

Analysis of Subjective Values of Car Users in Japan and U.S. Using Free Description Keyword Method

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ABSTRACT

In order to investigate “Customers’ Joy,” one of Honda’s philosophies, a survey was conducted in Japan and the United States to collect keywords concerning the attractiveness and value of automobiles. The collected data was visualized as clusters of keywords by using the singular value decomposition method on discrete data, which is a quantification type III of statistical analysis. Then, through semantic interpretation of the keywords belonging to these clusters, the concept structure of the attractiveness and value of automobiles perceived by automobile users was clarified. As a result, it was noticed that both Japanese and U.S. users share common values on economy and fuel efficiency, while Japan users value handling and safety and U.S. users value reliability, asset values, loading capacity, and comfort. In addition, the differences of value by age and value preferences by gender were also visualized by analyzing user attribute data collected in the survey. The differences in brand recognition between Honda and Acura were also explained by the differences in value concepts of reliability, asset values, and premium values.

1. Introduction

The founder of Honda once said, “Our research center is about our customer’s mind, not about technology.” This means that pursuing our customers’ values takes priority when creating our products. The enthusiasm of our founder has been inherited as our corporate philosophy of pursuing our “Customers’ Joy”^{(1), (2)}.

In order to investigate automotive user’s value concepts, the most commonly used method is user questionnaires. However, in subjective surveys such as user questionnaires, it often happens that the bias of the questioner contaminates the questions and can have unignorable effects on the objectivity of the research results^{(3), (4)}. So a new objective research method, different from ordinary questionnaires, has been needed to investigate the attractiveness and value of automobiles. Furthermore, the attractiveness and value that automotive users expect in their automobiles might vary depending on the country, its culture, and its development level. So a suitable analytical method that can express and clarify these diverse values using objective data is also needed.

In recent years, AI technology has evolved remarkably, and the techniques used to extract fundamental factors from large amounts of non-quantitative data by combining natural language analysis techniques and quantification type III method^{(5), (6)} have advanced greatly. In this technique, discrete data such as keywords and/or figures are quantified using frequency of appearance and other items, and fundamental factors of the data are identified by a singular value decomposition to understand the essence of the target data.

Therefore in this research, first, we collected linguistic data regarding the attractiveness and value of automobiles using a free-keyword description method so that the bias of the questioners was not mixed in. At the same time, the strength of connection between the keywords was also quantified by accompanying questions.

By applying quantification method III on the collected keyword and relevance data, the keywords that represent the attractiveness and the value of automobiles were clustered. Then the semantic interpretation of the keywords in the clusters was used to examine the structure of the subjective values of automotive users.

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2. Method

2.1. Survey Method

A web questionnaire survey was conducted in 2017, and responses from 5,000 automobile users in Japan and the United States, which are Honda's major markets, were collected. The survey participants answered the questions through a questionnaire site on the Internet. The survey sampling was adjusted so that the users' demographics and male/female ratio were close to those of Japan and the United States.

First, the participants answered the name of the car that they currently use most, and what car they would choose if they were to buy another car. For another car, both the car name and car category name were accepted as answers. Next, the participants listed four words about why they chose that car or the points they preferred, and then listed six words about what points they would value when choosing their next car. Then the 12 keywords they listed in the previous steps were displayed in a paired comparison and the relevance between the keywords was shown for four levels: strong, slightly related, weakly related, and almost irrelevant. In addition to the above questions, attributes of participants such as age, gender, annual income, and so on were collected, with privacy protection taken into consideration. The number of electric vehicle (EV) users is increasing, so these were also included in our survey as proportionally as possible to market share in order to investigate the attractiveness and values of EV.

2.2. Analysis Method

The collected data was analyzed in Japan and the United States, respectively.

As shown in Fig. 1, the matrices that represent the relevance between collected keywords were integrated from

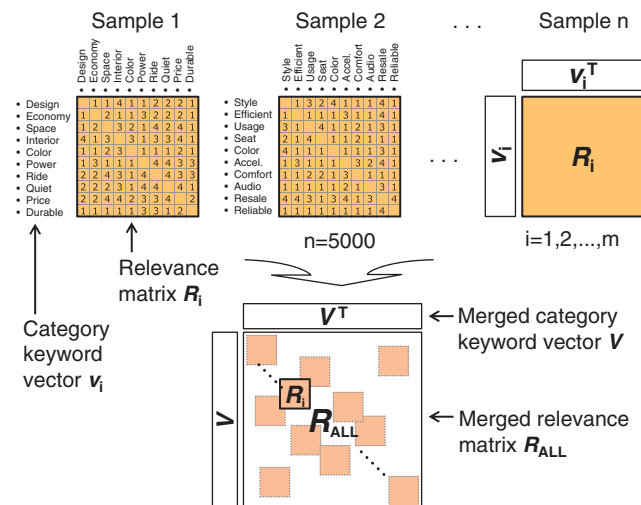


Fig. 1 Schematic image of creation of keywords and their relevance matrix from 5,000 samples

5,000 samples into a single comprehensive matrix and then analyzed. In the integration, we extracted frequent keywords using a certain threshold in which enough keywords for investigation could be included. Minor keywords only used by certain participants or keywords considered uncommon were removed as outliers. As a result, 410 words in the Japanese version and 475 words in the U.S. version were extracted for the analysis.

The top ten keywords in the Japanese version were fuel economy, design, color, price, safety, ease of driving, K-class cars, ride comfort, interior quality, and safe. In the U.S. version, they were price, color, safety, comfort, style, reliability, size, gas mileage, quality, and design.

In multivariate analysis, some methods use objective variables such as regression analysis, and some do not. The quantification method III belongs to the latter and can deal with category data, such as keyword data we are to deal with, as explanatory variables.

This method, also called correspondence analysis, extends the method of principal component analysis to category data, extracts latent variables from a vast number of explanatory variables, and can rearrange keywords into an x-y plot using the latent variables⁽⁷⁾. To find the latent variables, the correlation between the row and column components of the matrix were maximized. By repeating this mathematical operation, it becomes possible to plot each keyword with two independent essential factors as axes (Fig. 2).

The resulting keyword plot is the polar plot shown in Fig. 3, which can be interpreted using the following three indices.

- (1) Smallness of the polar angle: high relevance between keywords
- (2) Distance from the pole: high independence of keywords
- (3) Plot size: keyword appearance frequency

By plotting keywords on two axes, it became possible to interpret keywords without the clutter of complicated lines such as dendrograms, which are used in cluster analysis.

In order to interpret the mapped keywords, we presumed several keyword clusters along each polar coordinate angles.

Analysts interpreted the keywords contained in the

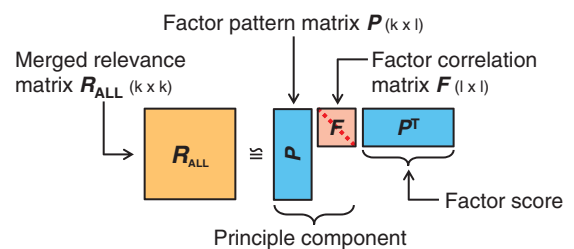


Fig. 2 Schematic image of quantification type III method and singular value decomposition on relevance matrix

clusters, and clarified the structure of the value that automobile users feel in their cars. Comparison of the analysis results from Japan and the United States and discussion regarding a few user attributes were conducted based on cluster interpretations.

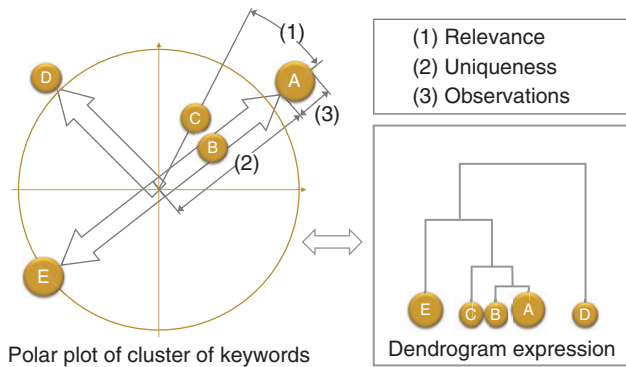


Fig. 3 Polar plot of cluster of keywords

3. Cluster Analysis

3.1. Japan

The plot of keywords regarding the attractiveness and value of automobiles answered by Japanese car users is shown in Fig. 4.

In the figure, the keyword “autonomous driving” is plotted in the upper left of the plot, “low maintenance cost” in the lower left and “color” in the lower right in each direction from the pole and at a distance. This means that these keywords are less related to each other and are being acknowledged by users as independent attractiveness or values.

The keywords aligned in the same direction of the above-mentioned keywords are those with related attractiveness or value, and so form each distinctive cluster. The keywords plotted outside at a distance from the pole represent unique attractiveness or value, and the keywords inside nearer the pole represent more general ones, as they are relevant to other keywords.

In addition, keywords with large plots such as “fuel economy”, “design”, “price”, “color”, and “safety” are the keywords frequently quoted by many users and are regarded

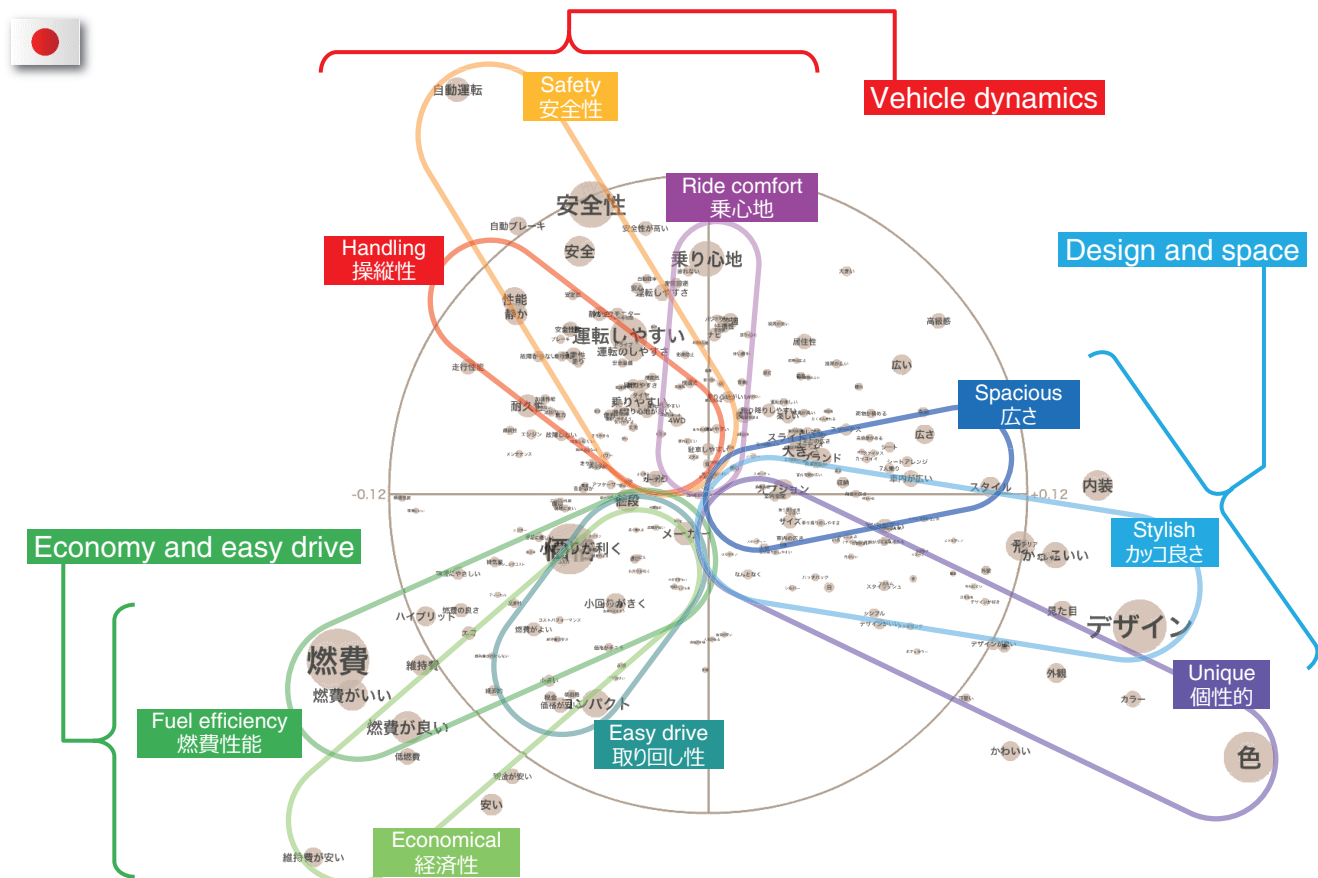


Fig. 4 Comprehensive polar plot of keywords of car values from Japanese car users

as widely supported values.

By interpreting the keywords in the clusters plotted in the polar plot in this way, it will be possible to look into the concept of the attractiveness or value of automobiles.

Now let's focus on the large cluster of keywords in the upper left direction in Fig. 4 to start the analysis.

First, in the upper left and most outside of the figure, the keyword "autonomous driving" is plotted. It is the keyword representing attractiveness or value of the cluster to which it belongs. Since keywords such as "autonomous braking", "safety", "safe", and "back monitor" are aligned in the same polar angle of the plot, this keyword cluster could be semantically interpreted as a concept of "safety" that users perceive from automobiles.

In the left of the "safety" cluster, keywords such as "performance", "quiet", "driving performance", "easy to drive", "easy to ride" are aligned at a slightly different angle. These keywords are thought to be attractiveness or value users feel when driving their cars, so we regarded it is appropriate to name the cluster as a "handling" cluster.

On the right side of the "safety" cluster, there are keywords such as "ride comfort", "do not get tired", "comfortable", "comfort", and "navigation". So this cluster could be named a "ride comfort" cluster.

To summarize the above interpretations, the large keyword cluster in the upper left consists of "safety", "handling", and "ride comfort" value concepts, and it can be said to form a conceptual structure that can be called "Vehicle dynamics".

By the way, if you look closely at this "Vehicle dynamics" cluster, keywords with almost the same meaning are plotted in close relation, such as "easy driving", "easy to drive", and "easy drive" or "safety", "safe", and "high safety". This indicates that the proposed method can classify keywords with the same meaning into almost the same position on the plot. Vice versa, the range where those keywords with similar meaning plotted into roughly represents the resolution of this method. Keywords related to "easy drive" were plotted near the center of the plot. These keywords are thought to be related more to other keywords than to safety-related ones.

Next, let's focus on keywords in the lower left part of the figure. Keywords such as "fuel economy", "good fuel economy", and "fuel efficiency" are prominent, and "hybrid" and "environmentally friendly" are also in the same cluster. Therefore it can be said that this keyword cluster is generally regarded by ordinary users as "fuel efficiency" performance.

Below the cluster of "fuel efficiency" performance, we find the keywords "low maintenance cost", "low cost", "low tax", and "maintenance cost". Near the center of the plot, "price" and "cost" are also plotted in a large circle. This cluster with these keywords, therefore, can be regarded as the concept of "economical", excluding fuel efficiency.

Keywords such as "compact", "small turning circle", and "zippy" exist in the same lower left area near the

"economical" cluster, so this cluster can be interpreted as "easy drive" performance, as we usually call it.

In summary, the large keyword cluster in the lower left is a group of concepts such as "fuel efficiency", "economical", and "easy drive", and it can be analyzed as a cluster that represents the value concept of "Economy and easy drive".

Third, we would like to focus on the right side of Fig. 4. The keyword "color" is plotted on the outmost side, and in the same direction, there are the keywords "color", "appearance", and "cute". This cluster can be interpreted as the "unique" value concept. Above the "unique" cluster are keywords such as "design", "appearance", "coolness", and "shape", and they represent the attractiveness felt by users about a good shape. So, this cluster was interpreted as the concept of "stylish".

Keywords that are distributed slightly inside such as "size", "wide interior", "wide cabin space", and "seat arrangement" seem to represent the value of the interior space that is relevant to the external shape. So we named this concept "spacious". This "spacious" cluster can be explained as being distributed more inside the plot due to its relevance to other attractiveness or values.

We summarize that the large keyword cluster existing on the right side of the plot forms a cluster representing "unique", "stylish", and "spacious", and that the whole concept can be called "Design and space".

The analysis result of the survey in Japan is summarized as follows. Japanese automobile users have three major concepts regarding attractiveness or value for automobiles. Each concept has its own conceptual structure, consisting of more detailed value concepts loosely combined with each other.

- (1) "Vehicle dynamics" is a value concept composed of individual values of "safety", "handling", and "ride comfort"
- (2) "Economy and easy drive" is a value concept composed of "fuel efficiency", "economical", and "easy drive"
- (3) "Design and space" is a value concept composed of "unique", "stylish", and "spacious"

3.2. U.S.

The plot of keywords provided by U.S. automobile users was analyzed in the same way as in Japan. The resultant plot is shown in Fig. 5.

The prominent keywords plotted at a distance from the polar were "color" in the upper right, "gas mileage" on the left side, and "roomy" in the lower right.

First, in the same direction as the keyword "color" in the upper right of Fig. 5, there are the actual names of colors, such as "red", "blue", and "white" as well as "attractive", "stylish", "sporty", "pretty", "sexy", "luxury", "beautiful", and "cool". These are the keywords the users provided when they were impressed and/or amazed. So this keyword cluster could be semantically interpreted as the concept of the exclusiveness of automobiles, and we called it the

“premium” cluster.

The keyword cluster under this “premium” cluster, including “looks”, “look”, “appearance”, and “exterior” could be interpreted as a cluster expressing beauty of form, so we named it “beauty”.

Further below the “premium” and the “beauty” clusters, keywords like “style”, “styling”, “design”, and “sleek”, as well as “sunroof”, “leather”, “leather seats”, and “heated seats” are aligned. This cluster includes keywords for a variety of optional equipment. The semantic interpretation of this cluster was concluded to be “customizability”.

To summarize, the clusters in the upper right of the plot consist of the three major concepts of “premium”, “beauty”, and “customizability”, so the whole value concept can be regarded as a “Style and design” cluster.

Second, we will look at the left side of Fig. 5. The most prominent keyword, “gas mileage”, is found on the farthest left side of the plot, and keywords such as “good gas mileage”, “fuel efficiency”, “fuel economy”, and so on are listed in the same direction as “gas mileage”. This cluster is the same concept of “fuel efficiency” performance that we have already seen in the Japanese version.

Under the cluster of fuel efficiency, keywords such as “economical”, “gas”, “fuel”, “hybrid”, “affordable”, “cost”,

and “good price” are observed, and they form the same cluster representing the concept of “economical” as in the Japan version. The keyword “environmental” is also found to the lower right of “hybrid” and is regarded as belonging to this “economical” cluster.

If we look into under the “economical” cluster, keywords such as “practical”, “towing”, and “ease of use” are found. The concept implied by these keywords can be interpreted as the application value of automobiles, so we analyzed this cluster as the concept “practical”.

Above the cluster of fuel efficiency, we find such keywords as “reliability”, “dependable”, “durability”, and “maintenance”. These keywords are thought to represent the “reliability” of hardware, and were rarely observed in the Japan survey. Furthermore, there is a cluster that includes the keywords “reliable”, “warranty”, and “resale value”, and these keywords are understood to be the concept of maintaining the “asset value” of automobiles. These concepts, “reliability” and “asset value”, are clusters of value concept that are characteristic to the U.S., as the frequency of these keywords is very high.

Summarizing the above analysis, the group of concepts on the left side of Fig. 5 consists of value concepts such as “fuel efficiency”, “economical”, “practical”, “reliability”,

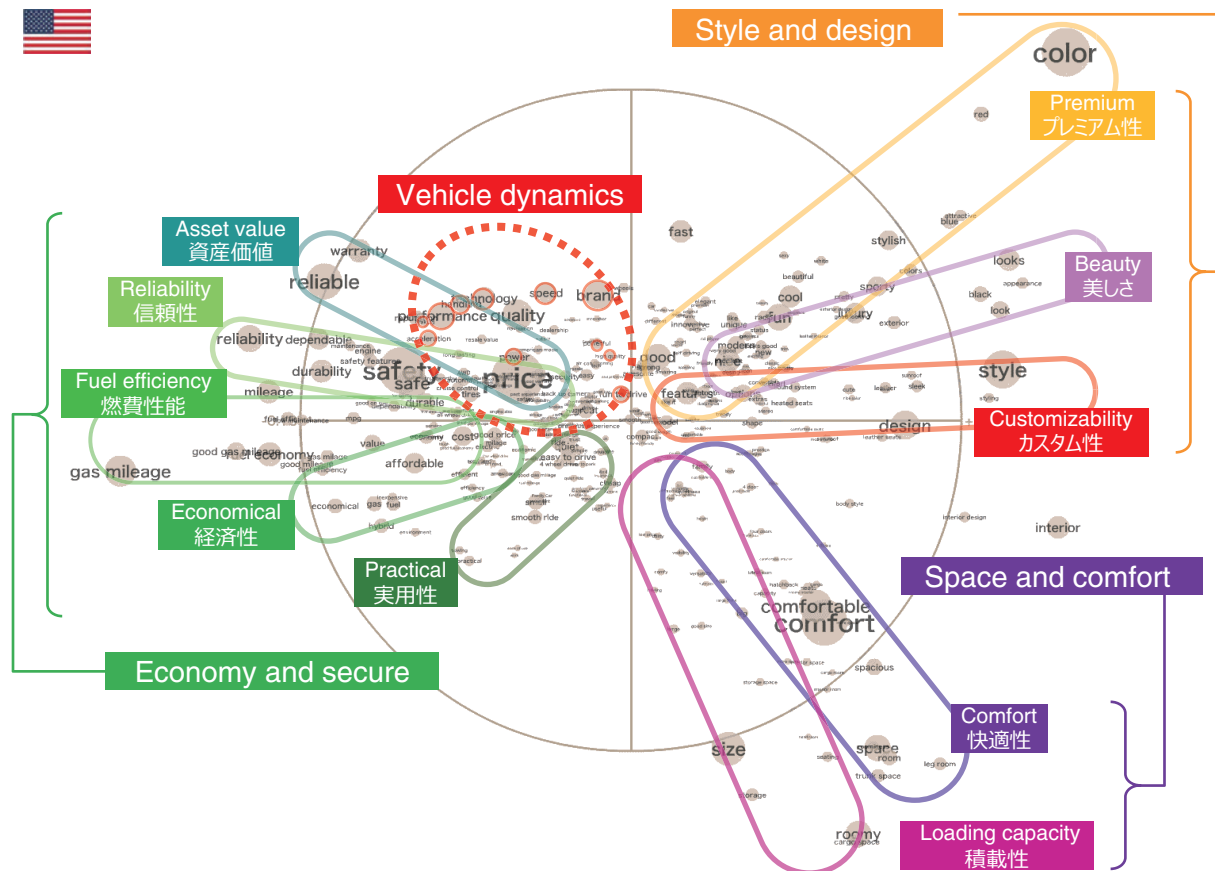


Fig. 5 Comprehensive polar plot of keywords of car values from U.S. car users

and “asset value”. It can be analyzed as a large cluster representing the value concept of “Economy and secure” that is characteristic to the U.S.

In addition, keywords we see in the Japanese version’s “Vehicle dynamics” cluster are observed to be distributed in the inner part of the upper left, rather ambiguously. In the U.S. version, these keywords, which seem to represent mechanical performance, appear not to be very remarkable in the plot. However, these keywords could be presumed to be distributed in the third axis perpendicular to this polar plot. Therefore, we defined a cluster of value concepts as “Vehicle dynamics”, also in the U.S.

Third, we see the most characteristic cluster of value concepts in the U.S. case in the lower right part of Fig. 5. In this cluster, we find many characteristic keywords with a high frequency of appearance.

In the direction of the prominent keyword “roomy”, at a distance from the center of the polar plot, there is a cluster of keywords such as “cargo space”, “storage”, “size”, and “luggage space”, and we find that the clusters are relevant to the value concept of “loading capacity”.

Slightly to the upper right of “loading capacity”, there is a cluster with “leg room”, “room”, “space”, “comfort”, and “comfortable”. This keyword cluster is regarded as the spatial value for passengers and we define this cluster as “comfort”.

These clusters of value concept, “loading capacity” and “comfort”, have many keywords and the frequency of appearance is also high, and they are not observed in the Japanese version. So “loading capacity” and “comfort” are distinctive value clusters as well as “reliability” and “asset value”. The large cluster on the lower right on the whole can be interpreted as the value concept “Space and comfort”.

We can summarize the analysis result of the survey in the U.S. as follows. U.S. automobile users have four major value concepts regarding attractiveness or value for automobiles: “Style and design”, “Economy and secure”, “Space and comfort”, and “Vehicle dynamics”. Each value concept has its own detailed value structure loosely combined each other.

- (1) “Style and design” is a value concept consisting of the individual values of “premium”, “beauty”, and “customizability”
- (2) “Economy and secure” is a value concept consisting of “reliability” and “asset value”, which are unique to the U.S., followed by “fuel efficiency”, “economical”, and “practical”, similar to those of Japan
- (3) “Space and comfort” is a value concept consisting of “loading capacity” and “comfort”, and is also unique to the U.S.
- (4) “Vehicle dynamics” is a value concept consisting of the individual values of “safety”, “handling”, and “ride comfort”, as in Japan

4. Discussion

By using the proposed method, well-cited user attributes such as age, gender, automobile brand recognition, and so on can be analyzed objectively, as can the value of EVs which are expected to be popular in the future.

4.1. Age and Gender

In Fig. 6, the age groups and genders of automobile users in Japan and the U.S. were plotted using an overlay in Figs. 4 and 5, respectively.

In both Japan and the U.S., plots of each age group were plotted in line and older age groups were placed toward

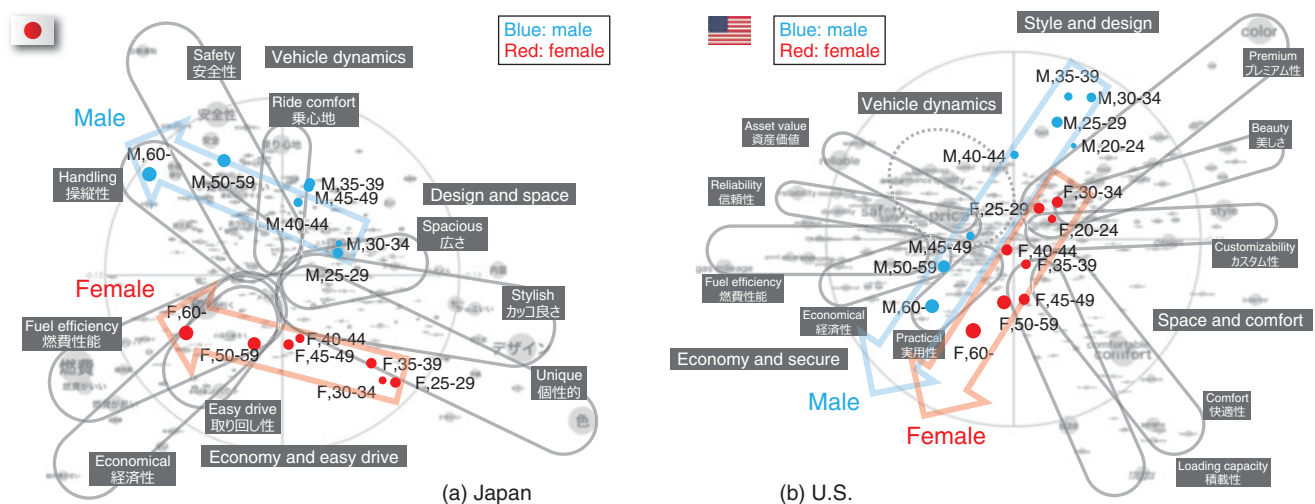


Fig. 6 Transition of values by age and gender in Japan and the U.S.

the direction of the arrows in the plot. Even though the direction of the arrows appears to be different in Japan and the U.S., the general trend seems to be common for both genders. Judging from the meanings of value clusters in the plot, the younger the user was, the closer the plot plotted near the design-related clusters that belong to a kind of sensual attractiveness. On the other hand, the older the user was, the closer the plot plotted near functional clusters, which belong to practical attractiveness.

In Japan, plots of older males are located closer to the functional values in the “Vehicle dynamics” value cluster, and plots for older female are closer to the utility values in the “Economy and easy drive” value cluster. There is a distance between the male and female plots, which means that automobiles that appeal to male users for their functionality might not be attractive to female users who value utility more than male users. This overlay plot can provide a basis for this type of discussion.

Since the relatively young female age class of 25 to 39 in Japan plotted close to design-related clusters, it is important to pursue rich color variations and good design as well as ordinary application values in order to enhance joy for these customers. On the other hand, the position of plots of females over 50 suggests that fuel efficiency, economical, and easy drive are extremely important for them. Realizing these value concepts would be effective in gaining joy for these customers.

Next, let’s look at the U.S. Similar to Japan, the younger the user, the closer the plot is plotted near design values, and the older the user, closer the plot is plotted near practical values clusters, such as “Economy and secure”. However, in the U.S., younger males aged 20 to 39 have plots far from the center of the polar plot, in the direction of the design cluster, which is not like Japan. Therefore, enhancing design values of automobiles might be more appealing to younger male users in the U.S. The gap between male and female plot points in the U.S. is smaller than in Japan, so the difference of values concepts of both genders is likely to be smaller than that of Japan.

These differences in value concept among age groups can be applied to analysis when planning and developing our products and technologies. Such analyses could help us by visualizing whether a single product can satisfy the value required by several user segments, such as younger users and older users. Such analyses could also tell us at what point the users would be satisfied. In the development of global vehicle products using common chassis platforms, compatibility with the demands of each country or region of the world would be required. In the new development process, the proposed method could provide measures to understand the values of various car users.

However, this single-year survey alone cannot distinguish whether the identified value concept changes with age or whether the value concept is just unique to each generation. It is important to note that clarification requires continuous surveys and fixed-point observations.

The same sort of analysis can be applied to a wide range of attributes, such as the users’ residence areas, the way users spend holidays, occupations, and annual income, and the proposed method is, therefore, versatile enough for future demand.

4.2. Brand

In Fig. 7, automobile brand names of the cars owned by survey participants in the U.S. were overlay plotted on Fig. 5.

The plot of the Honda brand, which is defined by the positions of keywords Honda users cited, was located in a slightly higher section on the left side, on the outermost side of the plot. Compared with other brands, Honda’s location is the most distant from the center of the plot and is near “reliability” and “asset value” in the “Economy and secure” cluster. Therefore, the Honda brand is thought to have better recognition for these values than other brands.

The plot of the Acura brand was located in the upper right, relatively to the outside, in the direction of the “Style and design” cluster. So-called premium brands, such as BMW, Mercedes-Benz, Audi, and Lexus are located here, and in the outermost area, BMW can be said to be the most clearly recognized brand by users. The position of Acura is the second outermost, next to BMW, and this can be interpreted as Acura being recognized for its attractiveness and values, which are close to those premium brands.

4.3. EV

In Fig. 8, the plots of EV users, EV potential users, and EV reluctant users in the U.S. were overlay plotted.

EV users and EV potential users were located near the upper section of the plot, near the premium cluster “Style and design”, which is close to the area of the

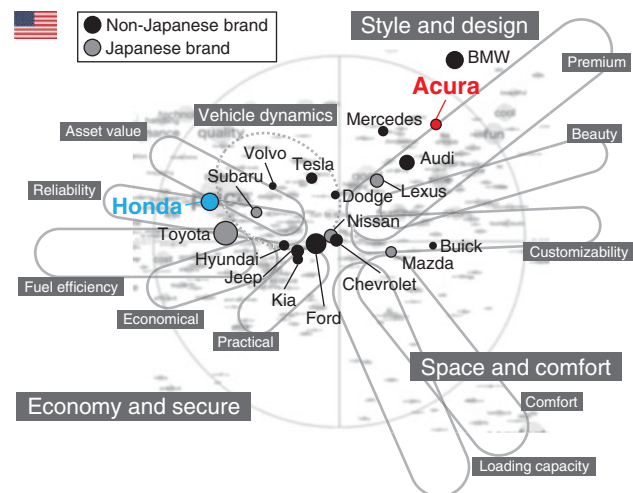


Fig. 7 Center positions of users' value keywords by each automobile brand (magnified plot)

premium brands. This suggests that EVs are recognized by automobile users as a kind of premium brand car in regard to attractiveness and value concepts. The top ten cited keywords both by EV users and by EV reluctant users were compared in Table 1. The six keywords were common to both users, and no special keywords relevant to environmental values were cited by EV users. This fact suggests that the previous assumption, that EVs are recognized as a kind of premium car, is appropriate.

When we look into the plot of EV reluctant users, it is located near the “practical” and “loading capacity” value clusters. If we plan to sell more EVs on the market in the near future, we need to take these user values into account in our products.

4.4. Commonality and Uniqueness of Japan and the United States

The common value concepts of the attractiveness and value of automobiles, both in Japan and in the U.S., were the value concepts of color, design, economy, and fuel efficiency.

In Japan, there is the value concept “spacious” in the large concept cluster “Design and space”, and Japanese users place importance on mechanical performance, or “Vehicle dynamics”, which is characteristic compared to the U.S. If size, space, and mechanical performance could be incorporated with our products in Japan, it could have a positive effect on users’ value.

On the other hand, it was characteristic in the U.S. for the large value concept cluster “Style and design” to include the concept “customizability”, and for the value concept cluster “Economy and secure” to incorporate both the “reliability” and “asset value” concepts. In the U.S., enhancing the customizability and/or providing various

Table 1 Comparison of keywords cited by EV users and EV reluctant users

EV users [%]	Keyword	EV reluctant users [%]	Keyword
14.15	Color	25.63	Price
13.21	Price	22.50	Color
12.26	Safety	20.43	Safety
11.32	Design	19.99	Comfort
11.32	Good	13.90	Style
10.38	Comfort	12.52	Reliable
9.43	Gas mileage	10.99	Size
9.43	Quality	10.17	Comfortable
9.43	Brand	9.26	Gas mileage
8.49	Comfortable	8.78	Safe

optional equipment could enhance the user perceived value concept “Style and design”, and enhancing reliability and durability in order to reduce users’ anxiety about malfunction could be of value to users. As “loading capacity” and “comfort” also form a large value cluster in the U.S., functionality oriented pickup trucks could be very attractive if equipped with large cabins with enhanced ride comfort, for example.

Meanwhile, the value concept cluster “Vehicle dynamics”, including the keyword “autonomous driving”, which was a stand-out keyword in Japan, was not prominent in the United States. It can be seen that U.S. users are choosing their cars not only based on mechanical performance-related values, but also on various values that are more diverse than those in Japan. In order to develop products targeting U.S. users, it should be a priority to study the psychology of customers in the United States, which has been shown to be very different than in Japan.

5. Summary

In this research, in order to analyze the value concept of attractiveness or value of automobiles, we used a free-keyword description method to conduct cluster analyses using the quantification method III of statistical analysis, based on the following:

- (1) Analysis of value concepts regarding attractiveness and value of automobiles through the semantic interpretation of keyword clusters
- (2) Difference analysis between Japan and the U.S., user attribute analysis, and brand recognition analysis to show the extensibility of proposed method

It is known that the keyword “autonomous driving”, prominent in the Japanese version, was not extracted in a similar survey two years prior to this. As collision damage mitigation brake systems and ADAS (Advanced Driving Assistant Systems) have become well recognized, users’ interest in autonomous driving has increased. This survey can be said to grasp such users’ psychology successfully. Similarly, it can be said that other keywords collected in

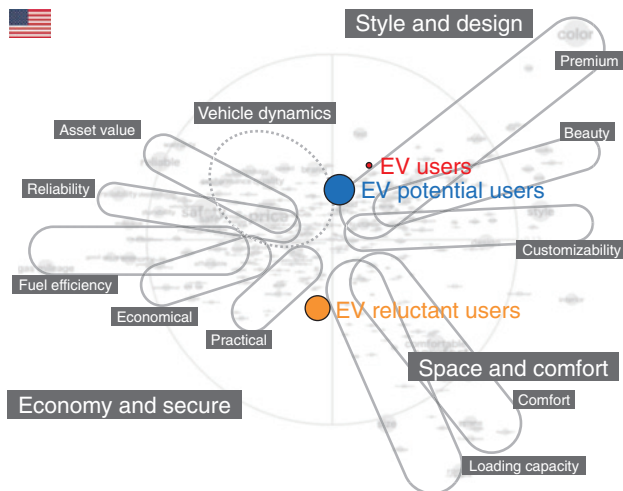


Fig. 8 Center positions of value keywords from users, potential users, and reluctant users of EV

this survey are also likely to capture the value concepts of automobile users accurately.

We hope that the proposed method will be developed further in order to help realize the Honda philosophy “Customers’ Joy” in the future.

References

- (1) The Nihon Keizai Shimbun, Shunju column, May 5, (2013) (in Japanese)
- (2) Honda Geppo, No. 4, (1951) (in Japanese)
- (3) Hayashi, C., Suzuki, T.: Shakai Chosa to Suryoka – Kokusai Hikaku ni okeru Deta no Kagaku (Zohoban), Iwanami Shoten, p. 76-86, (1997) (in Japanese)
- (4) Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., Podsakoff, N. P.: Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies, *Journal of Applied Psychology*, Vol. 88, No. 5, p. 879-903, (2003)
- (5) Hayashi, C.: Suryoka Riron to Sono Oyorei VIII, *Journal of the Japan Association for Philosophy of Science*, Vol. 9, Issue 4, p. 153-159, (1970) (in Japanese)
- (6) Hayashi, C.: Suryoka no Hoho, Toyo Keizai Inc., Ch. 6, p. 71-86, (1974) (in Japanese)
- (7) Loehlin, J. C., Beaujean, A. A.: *Latent Variable Models* (Fifth Edition), Routledge, Ch. 5, p. 171-178, (2017)

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