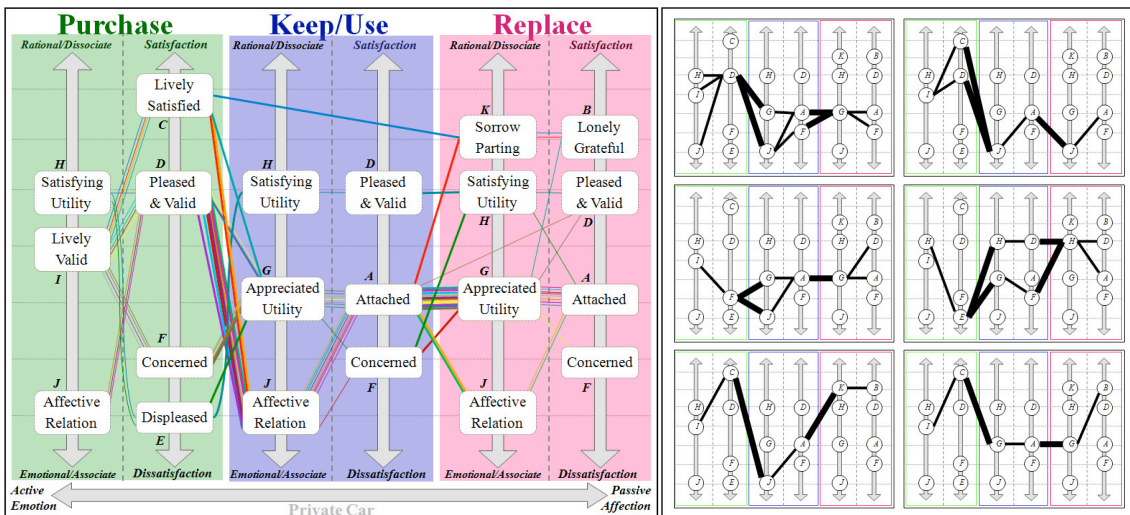


Figure 6: Model and various types of subjects' *Kansei* evolution during lifecycle of their Car

Regarding the model relevant to mobile phone (Fig. 5), six major patterns of *Kansei* evaluations are extracted. All these six types may start from the *Kansei* status of Joy/Fresh or Bother-Concerned in the stage of P and eventuate in the *Kansei* status of Ally, Bother/Valid-Concerned or Attached within the R stage. The status of Ally tending to *Rational-Lively/Pleased* direction indicates the subjects' satisfyingly appreciation because of a good partnership and pleasant utility of their mobile phones. The status of Attached tending to *Emotional-Edgily/Affected* direction indicates the subjects' close relation, interest and affective attachment to their mobile phones. And the status of Valid being positioned in the borderline somehow indicates the subjects' ecological concerns and environmental awareness while they are prizing their mobile phone and caring its longevity.

According to the reversely similarity between the given names or indications of the directions of X-Z and X-Y axis of the distribution graphs of the subjects in lifecycle of car (Fig. 4) and the directions of X-Y and X-Z ones of mobile phone (Fig. 2), the model relevant to car (Fig. 6) is

adapted to be more easily comparable with the model relevant to Mobile Phone. It looks more complicated than the one of mobile phone. Six various patterns of the subjects' *Kansei* evaluations are also extracted. The subjects' *Kansei* status in the stage of P regarding the axis direction of *Satisfaction-Dissatisfaction* may mostly be Concerned, Pleased/Valid or Lively Satisfied. But regarding the axis direction of *Rational/Dissociate-Emotional/Associate*, though their status in this stage is mostly Lively Pleased, few of them may be in the status of Affective Relation or Satisfying Utility. In the stages of KU and R most subjects' status is 'Attached' while they may be in the status of Affective Relation or Appreciated Utility at the same time. However, few subjects' status in the stage of R may be Pleased/Valid (concerning Utility) or 'Lonely Grateful-Sorrow Parting'.

5. CONCLUSION

Comparing the models of the subjects' *Kansei* evaluations during the lifecycle of their mobile phone and private car, in both cases the beginning of use generally brings Active Emotion whereas the end of use associates with Passive Affection. The subjects' *Kansei* evaluation in terms of using private passenger car as a long-lived product is more complicated than the one of mobile phone as a short-lived product.

In mobile phone the subjects' eventual *Kansei* status has three different trends characterized as Ally, Attached and Valid. The first one is the issue of user's good partnership relation with and pleasant utility of mobile phone. The second one is the issue of users' close affective relation with and attachment to their mobile phones. The third one is the issue of user's prizing his/her mobile phone as a valuable and still useful object deserving to be kept for a longer time. These trends imply that there are at least two other effective means for extending the psychological lifetime of such a short-lived product than just product attachment such as: facilitating a good partnership through software/hardware solutions; and functional or software upgradeability with durable hardware and durable aesthetics.

Regarding private passenger car as a long-lived product, overall, the subjects' *Kansei* status in all lifecycle stages of the product has three main trends: concerns, satisfaction or appreciation about utility; emotionally pleasure, satisfaction or sorrow/displeasure; and affective relation/attachment. However, in such a long-lived product it seems that almost in all types of subjects' *Kansei* evaluation there is a level of attachment. Similarly, those levels of attachment can be identified with the following three main causal trends: emotional pleasure; utility (function/operation) satisfaction; and affective relation. Among these three causal trends affective relation is the strongest user-product attachment which may more effectively contribute to the postponement of product replacement. Nevertheless, depending on the type of users' *Kansei* evaluation, different means or design solutions – such as durability, upgradeability, repair-ability, aesthetic durability and service – can be used for extending the subjective lifetime of such a long-lived product.

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