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ORIGINAL PAPER

A rapid Kano-based approach to identify optimal user segments

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Abstract

The Kano model of customer satisfaction provides product developers valuable information about if, and then how much a given functional requirement (FR) will impact customer satisfaction if implemented within a product, system or a service. A limitation of the Kano model is that it does not allow developers to visualize which combined sets of FRs would provide the highest satisfaction between different customer segments. In this paper, a stepwise method to address this shortcoming is presented. First, a traditional Kano analysis is conducted for the different segments of interest. Second, for each FR, relationship functions are integrated between $x=0$ and $x=1$. Third, integrals are inserted into a matrix crossing segments and FRs, where FRs with the highest sum across the chosen segments are identified. Finally, the functions of the chosen segments with the smallest interval, define the FRs appealing to the biggest target group. The proposed extension should assist product developers within to more effectively evaluate which FRs should be implemented when considering more than one combined customer segment. It shows which segments provide the highest possibility for high satisfaction of combined FRs. We demonstrate the approach in a case study involving customers' preference for outdoor sports equipment.

Keywords Kano model · Customer satisfaction · Innovation · Segmentation

1 Introduction

Developers of products, systems or services are increasingly adopting a user-driven approach in their development process. With the possible exception of open-source software or products, or products where users actively participate in the development, product developers need to conduct a careful analysis of customer needs to implement relevant features into the products. While studying the target population as a whole may provide some information useful for a top–down development process, such information is generally too shallow to enable detailed decisions about a product (Zikmund et al. 2012). Hence, segmenting the target population based on a given factor may, however, provide deeper knowledge for the developer. Also, product developers need to assess to which degree a particular feature should be implemented, and how much resources are reasonable to devote to its implementation. The problem becomes even more complex when multiple features are considered. Considering the factors mentioned so far—need for segmentation, effort or rate of implementation and evaluation of features in combination—it is not straight-forward for product developers to make informed decisions. Multiple methods are available for developers, some of which are more computationally intensive than others, while others are more labor-intensive in terms of data gathering (Trevisan et al. 2012). Previous methods also focus on combining an optimal combination of product features using rigorous mathematics such as in the subjective objective system (SOS) method, which assists product developers to select a subset of building blocks to form the optimal product configuration (Ziv-Av and Reich 2005). A combination of methods has also been proposed, where the output from one method is used as an input to another. This has, for example, been demonstrated using results from the Kano model as an input into quality function deployment (QFD) (van de Poel 2007; Cristiano et al. 2000). Kwong et al. (2011) used the model to develop an objective

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function of an optimisation model to integrate marketing with engineering. Besides using the Kano model as an input to other tools, or for business operations, the model has been used for direct practical applications, such as users' perception of functionalities within convergent products (Lee et al. 2013).

- Even though the Kano model has been useful for selecting functional requirements, it has not been so in assisting product developers choosing user segments. The purpose of this paper is to provide product developers with a rapid method to choose a suitable combination of functional requirements and user segments using the Kano model.

1.1 The Kano model of customer satisfaction

The Kano model was originally proposed by Kano et al. (1984). The model consists of a questionnaire approach used to investigate how users respond to given feature of a product, system or a service. Accordingly, depending on the customers' responses to the questionnaire, the Kano model classifies product features into three different types (Sauerwein et al. 1996). First are "Must-be requirements" which, when not fulfilled, cause dissatisfaction in the customers. The presence of such requirements is generally taken for granted by the product user, but their fulfillment will not increase the customer satisfaction. The possibility of making phone calls from a mobile phone would be an example of such requirements: it would cause great dissatisfaction if it was not there but, say, it would not be a useful criterion for customers to select between alternative products. The second types of requirements are referred to as "One dimensional". Such requirements exhibit a linear relationship with customers' satisfaction. As the requirement is fulfilled in an efficient manner, the customer becomes more satisfied. A discounted price would be an example of such feature. The last class of requirement is referred to as "Attractive requirements", and can be regarded as the most important and sought after by product developers (Sauerwein et al. 1996). They are not expected by the user and, as such, their exclusion from the product would not result in decreased satisfaction. The inclusion of an attractive feature would, however, increase the user satisfaction greatly. Other features of the Kano model include "Indifferent" features—when customers do not seem to prefer or dislike a given solution, "questionable" features—when a customer indicates that he/she likes the presence of a given feature, but also likes its absence, and finally, a "reverse" feature is one which, when absent, will result in increased customer approval. Obviously, the way customers view a particular feature is not static, but may change over time as a technology reaches maturity. Generally, attractive requirements tend to become "one-dimensional" and "must-be" requirements over time. For example, connecting to the internet using mobile phones was considered as an attractive requirement when first introduced, but over time, that particular feature came to be expected by the user, and is now regarded as a "must-be" attribute.

Figure 1 shows the relationship between the implementation of the various classes of functional requirements (FR) and customer satisfaction.

Using the Kano model can prove helpful in guiding the product development process. During the development stage, some trade-offs may be inevitable. A-Kano model may assist with such trade-offs by showing which feature results in the greatest user satisfaction. For example, a product already fulfilling a "must-be" requirement should not be developed further in that direction, as doing so would not increase the satisfaction of the users, freeing up product developers' time and energy to focus on features that will actually improve customers' satisfaction and make their product stand out from the competition (one-dimensional and attractive requirements, respectively).

1.2 Quantitative Kano model: the questionnaire

Despite its original qualitative nature, quantitative versions of the Kano model have been proposed, such as the Analytical Kano Model, or A-Kano (Xu et al. 2009), which have been shown to be effective tools in the product development process. The A-Kano works as follows: after deciding the market segment of interest, a questionnaire is constructed containing

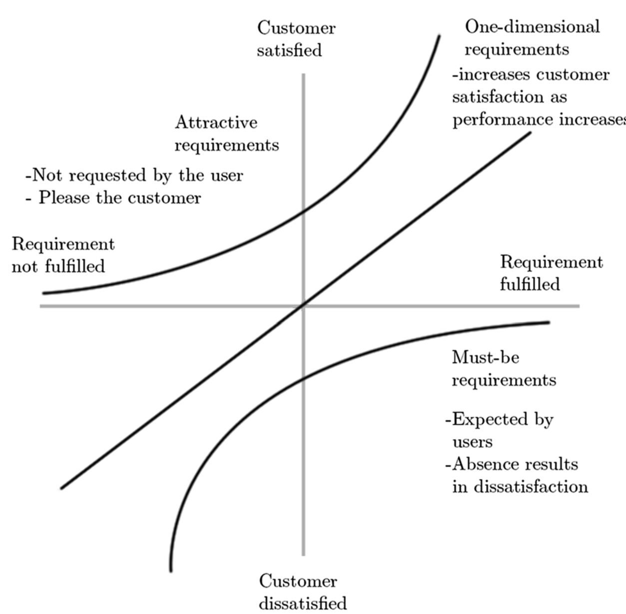

Fig. 1 Relationship between customer satisfaction and requirement fulfillment according to the Kano model

questions about the FRs of the target product or service. For each FR, two questions are asked: one functional and one dysfunctional. For example, if being asked about the weight of a cellular telephone, the customer might be asked “If the phone is as light as a matchbox, how do you feel?”, and then subsequently “If the phone is heavier than a matchbox, how do you feel?”. Each question has five possible outcomes:

1. I like it that way,
2. It must be that way,
3. I am neutral,
4. I can live with it that way,
5. I dislike it that way.

Responses are then collected into a classification table—exemplified in Table 1—which is then used to evaluate whether each FR is attractive, one-dimensional, must-be, indifferent, reverse or questionable (steering the analyst towards a correct function to use as shown below). In A-Kano, this is done by jointly considering the mode of the customers’ answers for each particular FR in the functional and dysfunctional form. Therefore, a relevant function (Eqs. 3, 4 or 7) is used based on the mode of classified answers from the sample or segment.

After classifying the FRs as explained above (attractive, one-dimensional, etc., based on the mode of answers), it is possible to calculate two values for each of them: customer satisfaction (CS) and customer dissatisfaction (DS), representing, respectively, how strongly the presence of that product feature will affect positively or negatively customer satisfaction. The CS value can be expressed as follows (Wang and Ji 2010):

$$\mathrm{CS}_i = \frac{f_{\mathrm{A}}+f_{\mathrm{O}}}{f_{\mathrm{A}}+f_{\mathrm{O}}+f_{\mathrm{M}}+f_{\mathrm{I}}} \tag{1}$$

Table 1 Classification table used to determine requirement class from a customer

CR’s	Dysfunctional				
	1. Like	2. Must-be	3. Neutral	4. Live with	5. Dislike
Functional					
1. Like	Q	A	A	A	O
2. Must-be	R	I	I	I	M
3. Neutral	R	I	I	I	M
4. Live with	R	I	I	I	M
5. Dislike	R	R	R	R	Q

A attractive, *O* one-dimensional, *R* reverse, *M* must-be, *I* indifferent, *Q* questionable

where f_{A} denote the number of attractive, f_{O} the number of one-dimensional, f_{M} the number of must-be and f_{I} indifferent responses. The CS value ranges from 0 to 1. Positive values would indicate that fulfilling that requirement would increase customers’ satisfaction (the closer to 1, the more important the requirement). Negative values (seen later in the Kano computation) would indicate the opposite, whereas CS values around 0 would indicate that there is very little influence.

In a similar fashion, the DS_i value can be calculated by adding the one-dimensional and the must-be requirement and dividing by the same normalizing factor, i.e.:

$$\mathrm{DS}_i = \frac{f_{\mathrm{O}}+f_{\mathrm{M}}}{f_{\mathrm{A}}+f_{\mathrm{O}}+f_{\mathrm{M}}+f_{\mathrm{I}}}. \tag{2}$$

Then, two points are located for each FR. These points define, respectively, the customer satisfaction when the FR is fully implemented or fully excluded from the product. These points can be plotted as $(1,\ \mathrm{CS}_i)$ and $(0,\ -\mathrm{DS}_i)$ (Wang and Ji 2010). To find the relationship functions, one must first identify if the FR is a must-be, one-dimensional or attractive. This can be done straightforwardly by looking at the corresponding classification table (such as the one in Table 1). In a generic form, the relationship function can be written as $S = f\ (x,\ a,\ b)$, where S is the customer satisfaction, x the level of fulfillment, a and b are the adjustment parameters for the Kano categories of customer requirements. For one-dimensional attributes, the function is $S\ =\ a1x\ +\ b1$, where $a1$ denotes the slope and $b1$ is the DS value when customer requirement (CR) (x) is at 0. Entering CS and DS points previously calculated into the equation, we get $a1 = \mathrm{CS}_i\ +\ \mathrm{DS}_i$ and $b1 = \mathrm{DS}_i$. Therefore, the function for one-dimensional product attributes can be written as (Wang and Ji 2010):

$$\mathrm{S}_i\ =\ (\mathrm{CS}_i - \mathrm{DS}_i\ )x_i\ +\ \mathrm{DS}_i \tag{3}$$

If the FR is an attractive one, the function can be seen to be exponential, and is, therefore, modified to be $S\ =\ a2ex\ \ +\ b2$. We now get $a2\ =\ \frac{\mathrm{CS}_i\ \ \mathrm{DS}_i}{e-1}$ and $b2\ =\ -\frac{\mathrm{CS}_i\ \ \ e\mathrm{DS}_i}{e-1}$. We can, therefore, see that the function for such attributes is (Wang and Ji 2010):

$$S_i = \frac{\mathrm{CS}_i - \mathrm{DS}_i}{e-1}e^{x_i} - \frac{\mathrm{CS}_i - e\mathrm{DS}_i}{e-1}. \tag{4}$$

For must-be attributes, the function can also be estimated using an exponential function. In the case of must-be attributes, the function is $S\ =\ a3(ex\ +\ b3)$. We acquire $a3$ and $b3$ using (Wang and Ji 2010):

$$a_3 = \frac{e(\mathrm{CS}_i - \mathrm{DS}_i)}{e-1} \tag{5}$$

and

$$b_3 = \frac{e\mathrm{CS}_i - \mathrm{DS}_i}{e-1}. \tag{6}$$

The function for must-be attributes can, therefore, be plotted as (Wang and Ji 2010):

$$S_i = -\frac{e(\mathrm{CS}_i - \mathrm{DS}_i)}{e-1}e^{-x} + \frac{e\mathrm{CS}_i - \mathrm{DS}_i}{e-1}. \tag{7}$$

1.3 Aims of the present research

The Kano model has been used within various fields, and several studies have demonstrated that it is an efficient way to sort through an initial new product feature list and identify a manageable set of FRs that will resonate with prospective customers (e.g., Atlason et al. 2014; Wang and Ji 2010). However, a current limitation of the Kano model is that it does not allow for the developer to assess which exact combination of FRs should be pursued by product developers, and for which customer segment(s). This limits the practical application of the model (Zikmund et al. 2012).

Situated within this context, the primary aim of this paper is to present an expansion of the conventional Kano model that can allow product developers to overcome this problem. We present our expansion through a case study where shortcomings of the conventional Kano model are addressed. The case study focuses on the FRs of customers with regard to outdoor exercise equipment. Here, the Kano model is expanded to experiment with a method where different segments can be identified and matched with FRs within the Kano framework.

Table 2 Background characteristics of participants in the case study

Background variable	%
Gender	
Men	37
Women	63
Age	
U20	4
20–29	47
30–39	12
40–49	15
50–59	12
60+	9
Income (In 1000 DKK per year)	
<100	29
100–199	20
200–299	14
300–399	18
400–499	10
>500	9
Exercise frequency per week	
Never	9
1–2 times	25
3–4 times	42
5–6 times	17
Every day	7
Do you train outside?	
Yes, every time	19
Yes, some times	60
No	21

2 Methods

2.1 Case study: outdoor exercise equipment

The broader context of this study was a collaboration with a Danish manufacturer of outdoor exercise equipment. The aim was to uncover the potential for new product development by identifying the most important FRs in this category, as well as the preferred features for specific customer segments defined in terms of demographic (gender, age, income) and behavioral factors (general training frequency and frequency of outdoor training). The data were collected with a quantitative Kano questionnaire conducted with a sample of 327 participants (63% women, 16–85 years old), who were recruited to the study through the authors' personal network and participated to the study on a voluntary basis. A more detailed description of the background characteristics of the participants is given in Table 2.

The Kano questionnaire was developed according to Wang and Ji (2010) and focused on 22 functional requirements relevant to the target product category, covering aspects such as the type of body parts to be trained, the product design and comfort, etc. The full list of functional requirements evaluated by the participants is given in Table 3.

2.2 Proposed expansion

As explained before, the Kano model lacks the possibility to go beyond aggregated responses. To address the aim of the study, we adopted a stepwise approach that extends the traditional Kano model and allow to systematically analyze and combine multiple segments. The approach works as follows:

1. A traditional Kano analysis is conducted for the different segments following the A-Kano procedure (Wang and Ji 2010) described earlier. After sorting the respondents according to the desired segments, the results are listed in a table for identifying the attributes, and the CS and DS values will be calculated to create relationship functions.
2. Subsequently, these functions are integrated between $x = 0$ and $x = 1$. Integrals are inserted into a combination of matrix crossing segments and FRs, as shown in

Table 3 Functional requirement included in the Kano questionnaire

Functional requirement	Pair of questions
Seat comfort	The outdoor fitness equipment has seat comfort, how do you feel?
	The outdoor fitness equipment has no seat comfort, how do you feel?
Grip handle	If the product has handles with grip, how do you feel?
	If the product has no handles with grip, how do you feel?
Static	If the product was static (one component), how do you feel?
	If the product was not static (not just one component), how do you feel?
Signs	If the product has signs and instructions for use, how do you feel?
	If the product has no signs and instructions for use, how do you feel?
Moving parts	If the product was designed with moving parts, how do you feel?
	If the product was not designed with moving parts, how do you feel?
App	If the product has an app and QR codes for instructions, how do you feel?
	If the product has no app and no QR codes for instructions, how do you feel?
Non-slip	If the fitness equipment has a non-slip surface, how do you feel?
	If the fitness equipment has a slippery surface, how do you feel?
Public area	If the outdoor equipment were placed in the public areas, how do you feel?
	If the outdoor equipment were not placed in the public areas, how do you feel?
Adjustable weight	The outdoor fitness equipment has adjustable weight, how do you feel?
	The outdoor fitness equipment does not have adjustable weight, how do you feel?
Flexibility	The flexibility of your body can be trained, how do you feel?
	The flexibility of your body cannot be trained, how do you feel?
Adults and children	The products were developed for adults and children, how do you feel?
	The products were not developed for adults and children, how do you feel?
Mobile holder	The equipment has a feature for placing the phone, how do you feel?
	The equipment has no feature for placing the phone, how do you feel?
Combination	If the product was able to be used for multiple exercises, how do you feel?
	If the product was not able to be used for multiple exercises, how do you feel?
Abs	The fitness equipment allows you to train your abs, how do you feel?
	The fitness equipment does not allow you to train your abs, how do you feel?
Biceps	The product will allow you to train the biceps, how do you feel?
	The product will not allow you to train the biceps, how do you feel?
Triceps	If the outdoor product was designed to train the triceps, how do you feel?
	If the outdoor product was not designed to train the triceps, how do you feel?
Legs	You are able to train your legs with the outdoor product, how do you feel?
	You are not able to train your legs with the outdoor product, how do you feel?
Endurance	Exercising with the fitness equipment enhances your endurance, how do you feel?
	Exercising with the fitness equipment does not enhance your endurance, how do you feel?
Back	The product is able to train the back, how do you feel?
	The product is not able to train the back, how do you feel?
Balance	Your balance will be trained using the fitness equipment, how do you feel?
	Your balance will not be trained using the fitness equipment, how do you feel?
Rowing	The product allows you to do rowing, how do you feel?
	The product does not allow you to do rowing, how do you feel?
Bike	The product allows you to bike, how do you feel?
	The product does not allow you to bike, how do you feel?

Table 4. After placing the integral values from the equations, which is the area between $x=0$ and $x=1$, the highest scores of segments and highest scores of the FRs are calculated. The sums for the segments are shown in the rightmost column, and the sums for the FRs are shown in the bottom row.

3. FRs with the highest sum across the chosen segments are identified. In a traditional Kano model, FRs result-

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Table 4 Combination matrix

FR	$\int_0^1$ FR1	$\int_0^1$ FR2	$\int_0^1$ FR3	…	$\int_0^1$ FRn	$\sum$ Segment
Segments						
Segment 1						
Segment 2						
Segment 3						
…						
$\sum FR$						

ing in the highest satisfaction would be selected. The number of segments to choose depends on the range of segments, if the distribution of results is large. The selection of segments should also be conducted in relation to possible marketing strategies.

However, here we also want to identify segments that are most likely to adopt the different FRs in combination with each other, and identify the segments that may have the same preferences. Three additional steps have to be followed to ensure the best outcome.

4. Choose the segments with the highest sum of all integrals covering all FRs. This has to be done as it ensures the highest possibilities for high customer satisfaction.
5. Isolate the FRs for those segments and have a look at the sum of the FRs. Chose the FRs with the highest scores. The number of FRs to be chosen also depends on factors such as cost of implementation and technological maturity. This can be evaluated by estimating the cost of implementing each FR.
6. Subtract the integrals and evaluate the results. The smaller the interval the more similar is the perception of satisfaction among the segments. Graphing the results may help visualize the size of intervals between segments for individual FRs, so a developer can visually inspect if different segments value FRs in a similar way.
7. The functions of the chosen segments with the smallest interval, define the FR forming the biggest target group. The largest sum of segments demonstrates the highest user satisfaction for a combination of segments for different FRs. This process can be iterative, as it depends on the original selection of segments in step 4. Meaning that the FRs ultimately chosen, may be different as more, or fewer, segments are included in this step.

3 Results

Before going into segmentation and eventually using the proposed method, a good starting point is to look at aggregated results. Using resulting functions to plot the results provide a visual overview of the perceived customer satisfaction. Plots from the aggregated results are shown in Fig. 2. Each line in the Figure is a plot resulting from Eqs. 3,4 and 7 using the sample data of selected functional requirements. The x axis represents amount of implementation of a given FR, where $x = 1$ is a fully implemented FR, and $x = 0$ is excluded. The y-axis on Fig. 1 represents customer satisfaction for a given rate of implementation. On the left side of the figure, one can see one-dimensional and must-be requirements from the sample study. Non-slip surfaces are shown to be a must-be requirement, with a negative exponential function and with a low satisfaction value when $x = 1$ compared to other functional FR's. On the right hand side of the figure, one can see that the highest scoring FR's are flexibility and abdominal muscle training, which are classified as attractive requirements.

Note that non-slip surfaces and explanatory signs did not show much potential for customer satisfaction, those requirements are, however, considered by the overall segment to be must-be requirements. Developers of the relevant equipment would essentially aim to implement must-be FR's, and attractive FR's to a feasible extent.

Table 5 shows how the calculation and evaluation of the results can be done using our proposed expansion on the data on customer requirements for outdoor sport equipment.

When calculating the desired segments and FRs, the first step is to take the sum of all integrals for all segments. The highest scoring segments are then chosen for further exploration, as they represent that are most interested in the product. In Table 5, the rows with the highest total score are outlined. These rows are then isolated and the sums for all FRs are then calculated only for the chosen segments. The highest scoring FRs are then selected: these represent the FRs with the greatest potential to increase customer satisfaction in the chosen; therefore, after going through this process, the product developer should be able to select a set of segments and FRs to be developed further. In this study, four segments are chosen because they seem to outperform other segments quite obviously. However, a developer needs to take various factors into consideration, also if the resulting integration results are similar across all segments.

By following the process previously explained in our case study, one can conclude that the product developer in this case study should focus on three segments: customers

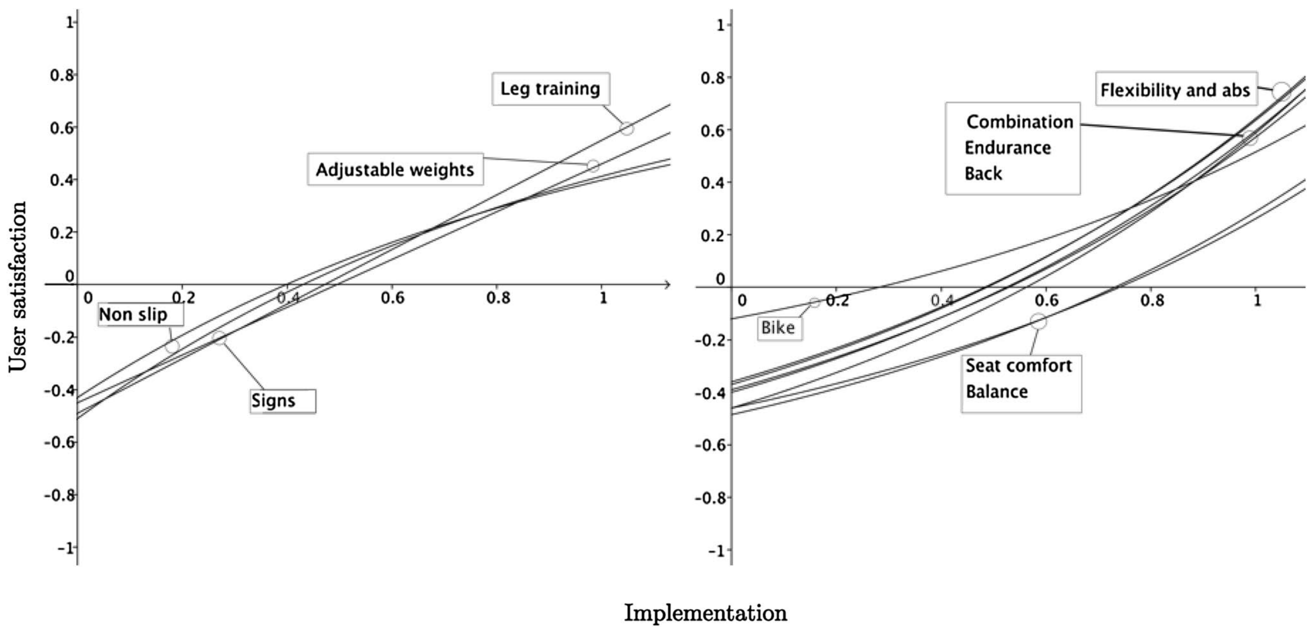

Fig. 2 (Left) One-dimensional and must-be requirements plotted. (Right) Attractive requirements plotted from the case study presented

Table 5 The combination matrix from the case study. (Color table online)

	1. Seat comfor	2. Balance trainin	3. Information sign	4. non slip grip	5. Mobile holde	6. Endurance traini	7. Bike trainin	8. Flexibility traini	9. Abs trainin	10. App combinatic	11. Back trainin	12. Non slip surfac	13. Static equipmen	14. Moving part	15. Rowing	16. Triceps trainin	17. Junior produc	18. Adjustable weigh	19. Combinatio	20 . Public are	21. Bicep	22. Leg	Σ Segmen
Age u20	-0.05	0.1	0.08		0.2	0.04			0.01	0.01	-0.2	-0.01						0.1		0.25		0.12	0.65
Age 20 - 29	0.02	0.1	0.03	0.14		0.02	0.16	0.11	0.08		-0.04	0.05						-0.1	0.01		0.05	0.05	0.68
Age 30 - 39		-0.04	0			-0.04		0.07	0.09		0.04	0.02						0.06	0.08			0.07	0.35
Age 40 - 49		0.09	0.03	0.06		0.07		0.09	0.11		-0.05	0.02						0.34	0.03			0.01	0.8
Age 50 - 59		0.03	0.28			0	0.09	0.02	0.1		-0.01				0.12				0.08				0.71
Age 60+			-0.1			0		0			0.06	0.04							0.01			0.05	0.06
Income u 100.000 kr	0.02	0.08	0.02			0.04	0.16	0.09	0.04		0	0.05						0.12	-0.02			0.03	0.63
Income 1 - 199.000 Kr.	0.06	0.06	0.05	0.12		-0.08	0.1	0.07	0.09		0.05	-0.04				0.07		0.03	0.02			0.01	0.61
Income 2 - 299.000 Kr			-0.02			0.1		0.08	0.12		0.04	0.03						-0.02	0				0.33
Income 3 - 399.000 Kr.	0.05	0.14	-0.05			0.03	0.13	0.1	0.14		0.08	0.03						0.13	0.06			0.04	0.88
Income 4 - 499.000 Kr		0.07		0.12		0.08		0.08	0.03		-0.02	-0.05							0.09			-0.05	0.35
Income 500.000+ Kr.		0.04	0.05			0.07	0.14	0.1	0.08		-0.04	0						0.04	0.04			0	0.52
Gender Male		0.07	-0.03			0.01	0.15	0.04	0.1		0.03	0.09						0.02	0			0.04	0.52
Gender Female	0.03	0.08	0	0.13		0			0.03		0.04	0.05						0.08	0.01			0.02	0.47
Exercise 0	0.06		-0.04			-0.04		0.08			0.03							0.04					0.13
Exercise 1-2	0.04	0.08	-0.06			-0.05	0.17	0.03	0.1		-0.03							0.01	0.03			0.01	0.33
Exercise 3-4	0.03	0.1	0.05	0.12		0.03	0.11	0.08	0.01		-0.04	0							0.02			0.03	0.54
Exercise 5-6	0.01	0.02	0.04	0.16		0.05		0.13	0.08		0.1	0.03				0.12		0	0.01			0.03	0.78
Exercise 7	0.03	0.1				0.09		0.11	0.13		0.12	0.07		0.17					0.09			-0.11	0.8
Outdoor Yes every time		0.08	0.04			0.03		0.09	0.05		0.02	0							0			0.04	0.35
Outdoor Yes sometimes	0.04	0.08	0.03	0.12		0.01	0.14	0.09	0.06		-0.01	0.06						0	0.01			-0.07	0.56
Outdoor No	0.04	0.07	-0.05	0.07	0.06			0.03	0.03	0.02	0	0.03						0.05	-0.1			0	0.25
Σ FR	0.09	0.35	0.02	0.22	0	0.24	0.13	0.43	0.46	0	0.25	0.15	0	0.17	0	0.12	0	0.47	0.19	0	0	-0.03	

Color indicates values, dark red indicates low, while dark green indicates high

aged between 40 and 49, customers with an annual income between 300 and 399 thousand Danish crowns, and customers exercising between five and seven times per week (their corresponding rows appear highlighted in Table 5). The FRs to be prioritized, according to our analysis, are then the ability to train balance, flexibility, the possibility of training abdominal muscles, and the presence of adjustable weights.

It can be seen that some FRs lack data to provide for complete calculations in the combination matrix. This is a result from a range of indifferent, reverse or questionable outcomes from the Kano model. It is, therefore, difficult to provide clear recommendations to the developer about such FRs. On the other hand, we can see that there are many features that, although fully represented by the Kano model inside the combination matrix, have a low score and should, therefore, not be pursued by the developer. For example, endurance training, back training exercises and combination products seem to provide low satisfaction among the segments selected. In this study, four FRs are selected, again because they seem to outperform the others with regard to user satisfaction. Among other things, here the developer needs to take implementation and production costs into consideration.

Finally, the analysis also identifies the segments that should not be targeted which in this case are customers aged over 60, customers earning between 200 and 299 thousand Danish crowns per year, and—not surprisingly—customers that do not exercise at all (Table 2). In terms of gender, male customers seemed to have a slightly greater potential for a product satisfaction than females, whereas in terms of age, the segment 30–35 is somewhat less attracted to the product than the rest.

4 Discussion and conclusion

The case study discussed in this paper is intended to demonstrate how an expansion of the Kano model can allow product developers to combine segments and FRs to make design decisions that may provide stronger satisfaction among a wider audience. In the case study presented, clear difference emerged between customer segments both with regards to overall interest in the product and in the way they weighted the importance of different product features. In such a situation, only looking at the aggregate results would be potentially misleading.

The method of forming segments is a problem identified by other researchers when using the Kano model (Chen and Su 2006; Füller and Matzler 2008). When it comes to segmentation, the method proposed in this paper does not propose a method for identifying or proposing segments to be included in the analysis. We aim to develop a method for structuring segments, which can then be used as an input to prioritize user segments in the product development phase. When constructing segments, one might, for example, use cluster analysis in the process, also to retrieve segments that are of sufficient size to conduct the Kano calculations. If a segment is not of sufficient size, it may be impossible to calculate the CS and DS values, which are required to retrieve any meaningful results. A heuristic including computational methods (cluster analysis for example) and other more detailed guide of constructing the segments is to be developed. In the case study presented here, the segments were selected based on expert opinion, both of the developers of the products and the individuals conducting the study. The method of segmentation will, however, be improved using quantitative methods.

The usefulness of this approach thus relies on selecting user characteristics that are relevant to the target product category (e.g., physical activity level for outdoor sports equipment), which should be carefully considered on a case by case basis.

We believe that the Kano model has to be developed further but, at the same time, we are confident that the expansion presented in this paper does provide developers of products, systems or services with better understanding of customer acceptance of products, and how combinations of FRs and segments may improve innovations and their success on the market. Another point to be made is about the selection of FR's to be included in the initial Kano survey. In that regard, Reich and Ziv-Av (2005) have provided a method which may assist product developers to choose and prioritize functional requirements to be analyzed using the method proposed in this paper.

To further ease the adoption of our approach, we are currently developing a dedicated package for the analyses of Kano data in the open-source software R (R Development Core Team 2015) including all functions for the segmentation approach here.

To the best of our knowledge, this paper is the first attempt at considering targeted segmentation in the framework of the Kano model. We note, however, that similarly motivated authors have previously proposed to address the same issue by combining the classical Kano model with other techniques that can provide segment-based utilities, such as conjoint analysis (Min et al. 2011; Schmidt et al. 2014; Wang and Wu 2014). It is also evident that other authors have used the Kano model to integrate various other aspects into product development, for instance, marketing aspects (Kwong et al. 2011). In future research, it would be of interest to compare the latter approach to ours, as they share the same rationale, but differ substantially in terms of the cognitive load required by the respondents and the underlying mathematics used to estimate the importance of different FRs. Furthermore, the customer segmentation could also be developed further in relation to Kano's model, for example, using cluster analysis prior to deployment of the method demonstrated in this paper, which would be especially important in case the different preference patterns in the customer sample are not specific to any predefined demographic variable.

A crucial aspect that deserves attention in future research is how to include production cost and price levels in the

Kano model. This aspect has received some attention in the literature. Xu et al., (2009) incorporated production time in their approach, but did not take into consideration internal costs and customer satisfaction as parameters. Other authors have used Kano in combination with cost optimization methods such as quality function deployment (QFD) (Chaudha et al. 2011; Ji et al. 2014). In all cases, the focus has not been on systematically integrating costs from the producers' side into the Kano model.

Current work by the present authors aims at developing a more comprehensive method built on Kano's principles where costs are included. The proposed future work will be useful to enable the product developers to move from an abstract customer satisfaction in a fixed-cost situation, towards identifying which specific combination of FRs, offered at specific price points, will result in the greatest returns for the company when benchmarked against production costs.

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