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MODELLING THE INTERDEPENDENCES BETWEEN BRAND LOGO DESIGN AND CONSUMERS' PERCEPTIONS REGARDING BRAND PERSONALITY DIMENSIONS

Abstract. The paper studies the interdependencies between the brand logo design and customers' perception regarding brand personality dimensions. We propose a classification of retailers' brand logos in three groups, based on the type of retailer: mainstream, discount or specialized. Our regression analysis results show statistically significant differences between how consumers perceive brand personality of retailers pertaining to a different group. This proves that retailers do actively adapt their brand logo design in order to position themselves in relation to their direct competitors. However, there are statistically significant differences between our theoretical grouping of logos and the grouping generated through K-means analysis. We thus prove that there are potentially several other factors besides the brand logo which influence consumer perceptions of brand personality similarity, such as brand salience and pre-existing brand associations.
Keywords: brand logo design; brand personality dimensions; brand positioning; machine learning; cluster analysis.
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1. Introduction on literature review

A basic aspect in substantiating marketing strategies is understanding the profile of potential consumers, in order to be able to identify and target the most profitable consumer segments. Information regarding the personality of target consumers is particularly important in the development of marketing strategies, as the dimensions of consumer personality influence their attitude, preference and choice towards certain services /products (Kim et al., 2005).

The compatibility between brand personality and customers' personality generates positive feelings, which will positively influence brand attachment, brand satisfaction, brand preference and will also strengthen the long-term relationship with the brand (Kim et al., 2005; Jamal and Goode, 2001). This personality compatibility also better allows consumers to use brands as a relevant means of self-expression and as a lifestyle "beacon" (Munteanu and Pagalea, 2014).

Therefore, it is essential to define and understand the concept of brand personality correctly, and also to identify the instruments through which brand personality can be influenced by marketers. We further clarify these theoretical aspects.

According to the definition given by the American Marketing Association (2017), the brand represents "a name, term, sign, symbol or any other element with the role of identifying the goods or services of one seller and to differentiate them from the competition". The essence of the brand consists in the set of mental associations that the consumer makes in connection with a name, sign or symbol that represents a product or service. In the absence of these associations, the brand name remains a simple identification element. The visible part of the brand is represented by the name, logo and marketing communications. Integrated marketing communications consist of "the strategic coordination of all messages and media used by an organization to influence its perceived brand value." (Duncan and Everett, 1993). However, the profound, „hidden" associations of the brand are related to the positioning of the brand on the competitive market, the personality of the brand, the culture behind it and the basic skills of the organization behind the brand (De Chernatony, 2010).

Brand personality refers to the totality of human traits reflected by the brand, which the consumer deduces from all direct and indirect experiences with the brand (Heding et al., 2016). Based on these human traits reflected by the brand, the consumer develops expectations about the brand's behaviour and about his future relationship with the brand. Brand personality can positively influence the number, uniqueness, power and relevance of consumer associations about the brand, their attachment to the brand, customer satisfaction and loyalty, as well as the quality of the long-term relationship with the brand (Freling and Forbes, 2005; Malär et al., 2011; Park and Lee, 2005).

Brand personality can be communicated through all the components of the marketing mix. Brand personality can be influenced by a number of elements, such as brand name, the symbols associated with the brand, product category, attributes of marketed products, advertising style, price or distribution channel (Batra et al., 1993). In particular, brand logo design has been shown to influence the perceived brand personality (Grohmann, 2008; Bajah and Bond, 2018).

Several discussions have been raised as to which human personality traits can rightfully pertain to a brand personality scale and how these traits can be measured correctly. One of the most used models of brand personality (Aaker, 1997) reveals that brand personality can reflect both personality traits held by the consumer (sincerity, enthusiasm, competence) and aspirational traits (sophistication and power). However, only the first three dimensions of the brand personality scale developed by Aaker (1997) correspond to the Big Five model of human personality. Azoulay and Kapferer (2003) point out certain disadvantages of Aaker's scale, which does not strictly measure brand personality as defined in psychology, but rather assesses "any non-physical attribute related to the brand." Therefore, measuring brand personality through the classic Big Five model could provide a more effective tool for drawing a parallel between the brand personality and the personality of target customers. Mulyanegara et al. (2007) identify the existence of such a parallel between customer personality dimensions and brand personality dimensions, as measured by the Big Five model. However, the original Big Five scale items are not entirely suitable for measuring brand personality (Caprara et al., 2001), and may be interpreted differently for different brands. Therefore, this paper seeks to adapt the Big Five dimensions of the human personality so as to reveal the parallel dimensions of brand personality.

The Neuroticism-Extraversion-Openness Personality Inventory (NEO PI), developed by Costa and McCrae (1988) is a largely used personality questionnaire based on the Big Five personality dimensions. The revised version, NEO PI-R, defines the Big Five factors very similarly to lexical studies, with slight differences. The Openness dimension emphasizes the central features of the desire to examine new ideas, to explore the imagination, and to try new things. NEO PI-R also considers the role of intellectual capacity, considered to be a distinct personality characteristic (Ashton, 2013).

The logo design of any organization aims to reflect the organization's mission, values and performance. Although complex logos are more difficult to process than simple logos, logo complexity is a signal of innovation, uniqueness, originality and can thus positively affect buyers and stakeholders' attitudes and behaviours towards the brand (Van Grinsven & Das, 2014; Mahmood et al., 2019). Brand logo design has been shown to influence the perceived brand personality (Grohmann, 2008; Bajah and Bond, 2018), but the existing research in this domain is still scarce.

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2. Methodology and instruments

The paper studies the interdependencies between brand logo design and customers' perception of brand personality dimensions. The central objective of this paper is to verify the following three hypotheses:

Hypothesis 1: Brand logo design has a significant impact on customers' perception regarding brand personality dimensions, in terms of the proposed retailer groups, depending on the category in which the logos fall;

Hypothesis 2: There are significant differences between the considered brand logo groups in terms of how customers perceive brand personality dimensions;

Hypothesis 3: The theoretically-based groups of logos are significantly different from the groups of logos generated by the K-means clustering method used in the data mining area.

We further present the data and tools involved in testing the above hypotheses, the obtained results, the conclusions and directions for future research.

We conducted the study by using a survey and an online questionnaire. The questionnaire items were designed by taking into account the dimensions and subdimensions of the NEO PI-R, using the variant with 300 questions. Items were adapted from the International Personality Item Pool website in the version translated by Iliescu et al. (2015) after Maples et al. (2014). The items related to customers' perception of brand personality dimensions were selected to reflect a parallel with the dimensions of human personality, but were adapted in the context of purchasing products / services under a certain brand logo.

The questionnaire includes selected questions related to the 5 personality dimensions within NEO PI-R (Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness), adapted to study the brand personality dimensions. Neuroticism highlights respondents' tendency to act impulsively towards the brand. Extraversion evaluates the brands' capacity to evoke stimulation, activism and assertiveness. The Openness dimension evaluates the degree to which the brand logo evokes pleasant aesthetics, imagination, adventure, diversity and positive values. Agreeableness measures subdimensions related to trust, honesty and modesty, while Conscientiousness evaluates competency, professionalism and stability perceptions.

The questionnaire items for the 14 selected logos were structured as follows: 5 questions for socio-demographic information on: age, gender, level of completed studies, income, social context of the purchasing process (items 1-5), 5 items for the Neuroticism dimension (items 6-10), 5 items for the Extraversion dimension (items 11-15), 13 items for Openness (items 16-29), 4 items for Agreeableness (items 30-34) and 4 items for Conscientiousness (items 35-38). Items 6-38 are repetitive and are associated with each logo considered. The brand personality construct was statistically validated, with a Cronbach Alpha internal

consistency coefficient of 0.987 for the brand personality as a whole and with Cronbach alpha > 0.7 for each personality dimension.

Respondents are customers who regularly purchase desired goods from retailers. Sampling involved the random selection of subjects (individuals) from the statistical population, each subject having the same probability of being selected. The sample size was 60 people. The gender structure of the respondents was: 45% male respondents and 55% female respondents. The participants were informed that the storage and processing of data will be done by protecting personal data confidentiality.

We studied brand personality in the context of the main FMCG retailers with a physical presence on the Romanian market. The FMCG retail market main formats included were mini-markets, supermarkets, hypermarkets, cash&carry, etc.

In order to test Hypothesis 1, we optimized the representation of the interdependence between brand logo design and customer perception of brand personality in a multitude of applicable models: deep neural networks, logistic regressions, models, assemblies or a subset of these. To do this, we used the OptiML option within the BigML software, which implements advanced data mining methods and algorithms, on the data set resulting from the respondents' answers to our previously proposed questionnaire. OptiML involves the automation of model selection at a higher level, the selection being made within the set of advanced data mining methods, in easy representation of the reality within the data. In other words, OptiML will find the best model of supervised learning for the considered data, in order to solve regression or classification problems. The performance metric in the selection of the optimal method is found in the F test or in the ROC (Receiver Operating Characteristics) curve.

The OptiML algorithm involves two phases. In the first phase, also called the search phase, a predefined data set is used to iteratively find reliable sets of parameters, e.g. those that meet the required criteria. The second phase consists of Monte Carlo Cross-Validation for those parameters for which the error values are minimal. The validation phase involves, iteratively, new divisions in the training / testing process so that the best models will usually have more evaluations associated with them, taking into account the argument that specifies the maximum allowed training time. During the execution of a phase, if an interruption is generated, BigML will interrupt normal execution after the completion of the current instruction and will handle the interruption through debugging procedures. These interruptions are used to avoid polling and are the foundation of pre-emptive multitasking on a single data set system.

When the process is complete, a list of the best models is returned so that they are comparable and the model that best fits the intended goal can be selected. Consequently, the model with the highest coefficient of determination is the best, this being applied to verify the first hypothesis discussed in this paper.

In order to test Hypothesis 2 and to model the behavioural prediction equations, the problem of grouping the logos of retailer brands into significantly

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distinct groups was raised. We assumed that retailers of the same type will seek to outline a similar brand personality through their logo, in order to position themselves properly in relation to direct competitors. This assumption is supported by Miceli and Pieters (2010), who demonstrate that copycat brands tend to imitate visual attributes and themes of their main competitors in order to be perceived similar to them by consumers and thus be considered a sound alternative. At the same time, we assumed that respondents tend to classify visually similar logos into similar categories (Fuchs and Diamantoupoulos, 2012), identifying as a result similar personality traits of the brands represented by similar logos. We selected 14 international retailers, with visibility in Bucharest, which were classified according to the category they fall into: traditional mainstream retailers (Group 1), discount retailers (Group 2) and stores specializing in traditional and / or natural products (Group 3). To confirm / refute this hypothesis, we used the One-Way Anova test, available in the SPSS statistical module.

In order to validate Hypothesis 3, we used an unsupervised learning method, namely the K-Means Algorithm, as it has the following advantages: it is efficient (the algorithm stops after a small number of iterations), the K-means procedure has an insignificant degree of sensitivity to the problem of cluster initialization and also a high degree of accuracy. The K-Means Cluster algorithm uses Euclidean distance, and the prior standardization of variables is important. The algorithm consists in the initial random fixation of the class centers (the number of classes being known) and then the steps are repeated: 1) assigning each case to the nearest center; 2) updating the centers as average values of the elements belonging to the respective class until relatively few elements change their cluster. Thus, after running the algorithm in SPSS, the groups obtained will be compared with the groups proposed in this paper and the percentage of similarity will be decided in order to validate / invalidate the third hypothesis.

Last but not least, using the MathLab development environment for numerical calculation and statistical analysis, we provide the impulse responses of the information on the division of brands into the 3 groups generated by clustering, both at the learning phase and at the iteration level.

3. The results of the study on the interdependence between brand logo design and customers' perception regarding brand personality dimensions

We present the results of the study, obtained after data processing using SPSS and BigML modules, specific to supervised and unsupervised learning.

The messages sent by the logos in groups 1 and 2 (see figure 1) have generated perceptions of average and above average values of the five brand personality dimensions of NEO PI-R. In contrast, the logos in group 3 have created perceptions of brand personality dimensions with values below the threshold value

2. This reveals the potential ineffectiveness with which brands in the category of
specialized retailers convey their brand personality through their logos.

Figure 1. The effect of brand logo design on brand personality dimensions

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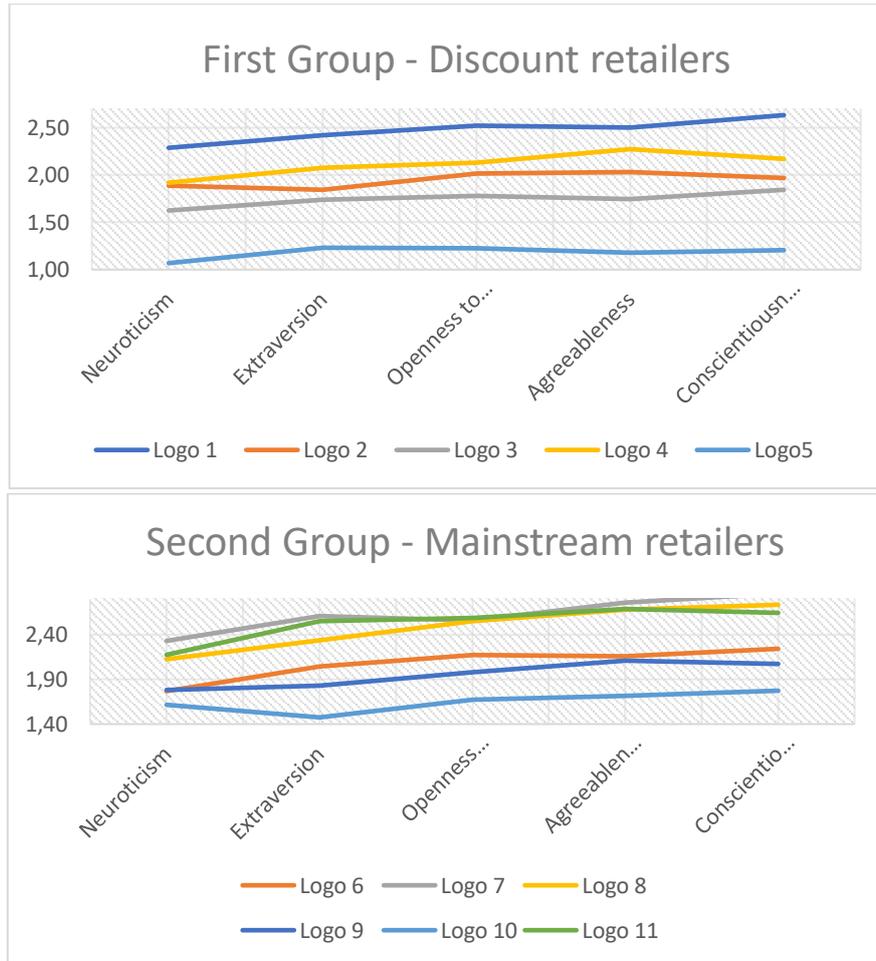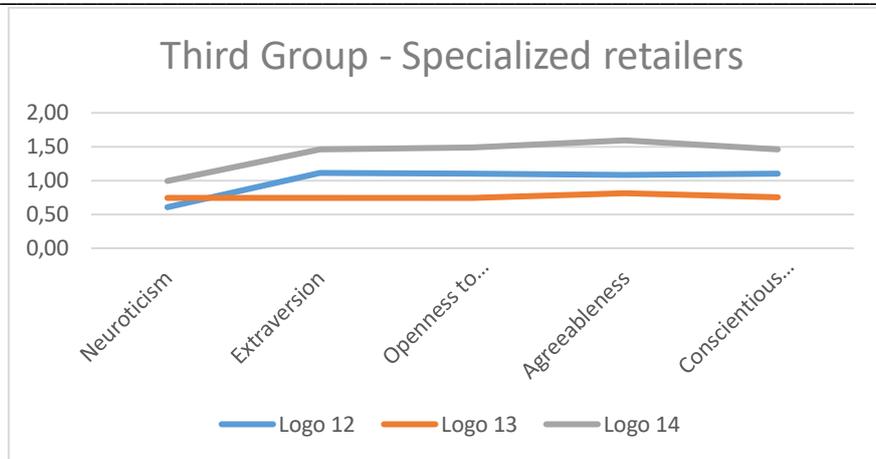
The brands in Groups 1 and 2 are perceived as having a relatively high Openness to Experience and thus as offering a high level of novelty and diversity. Neuroticism was a destabilizing element in relation to consumer decision-making strategies, at the level of the three groups analyzed and has generated the lowest scores per brand. Less known brands seem to have lower levels of neuroticism, suggesting that lack of information and uncertainty about the brand increases the perceived risk and makes consumers less likely to be impulsive when buying products under these brands. Agreeableness and Conscientiousness usually had higher values than Extraversion and Openness to Experience, especially in the mainstream retailer group.

One can also notice that the five brand personality dimensions in Group 2 obtained overall higher scores, and there exists a more pregnant differentiation in between the five dimension scores, as opposed to the more linear scores of Group 1 and Group 3.

BigML, using the OptiML algorithm, generated 49 possible models (1 multivariate linear regression, 42 sets of combined models (neural networks, regressions, etc.), 4 cross-models and 2 models estimated to be deep learning). According to the performance metrics, it turned out that the multivariate linear regression model is the best estimated model for highlighting the interdependence between brand logo design and customer perceptions regarding brand personality, in terms of proposed groups, depending on the category in which the logos fall.

The coefficient of determination has a value of 0.9977, which shows that the brand logo design has a significant impact on customer perceptions of brand personality dimensions in terms of the proposed groups, depending on the category in which the logos fall. Under these conditions, *Hypothesis 1* of this paper is confirmed.

The group associated with traditional mainstream retailers has significant value impulses, unlike the other two groups. Traditional mainstream retailers show

a significant degree of instability, as evidenced by the migration of 80% of the components into other new clusters, generated by SPSS (see Figures 2 and 3).

Following the testing with One-Way Anova, it emerged that there are significant differences between the three logo groups, groups which have been created based on type of retailer: traditional mainstream retailers, discount retailers and stores specialized on traditional and/or natural products (p-value < 0.01, F test values > F test table value). By virtue of the above, *Hypothesis 2* is confirmed.

Following the application of the K-Means algorithm, SPSS returned the data presented in table 1. Table 1 shows the division into groups/clusters of the logos, generated with the K-Means algorithm, in comparison to the logo groups we proposed based on theoretical grounds, e.g. logos specific to traditional mainstream retailers (group 1), discount retailers (group 2) and stores specialized in traditional and/or natural products (group 3).

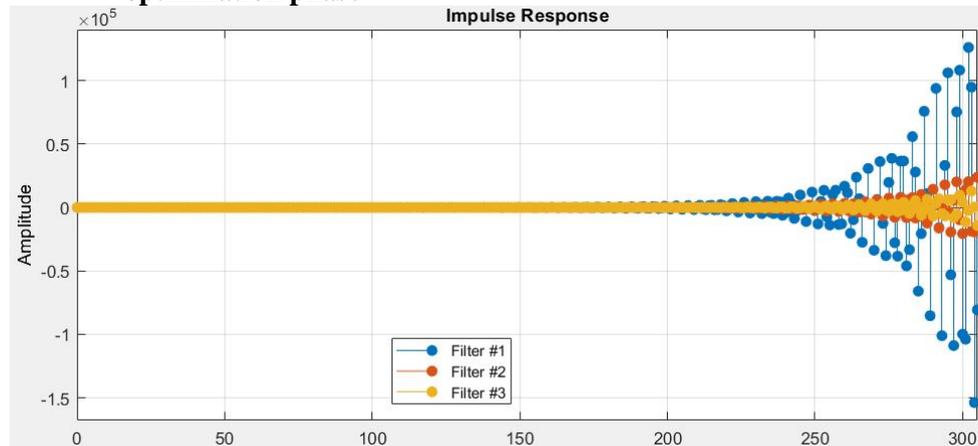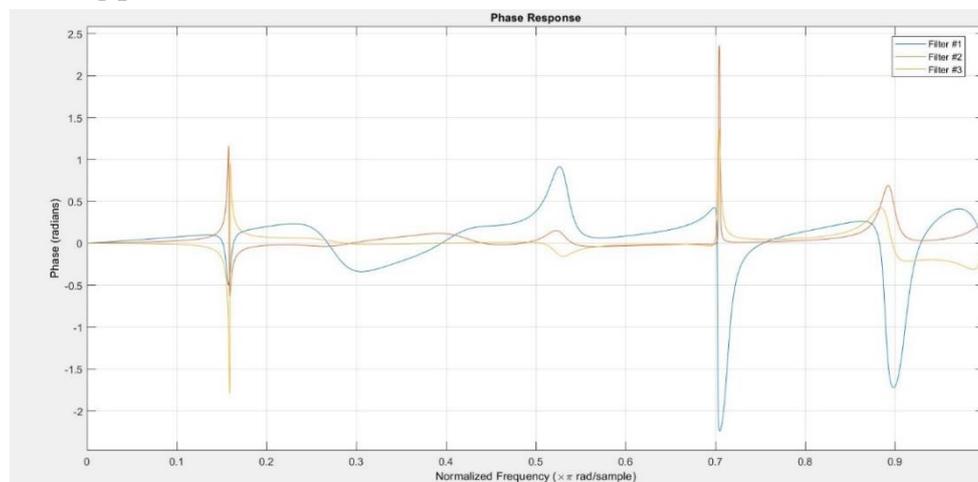**Figure 2. Informational response of the three groups to impulses in the optimization phase**

Figure 3. Informational response of the three groups to impulses in the learning phase

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According to Table 1, 92.86% of the logos were regrouped into new clusters. All stores specializing in traditional and / or natural products, considered in Group 3 have migrated to a new group that also contains a logo from the category of traditional mainstream retailers, which means that the new cluster-generated Group 2 is the improved form of the proposed Group 3. On the other hand, 60% of the discounter logos in the proposed Group 1 are reorganized together, in the cluster-generated Group 3. The cluster-generated Group 1 is based on 50% of the logos specific to traditional mainstream retailers, pertaining to the originally proposed Group 2. Therefore, the K-means clustering method has generated groups of logos which are significantly different than our proposed theoretically-based groups of logos. Hypothesis 3 is thus confirmed.

Table 1. Division of logos into groups / clusters, generated with the K-Means algorithm versus theory-based clusters, generated by the type of retailer

Logo	Cluster generated with the K-Means algorithm	Theoretical clusters based on the type of retailer: traditional mainstream retailers (group 1), discount retailers (group 2) and stores specializing in traditional and/or natural products (group 3)
Logo1	1	1
Logo2	3	1
Logo3	3	1
Logo4	3	1
Logo5	2	1
Logo6	3	2
Logo7	1	2
Logo8	1	2
Logo9	3	2
Logo10	3	2
Logo11	1	2
Logo12	2	3
Logo13	2	3
Logo14	2	3

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4. Discussion, conclusions and directions for future research

The validation of Hypotheses 1 and 2 firstly proved that consumers do make very specific and distinct brand personality inferences based on the brand logo design. Secondly, we proved that consumers do indeed classify brands in accordance to logo similarity and that retailers pertaining to the same category tend to actively use similar logo designs, in order to position themselves similarly in relation to direct competitors. By visually analysing the validated groups of logos, proposed according to retailer type, we can indeed observe several design similarities.

First of all, we notice that the logos of discount retailers have a full background, which uses bright colours, like red or yellow, while the mainstream retailers have transparent, white backgrounds and similar blue and red symbols. These observations rightfully explain the perceived similarity of logos belonging to Group 1 and 2, respectively, because "using positive or negative shapes has been shown to be very effective for logo similarity matching" (Soffer and Samet, 1998). The specialized retailers in the third group have in common stylised elements of natural symbols, in opposition with retailers in Groups 1 and 2, who mostly use abstract symbols in their logos. Natural logos are perceived differently than abstract logos (Machado et al., 2015; Zhu et al., 2017), which could also justify why the group of specialized retailers was perceived distinctly by consumers.

Secondly, we also noticed that in Group 2 brand personality dimensions obtained higher scores, while the 5 scores themselves are more visibly differentiated (notably, Openness to Experience and Agreeableness are generally higher than Extraversion). These high and differentiated scores could reflect the fact that consumers are better able to perceive real differences in the brand personality dimensions, based on the brand logo and their prior brand experiences. This could be caused by the fact that brand logos of mainstream retailers (Group 2) have a more complex design than those of discount retailers (Group 1). Complex logo design has been shown to positively impact brand attitudes on the long term, while simple logo design has higher effects on brand recognition and recall (Van Grinsven & Das, 2014). Therefore, a more positive brand attitude could explain the increased brand personality scores for the more complex logos of mainstream retailers. While the complex logos of mainstream retailers transmit emotionality through various pictograms, the more basic logos of discount retailers transmit simplicity and a more uniform brand personality. However, simpler brand logos have been shown to encourage an increased consumption for food products (Bossel et al., 2019). Thus, the simple logos of discount FMCG retailers might actually communicate a „more for less" rationale, encouraging consumers' economic behaviours of buying larger quantities at smaller prices.

Thirdly, logo simplicity might also influence consumers' perceptions of brand in different ways, in accordance to the retailer category where the brand positions itself. Interestingly, in the mainstream retailer group, the simplest brand

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logo was perceived with the lowest brand personality scores, while in the discounter group, the simplest logo had the highest score. This might be justified by consumers' expectations regarding each type of retailer. Thus, having a simple logo, but being positioned through transparent backgrounds in the mainstream retailer group could have the downside of being perceived as offering less value and diversity than consumers expect from mainstream retailers.

These similarity perceptions between brand logos pertaining to the same type of retailers can have important managerial implications. For retailers entering the market, it may be very important to position themselves similarly to their direct competitors in terms of logo design, in order to be perceived as a strong enough alternative in the market. A more simple logo on a transparent background when entering the market could favour brand recognition, recall and similarity perceptions with the other mainstream retailers (Van Grinsven and Das, 2014), but could limit the market share the brand will be able to achieve. Therefore, newly entered mainstream FMCG retailers might need to consider updating their logos in time, by adding complexity to their logos. On the other hand, leading retailers may also try to adapt their existing logo to a more modern design, in order to differentiate themselves from followers and to maintain a fresh, unique brand personality. It is thus important for established retailers to determine the appropriate time to rejuvenate the logo design, by analysing emerging competition, as well as the evolution of consumer perceptions (Müller et al., 2013).

It also appears that consumers perceive their own personalities are more similar to those of mainstream retail brands than of discount retail brands (Willems and Swinnen, 2011). Thus, leading mainstream retail brands may wish to further emphasize strong emotional connotations of their brand through logo design, strongly positioning themselves on Openness to Experience. Contrarily, discount retailers might capitalize on consumers' practicality and position themselves as the sound alternative to more expensive retailers, thus cleverly emphasizing Conscientiousness and Agreeableness traits in their logos.

On the other hand, the validation of Hypothesis 3 reveals that retailer brands cannot be divided exclusively based on retailer category and thus on logo similarity. It appears there are several other influencing factors which lead to brand personality similarity perceptions, which are mainly related to brand equity (Keller, 2013).

Group 2, generated by OptiML, also includes, in addition to the logos specific to stores specialized in traditional and / or natural products, a logo specific to discount retailers. This might be justified by the fact that both this discount retailer and the specialized stores have a lower brand salience than the other retailers included in the study. Therefore, consumers might have fewer mental associations in relation to the brands in Group 3 and could be filling this missing information with negative inferences, such as greater risk and less success on the market, and thus with less positive brand personality associations. Hence, it seems

that brand salience is the primary factor which leads to brand personality similarity perceptions. More salient and visible brands will tend to receive more favourable brand personality associations.

Thus, besides the logo design, the number, strength and positivity of consumers' prior brand associations will influence the perceived brand personality. When evaluating the brand's personality dimensions, it appears that consumers combine the instant information transmitted by the brand logo with the various information retrieved from memory regarding that particular brand, such as customer experience, product quality and variety, store atmosphere.

Consequently, as a managerial implication, it could be important for retailers to include in their logo design specific cues related to customer experience, product range and store atmosphere, which will more easily bring to memory customers' positive previous experiences with the brand.

We propose several future research directions. Consumer perceptions of brand logo similarity and brand personality similarity could also be studied in other retailer categories besides FMCG, such as technology, fashion apparel, home improvement, etc. In these retailer categories also, it is possible that direct competitors have adopted visually similar logos, which would lead to consumer perceptions of similar brand personalities. Moreover, it would be interesting to determine the degree to which consumers' perceptions of brand personality similarity are determined by their perceptions of brand logo similarity versus their prior brand knowledge and experience.

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