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Pivot profile method: What is the influence of the pivot and product space?

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ABSTRACT

The Pivot Profile© (PP) was proposed recently by Thuillier, Valentin, Marchal, and Dacremont (2015) as an alternative to classical descriptive methods. Its principle is to describe each product by comparing it to a stable reference (called Pivot). While the method seems promising there is little data available and some issues still need to be examined. This paper proposes to evaluate two of these issues: the effects of the similarity within the product space and of the choice of pivot. We compared the pivot profiles obtained for three different sets of beers, varying in their within-set sensory similarity, using different pivots. We found that PP results are more influenced by the within-set similarity than by the choice of the pivot. We suggest that the PP method is more suitable for restricted product spaces in terms of sensory characteristics, and that the creation of a "central product" as the pivot can be a good option when the type of products allows it. However, further studies need to be conducted to assess PP in terms of assessors' repeatability and consensus, as well as to propose alternative statistical analyses that would take into account the individual PP data.

1. Introduction

In response to industrial demand to develop fast and cost effective methods to describe product sensory attributes, new sensory tools have been described in the literature under the name of rapid methods (Valentin, Chollet, Lelièvre, & Abdi, 2012; Varela & Ares, 2012). One of the most recent tool was proposed under the name of Pivot Profile© (PP) by Thuillier et al. (2015) for the description of champagne wines. The idea behind PP is to use a comparative strategy like in Flash profile (Dairou & Sieffermann, 2002; Delarue, 2014), sorting task (Chollet, Valentin, & Abdi, 2014) or projective mapping (Dehlholm, 2014; Risvik, McEwan, & Redbottena, 1997) but comparing each product to a stable reference instead of comparing all products together. This characteristic is common with Polarized Sensory Positioning (PSP, Teillet, Schlich, Urbano, Cordelle, Guichard, 2010). In PSP, assessors are asked to evaluate the distance between a sample and three references or poles whereas in PP they have to describe the differences between the sample and the reference (pivot). One of the main interests of these two reference-based methods is that they allow data aggregation as the samples do not need to be presented all at the same time as for the other comparative methods previously quoted (Valentin et al., 2012). The main difference between the two methods is that PSP does not rely on language and so it provides only a positioning of samples, when PP provides both a positioning and a description of the samples.

Practically in PP assessors are provided with pairs of products including the reference or pivot (clearly identified as such) and the product to be evaluated. Assessors are asked to observe, smell and taste the pivot and the product and to write down each attribute that the product has in smaller or larger amount than the pivot product (*e.g.* less sweet, more astringent). Data analysis begins by regrouping synonyms and optionally regrouping the terms by categories. Then, negative and positive frequencies are computed for each term and each product, and the negative frequency is subtracted from the positive frequency. The resulting score is finally translated so as to obtain positive scores only. The final matrix is submitted to correspondence analysis (CA) to obtain a sensory map of the products.

PP seems to be very promising as it allows for a fast description of products with the possibility of aggregating data across sessions. However, so far very little data are available with only two published articles at that day. Thuillier et al. (2015) reported that champagne descriptions obtained *via* PP were coherent with what was *a priori* known about these wines and Fonseca et al. (2016) demonstrated with chocolate ice-creams that PP has high analytical and discriminative power compared to comment analysis. So, additional work is clearly needed to confirm the potential of this method. A first issue with PP is the choice of the pivot product. In a series of simulations Thuillier et al. (2015) demonstrated that "*the choice of the pivot does not impact product description space in a dramatic way*" (p. 72). Yet this still needs to be verified with real products and assessors. The difficulty is that if the pivot is too neutral compared to the products to be described, assessors

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might have difficulties finding terms that are less than the pivot and inversely if the pivot is too caricatural assessors might have difficulties finding terms that are more than the pivot. The ideal solution thus is to have a pivot with a central position compared to the product space to be described. Thuillier et al. (2015) suggest creating a "central product" by blending all products to be described but specify that this option is possible "*only for liquid, semi-liquid or powder products that can be easily mixed*" (p. 72). However, the author did not test this idea. The same issue holds for PSP as a minimum of two poles need to be chosen. Teillet, the author of the method himself, indicates that "the choice of the poles seems to be a critical point of PSP" (Teillet, 2014, p. 265). Recent publications on this issue reports that small changes in the choice of the poles do not lead to relevant changes in product configurations but it seems crucial that the poles should reflect the main sensory characteristics responsible for the expected similarities and differences among the products to be evaluated (Ares et al., 2015; De Salamando, Antúnez, Torres-Moreno, Giménez, & Ares, 2015). Another issue is related to the similarity within the product space (within-set similarity). Most rapid methods do a good job at describing and discriminating among products as long as the differences between products are not too small. When the differences are too subtle, classical descriptive analysis is generally more efficient (Antúnez, Vidal, de Salamando, Giménez, & Ares, 2017).

The aim of this paper was to evaluate the potential of PP to describe complex products and to evaluate the effect of within-set similarity and of choice of pivot on PP performance. We selected three sets of beers as an illustration of complex products (Fig. 1). The first set is composed of very different beers (low within-set similarity), the second set has an intermediate within-set similarity and the third set is the less similar one. Each set of beers was evaluated in comparison to one, two or three different pivot products.

2. Material and methods

For assessing the effect of the choice of pivot we evaluated Sets 2 and 3 respectively with several pivots (blue lines in Fig. 1). To obtain a central product we followed Thuillier et al.'s suggestion and created a blend of all beers of each set. For Set 2, we compared this central blend pivot (P1) with two extreme pivots which are real beers. For Set 3, we compared the central blend pivot (P1) with a central pivot beer (P2) which is a real beer quite similar to the beers of Set 3. If PP is sensitive to the choice of pivot, we expected to obtain different product descriptions of the beers depending on the pivot product inside each set.

For assessing the effect of within-set similarity on PP performance, we compared the results of the three sets when evaluated in comparison with their respective central blend pivot (P1, orange line in Fig. 1). If PP is sensitive to within-set similarity, we expected PP to give better performance with Set 1 (the less similar) than with Set 3 (the more similar).

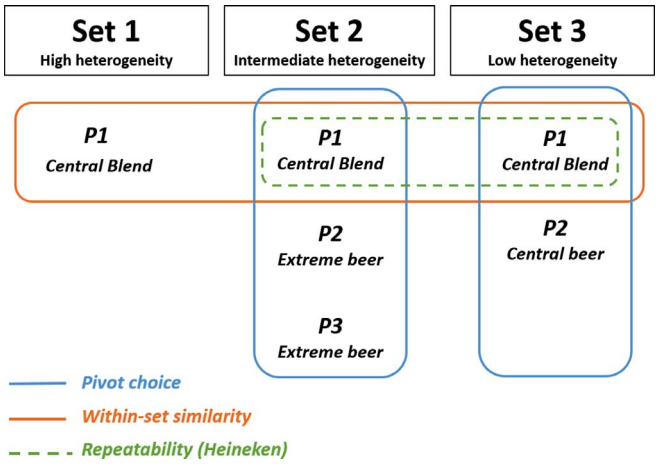

Fig. 1. Global schema of the experiment.

2.1. Assessors

In their simulations, Thuillier et al. (2015) evaluated the effect of panel heterogeneity as a factor that could impact PP outcome. They showed that several sets of heterogeneous individual descriptions lead to similar product descriptive spaces which suggests that this factor might not be a problem. However, they also mention that the heterogeneity they simulated was closer to the heterogeneity that could be expected from a trained panel and that a bigger effect could be expected with consumers. Based on this statement we used trained panelists as assessors to avoid additional noise in the data. So 11 trained assessors (6 women, 6 men aged from 28 to 59 years old) enrolled in a training program designed to produce beer trained panelists. They had been formally trained to evaluate different kinds of beers (including the beers studied here) one hour per week for an average of four years. The training consisted in detecting and identifying flavors in beer and evaluating the intensity of general compounds on a non-structured linear scale. They did not have any knowledge about PP and had never participated in a PP test before.

2.2. Beers

The choice of the beers was based on previous published and unpublished studies involving sensory profiling of a large number of beers, and on the extensive knowledge of the authors of the beer sensory characteristics grounded on more than 15 years of research activity on this topic. The beers of each set are detailed in Table 1. Set 1 (low within-set similarity) includes both blond and amber beers with various alcohol contents. Set 2 (intermediate within-set similarity) includes five blond beers: two of them are more aromatic and alcoholic (Leffe and Grimbergen) than the three others (Pelforth, Stella Artois and Heineken). Set 3 (high within-set similarity) is composed of five similar blond beers with very close alcohol contents.

For each set, the central blend pivot is made of an equi-volume

Table 1
The three sets of beers with their respective pivots.

	Beers	Color	Alcohol content (% vol.)
Set 1	Chti	Blond	6.4
	Chti	Amber	5.9
	Leffe	Blond	6.6
	Leffe	Amber	8.2
	Pelforth	Blond	5.8
	Pelforth	Amber	6.0
Pivot 1	*Blend of the 6 beers*	/	/
Set 2	Grimbergen	Blond	6.7
	Leffe	Blond	6.6
	Pelforth	Blond	5.8
	Stella Artois	Blond	5.2
	Heineken*	Blond	5.0
Pivot 1	*Blend of the 5 beers*	/	/
Pivot 2	*Affligem*	*Blond*	*6.7*
Pivot 3	*St Omer*	*Blond*	*5.0*
Set 3	1664	Blond	5.5
	Carlsberg	Blond	5.0
	Heineken*	Blond	5.0
	St Omer	Blond	5.0
	Stella Artois	Blond	5.2
Pivot 1	*Blend of the 5 beers*	/	/
Pivot 2	*Jupiler*	*Blond*	*5.2*

* The Heineken beer was presented two times to the assessors within Sets 2 and 3 (compared to Pivot 1 each time) to assess the repeatability of the method.