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Full Length Research Paper

The effect of the 'golden ratio' on consumer behaviour

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This paper evaluates the relationship between the "golden ratio" and consumer aesthetic preferences, and investigates its possible implementation into market offer. Due to the increasingly diverse offer to which consumers are exposed, each detail of the offer should be in the function to attract consumer's attention. These requirements increase the importance of design. Package design should facilitate the raise of 'usual' products to the level of 'unusual' products. Different forms of frontal sides of packages were created in the proportion of the golden ratio for research purposes. By setting simple geometric shapes, with the absence of colors and other elements which may distract consumer's attraction, a solution was created with the aim to direct the attention to proportional ratio of both the package form and graphical solution, instead of other visual elements. The achievement of "commercial beauty" as simultaneous effect of "aesthetic beauty and economic good" is also important from the aspect of our study. It is about different effects, products, services and relationships in mass consumer culture. This research offers answers to the question of consumer preferences related to package design based on the proportion of the golden ratio.

Key words: Marketing, consumer behavior, the golden ratio, aesthetic preferences.

INTRODUCTION

Today, business activities take place in a rapidly and radically changing environment. The world is turning around very fast as an overstretched and long-detained spring was observed recently. Since 20th century, the 'global framework' of management and marketing in general is in the process of constant innovation, searching for forms and methods of an improved understanding of consumer's needs.

Recognizing the fact that management is clearly a science where renowned individuals are only those who are able to link theory with practice, this paper was written as an effort to determine the connection between the golden ratio and consumer's aesthetic preferences and study the possibility of its implementation towards market offer.

Is the golden ratio an immortal concept of ideal proportions? After two thousand years of research and inspiration throughout history, inspired by the golden ratio, it is still being re-explored while still inspiring and fascinating. How many more research is needed in order to prove the value of this relationship, or perhaps the golden ratio will turn out to be nothing more than a specific ratio?

Golden ratio, golden section, golden mean, (Livio, 2002; Piotr, 1996; Richard, 1997), divine proportion, divine section (Latin: section divina), golden proportion, golden cut, (Summerson, 1963), golden number - these are all terms describing the relation that is called 'the golden ratio'. The golden ratio is often denoted by the Greek letter *phi,* usually lower case (φ). It is difficult to say with certainty when mankind discovered and implemented the "golden ratio" (the golden ratio is an "irrational mathematical constant", approximately 1.6180339887), but the assumption that "some or many aspects of the golden ratio were found, then lost many times, only to be rediscovered again" seems realistic. The belief that the Egyptians were using the golden ratio in the design of large pyramids and that the Greeks based the whole interior design of the Parthenon on golden ratio provides a possible explanation for the amazement of mankind with these structures. Medieval churches and cathedrals are designed in a way very similar to the way it was done

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by Greek architects. *Notre Dame de Paris,* the western façade which design is based on the golden ratio, is one of the most famous cathedrals in Middle Ages. Architect of the interior of Chartres Cathedral (constructed between 1194 and 1260) is unknown, but it is the "personification of the golden ratio."

What attracts most attention is the question, to what extent the golden ratio is an ideal proportion? What is the influence of the golden ratio on visual perception? Is searching for the ideal beauty essential to human beings? How much could answers to these questions help us to understand better consumer behavior?

THEORETICAL FRAMEWORK

Throughout history, regardless of whether they studied or produced beauty, many authors, including philosophers as well, were searching ideal beauty. Like any great idea, the idea of beauty also has its historical precursors. From ancient philosophers and the introduction of the concept of eurhythmy (a kind of symmetry: if the symmetry is defined as the "harmonic agreement arising from parts of a totality", eurhythmy can also be defined as harmony; a harmony of an object with viewer's senses instead of harmony of several pieces of an objects) through the Middle Ages and the Renaissance, Thomas Aquinas defined beauty in *Summa theologiae* as, *Pulcra enim dicuntur quae visa placenta* – beautiful things are those which please when seen and Francis Bacon defined imagination as a sector of the mind which "is not bound by the laws of reality – matter, and can link what is split by the nature and recognize what is merged by the nature ..." (Monroe, 1985). British philosophers of the 17th century ..., the idea of aesthetics, taste and beauty was in the area of subjectivity. "The word 'beauty' indicates the ideal principle... Beauty indicates the perception of consciousness ..." (Hutcheson, 2004).

Beauty (*kallos* in Greek, *pulchrum* in Latin, *beautiful* in English, *schön* in German..) is "derived and used in a wide range of naming and judging not only nice things, shapes, colors, sounds, but also thoughts, practices" (Tatarkijevic, 1978). In English dictionary, there are a number of terms defining the things we are speaking about: beautiful, lovely, pretty, handsome or fair. It is obvious that 'beauty' has many names and faces. What is important for our research is the so called "*commercial beauty*". It is about different effects, products, services and relationships in a mass consumer culture - beauty is related to food, clothing, transportation, hygiene, nice body, nice living environment, entertainment, tourism and so on. "Commercial beauty is both *aesthetic beauty* and *economic good* in the same time related to mass consumption and the use in daily life" (Fisk, 2001). Whether it is a detergent, clothing, car or a TV clip, web page design..., "commercial good can be defined as the 'aesthetic' of mass communication of goods in the field of intersection of economic and life expectations ..." (Suvakovic, 2010). What seems to be the key conclusion regarding "*commercial beauty*" is the association of 'aesthetic' and 'economic' values with the everyday living, revealing that "the aesthetic value is being constructed in the field of power of economic value, because in today's world, economic power is the dominant form of power" (Suvakovic, 2010). We will extend these considerations with the following opinion of Richard Price: "It seems beyond doubt that there are objects with a natural suitability to be liked or not liked, because there is a necessary agreement and disagreement between them and the consciousness that perceives them (contemplating mind)" (Price, 1969). This attitude is highly important to the main topic of this paper, which is – the impact of the golden ratio on consumer perception, and thus on consumer behavior.

Is the golden ratio a concept of the ideal proportion and how is it characterized? Euclid (born: fl.300BC; died: unknown), in his book *Elementis* (Greek: Στοιχε□α), writes about "division of a distance to an extreme and mean ratio forming thereby the golden ratio with the language of mathematicians". A straight line is said to have been *cut in extreme and mean ratio* when, as the whole line is to the greater segment, so is the greater to the less" (Euclid, 1996). This book marked the beginning of a new way of thinking "based on empirical thought." Fibonacci reveals the particularity of a number sequence - Fibonacci sequence (0, 1, 1, 2, 3, 5, 8, 13, 21 ...), though there is no information about his understanding of the relation between this sequence and the golden ratio. Leonardo da Vinci used the golden ratio to determine the basic proportions of his paintings *The Last Supper* and *Mona Lisa* (Livio, 2008). There are reasonable assumptions that Leonardo da Vinci was the first who called it "divine proportion" (*sectio aurea*), which is Latin term for the golden ratio. Leonardo da Vinci's illustrations of polyhedral in *De Divina Proportione* (*On the Divine Proportion*) and his views that some bodily proportions exhibits the golden ratio have led some scholars to speculate that he incorporated the golden ratio in his paintings (Hart, 2002).

Keppler revealed the association of Fibonacci sequences and the golden ratio. The German mathematician Martin Ohm was the first who formally used the term "golden ratio" to describe "this wonderful proportion" – in the notes in his book *Die Reine Elementar-Mathematik*, from 1835. The long list of artists who, explicitly or implicitly, applied the golden ratio in their works is far from being completed. In the first half of the 19th century, Gustav T. Fechner, a pioneer of experimental psychology, conducted a series of studies inspired by the golden ratio and its influence. He is known for his experiment with measurements related to rectangle items (books, boxes, buildings), concluding that most people like rectangular shapes containing the golden ratio. Fechner writes: "Some shapes or ratios, taken by themselves,

may surpass others in being more pleasurable. Yet they are never used in volition, but combine with neighboring shapes or relations, either of the same object or of the environment, or with shapes inscribed in the object itself or crossing it. Each shape, each ratio is codetermined in the impression it produces, by a direct or associative relation to other forms and ratios, which are apprehended together with it... This I have called codetermination by combination" (Arnheim, 1996).

Without an attempt to list all famous and important names associated with the golden ratio, we will point out the idea of Le Corbusier that "industry needs a system of proportional dimension that would match the needs of the human body and the beauty of the golden ratio ...", creating the so called *Modulor* concept (Le Corbusier, 1999). In response to Le Corbusier's description of the concept, Einstein wrote that it was "the measure of proportions that counteracts the appearance of poor, and facilitates the appearance of good."

"In the world that, over two and a half centuries, has reached an amazing level of knowledge based on the principles of logic and rational thinking ... we are faced with the physicists' recognition that instead of knowledge, the actual key to discover the unique principle is experience... The reason for the importance of changes is that now that we begun to study the golden ratio, we must remember that one of its most important aspects is the relation when we include ourselves and the world around us into the equation" (Hemenway, 2009).

Over time, the study of golden ratio has been not confined only to mathematics and geometry, but it also exists as a research and study inspiration in other fields: biology, arts, music, history, architecture, psychology, medicine, etc. Weiss and Weiss (2003) analyzed psychometric data and theoretical considerations and concluded that the golden ratio underlies the clock cycle of brain waves. In 2008, this was empirically confirmed by a group of neurobiologists (Roopun et al., 2008). In 2010, the journal *Science* reported that the golden ratio is present at the atomic scale in the magnetic resonance of spins in cobalt niobate crystals.

Facts about the existence of the golden ratio in the structure of human organism, as well as in the structure of plants and animals, suggest that the golden ratio is something that shapes us. Does our mind prefer this relationship that we are made of? Do we strive to identify ourselves with something that is similar to us or we search for something that is different from us? Is it possible to reconcile this contradiction into harmony, or we will always prefer one or the other? We as human beings perhaps subconsciously seek the ideal. Since we have a sense of vision and process visual experience cognitively and emotionally, psychology, as a science, helps us to clarify the doubts we have regarding proportion and the golden ratio.

In his essays on psychology of arts, Rudolf Arnheim said the following on proportions: "…One of the basic visual experiences is that of right and wrong. In particular, the partitions of lines or other linear distances, and the shape of rectangular surfaces or bodies impress us not only as whit they are but also by telling us whether or not they are what they ought to be" (Arnheim, 1996). He believes that some form of a house, shape of a shelf or picture frame can actually indicate the need for change, either expansion or shrinkage, in order to improve the experience of perception. Correctness is not a static but a dynamic state, while faultiness is interpreted as a struggle against the liberation from the sense of dissatisfaction. "Well - balanced shape is a main source both of the harmony found in many products of nature and man and of the pleasure given by that harmony" (Arnheim, 1996).

The ability to estimate spatial relationships is derived from our learning, that is, someone has taught us what is good, however, at the same time, this state of things may impede our curiosity. It follows that, by relying solely on the learned values, we can hardly accept, understand and appreciate works of art of other individuals or civilizations, regardless to how much it agree with what we prefer. "Other cultures have different ideas about ideal proportions. In parts of sub-Saharan Africa, for example, length of the neck – as seen in the sculptures that inspired Picasso and Matisse at the beginning of the 20th century - is valued above other physical attributes. The Japanese have a system of proportion called "tatami", named after the rice-straw floor mat "(Pipes, 2008).

All these facts indicate that it is necessary to set a different theory, to change the 'angle' of observation. To better understand the impact of proportional relations, we should start from the assumption “that properties, inherent in the perceptual patterns themselves, impinge upon us and largely account for our reactions". Every human being and every organism has general biological needs that require clarity and simplicity for the orientation, balance-seeking and cohesion for the sake of serenity and well-functioning, and variety and tension for stimulation. "The proportion of the golden ratio in which the smaller part is related to tin-larger as larger is the sum of both, and which yields a ratio of roughly 8:5 - may successfully combine unbreakable unity with lively tension" (Arnheim, 1996). Balance as a general principle arises from the perceptive response, which is not related to the imposition of general needs, but is the result of the tendency that governs the functioning of organisms in a variety of physical and mental levels. "The psychology of motivation interprets human striving as a need for balance; but balance is also assumed to govern the physiological forces organizing the processes of vision in the brain. Therefore, when we assert that the need for balance is at the root of the sense of proportion, we concede a rather broad organic base to that *sense*" (Arnheim, 1996).

The application of the golden ratio in the applied arts can be seen in design of books, graphic design, wide

screen televisions, postcards, posters, photography and industrial design. Package design consists of the form, that is, the structural and graphic solution of packing. Proportional relationship as a fundamental principle or rule in art and design is just one part that the package (package appearance) can influence. Complexity of the package consists of form functionality, the material of which it is composed, and the visual elements contained on the packing. Other than the function which refers to the fact that it should contain, protect and preserve the product, packaging has a role of visual communication between producers and consumers. "Through a comprehensive design methodology, packaging design uses many tools to solve complex marketing problems. Brainstorming, exploration, experimentation, and strategic thinking are some of the fundamental ways that visual and verbal information is shaped into a concept, idea, or design strategy. Through an effectively resolved design strategy, product information is communicated to the consumer. Visual problem solving is at the core of packaging design.

The goal is not to create design that are purely visually appealing since packaging designs that are solely aesthetically pleasing do not necessarily achieve marketable results. Creatively accomplishing the marketer's strategic objective through an appropriate design solution is the primary function of packaging design (Klimchuk and Krasovec, 2006).

In the book "Marketing communication: a brand narrative approach," Dahlen et al. (2010) believe that "the effects is strongest for relatively serious product categories and usage context. There is also a relationship between package ratio and market share for frequently purchased consumer goods (tested for cereals, cookies, detergent and soaps). For cookies and cereals (less serious categories) packages that are close to a square have higher market share. For detergent and soap (more serious package), packages with clear rectangular ratios have higher market share".

Due to the increasingly diversified offer to which consumers are exposed and the fact "that 53% of purchase is done on impulse ..." (Kotler and Keller, 2006), every detail of the offer should be in the function of attracting consumer's attention. These requirements increase the importance of design. Package design should allow 'usual' products to raise their level of 'unusuality'.This research offers answers to questions regarding consumer's preferences related to the design of package, based on the proportion of the golden ratio.

RESEARCH METHODOLOGY

Stimuli

Different forms of frontal sides of packages were created in proportions of 1:1.618 (golden ratio) for this study.

Simple geometric shapes and surfaces were also set against each other in the proportion of the golden ratio (all forms in the second position in Figures 1, 2, 3 and 4 and all forms in Figure 5).

To enable comparison, frontal sides of other packages were also created, but in proportion 1:1.2, where all elements were also arranged in the given proportion 1:1.2, which is not the golden ratio (all forms in the first position in Figures 1, 2, 3 and 4).

By placing a simple geometric shape and by the absence of color and other elements that could distract consumer's attention, a solution is created in order to precisely focus the attention on the proportions, both of forms of packaging and the graphic solutions, instead of other visual elements.

Procedure

Each respondent was given a pair of stimuli (Figures 1, 2, 3 and 4), followed by all shapes of the golden ratio (Figure 5), with the task to opt for the shape that they prefer (the most).

They were suggested to come to a decision as soon as possible so we could talk about the state of 'first impression', but the respondents' individual needs during exposure to the stimuli were respected, so that the next stimulus was presented only after the response.

Research variables

Independent variables in our study were gender, age, the golden ratio and the shape; the dependent variable was the preference of our respondents

The sample of respondents

The study included 200 respondents: 48% male (96) and 52% female (104). Respondents were selected at random and voluntarily participated (Table 1).

The average age of our respondents was 32.3, the average age of male respondents was 35.57 and female respondents 29.27. There is a bit of higher variation in the age of male respondents (SD = 21.352).

RESULTS AND DISCUSSION

Research results

The first part of the research process consisted of the analysis of the impact of gender on preference of stimuli pairs. According to Table 2, our respondents generally prefer geometric patterns with the proportion of the golden ratio (56.4%) more than those where the golden ratio is absent (43.6%). As to gender, this tendency is almost identical: 56.8 vs. 43.2% of male respondents and 56 vs. 44% of females. If we look at preferences by stimuli, it can be seen that only in the third pair of stimuli (Figure 3) the shape containing the golden ratio (58.5%) is more preferred than the shape without the golden ratio (41.5%).

Regarding gender, there is also an identical tendency in the third pair of stimuli: 53.1 vs. 46.9% of male respondents and as much as 63.5 vs. 36.5% of females is in favor of the shape without the proportion of the golden ratio. Therefore, both men and women prefer the triangle when it is without the golden ratio. The greatest

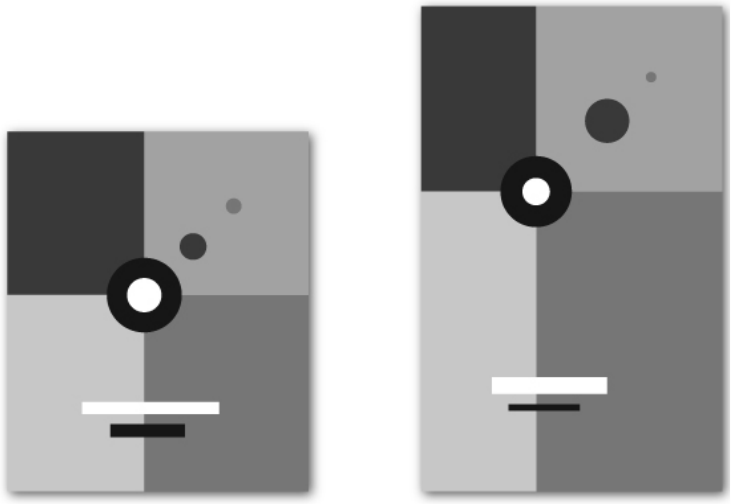


Figure 1. The first pair.

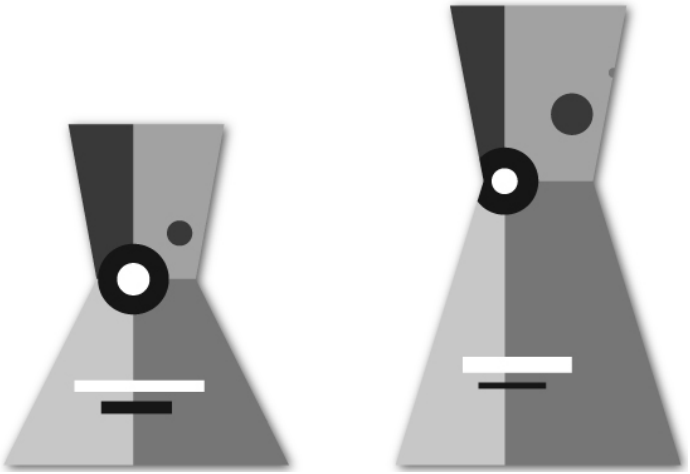


Figure 2. The second pair.

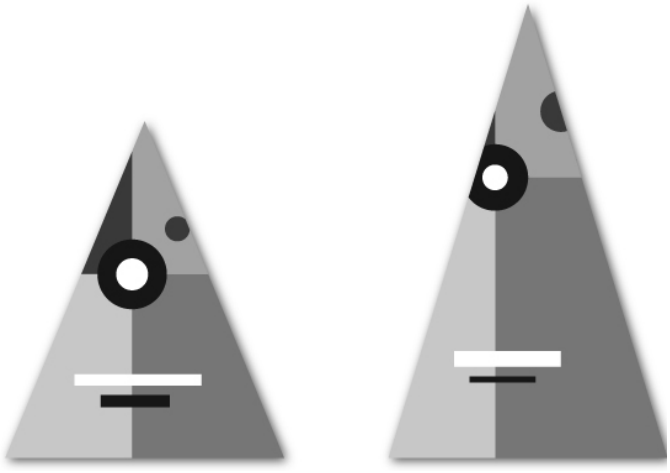


Figure 3. The third pair.

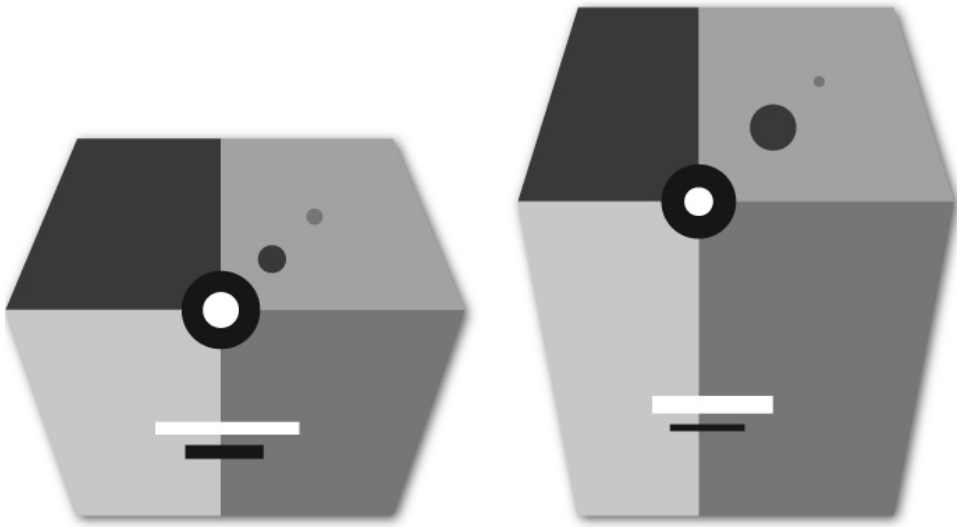


Figure 4. The fourth pair.

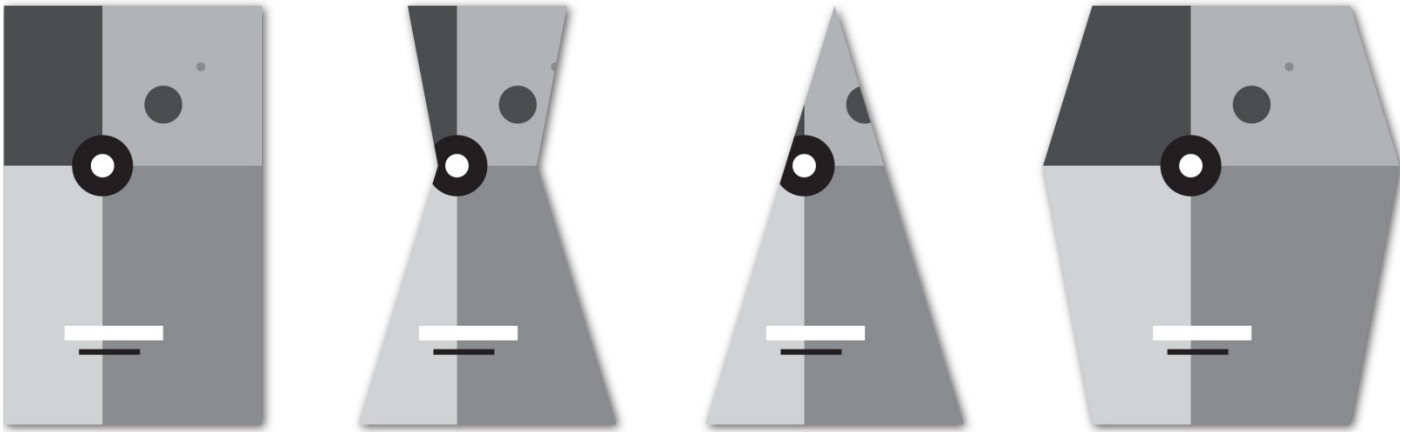


Figure 5. Stimuli containing the proportion of the golden ratio.

Table 1. The respondents' gender.

Gender		Frequency	Percent	Valid percent	Cumulative percent
	Male	96	48.0	48.0	48.0
Valid	Female	104	52.0	52.0	100.0
	Total	200	100.0	100.0	

preference of golden ratio is shown on the fourth pair of stimuli (hexagram) and generally, it is 66 vs. 34% and also by gender (63.5 vs. 36.5% of males and 68.3 vs. 31.8% of females).

According to Table 3, gender generally effects the preference by the criteria – contains the proportion of the golden ratio or not (chi square = 26.648, p = 0.000), and this effect among female respondents is chi square =23.444, p = 0.000, while among adult male respondents it is absent (chi square = 5.815, p = 0.121). The research showed that there is the golden ratio effect existing on stimulus preference which is in favor of the golden ratio, except for the third pair of stimuli (a triangle) where the situation is actually reversed. It turned out that women

Table 2. Stimuli*preference*gender crosstabulation.

Gender				Preference		Total
				Normal	Golden	
Male	Stimuli	First pair	N	40	56	96
			%	41.7	58.3	100.0
		Second pair	N	40	56	96
			%	41.7	58.3	100.0
		Third pair	N	51	45	96
			%	53.1	46.9	100.0
		Fourth pair	N	35	61	96
			%	36.5	63.5	100.0
	Total		N	166	218	384
			%	43.2	56.8	100.0
Female	Stimuli	First pair	N	42	62	104
			%	40.4	59.6	100.0
		Second pair	N	42	62	104
			%	40.4	59.6	100.0
		Third pair	N	66	38	104
			%	63.5	36.5	100.0
		Fourth pair	N	33	71	104
			%	31.7	68.3	100.0
	Total		N	183	233	416
			%	44.0	56.0	100.0
Total	Stimuli	First pair	N	82	118	200
			%	41.0	59.0	100.0
		Second pair	N	82	118	200
			%	41.0	59.0	100.0
		Third pair	N	117	83	200
			%	58.5	41.5	100.0
		Fourth pair	N	68	132	200
			%	34.0	66.0	100.0
	Total		N	349	451	800
			%	43.6	56.4	100.0

Table 3. Chi-square tests.

Gender	Value	df	Sig.
Male			
Chi-Square	5.815	3	0.121
No. of valid cases	384		
Female			
Chi-Square	23.444	3	0.000
No. of valid cases	416		
Total			
Chi-Square	26.648	3	0.000
No. of valid cases	800		

Table 4. Stimuli*preference*age.

Stimuli	Preference	Mean	Std. deviation	N
	Normal	28.22	16.928	82
First pair	Golden	35.13	21.476	118
	Total	32.30	19.985	200
	Normal	28.22	16.928	82
Second pair	Golden	35.13	21.476	118
	Total	32.30	19.985	200
	Normal	24.40	13.511	117
Third pair	Golden	43.42	22.290	83
	Total	32.30	19.985	200
	Normal	21.91	15.404	68
Fourth pair	Golden	37.64	20.015	132
	Total	32.30	19.985	200
	Normal	25.71	15.694	349
Total	Golden	37.39	21.363	451
	Total	32.30	19.948	800

Table 5. ANOVA Stimuli*preference*age.

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	33290.000	7	4755.714	13.233	0.000
Stimuli	1606.358	3	535.453	1.490	0.216
Preference	28008.719	1	28008.719	77.934	0.000
Stimuli*preference	5525.878	3	1841.959	5.125	0.002
Error	284636.380	792	359.389		
Total	1152300.000	800			
Corrected total	317926.380	799			

are more sensitive to the existence of the proportion of the golden ratio in the stimulus than men.

In general (Table 4), older respondents (37.39) prefer shapes containing the golden ratio. As for the stimuli pairs, the situation is the same, with the biggest difference in the third pair of stimuli (triangle): the average age of respondents who prefer a triangle containing the golden ratio is 43.42, while those who prefer a triangle without the golden ratio is 24.4. Thus, as to the triangle and golden ratio, we can even talk about some kind of generation gap. According to Table 5, there is a statistically significant difference in the relationship between respondent's age and the preference to the golden ratio in the shape ($F = 77.934$, $p = 0.000$). Thus, older respondents prefer the shape that contains the golden ratio. When considering the relationship between the shape and the respondents' age, there is no statistically significant difference in the respondents' age and the shapes they prefer ($F = 1.490$, $p = 0.216$). However, the research showed that there is an interaction between shapes and preferences, that is, our preference to the golden ratio depends on the shape where it is contained ($F = 5.125$, $p = 0.002$). Thus, to obtain statistically significant differences in age, both shape and golden ratio should be combined.

In general (Table 6), it can be seen that respondents mostly prefer the hexagram that contains the golden ratio (36.5% of total respondents) and the least the triangle that contains the golden ratio: only 13% of total respondents.

When regarding gender, the situation is identical: a slightly higher percentage of women (14.4%) than men (11.5%) prefer the triangle containing the golden ratio. Men like more, the square containing the golden ratio (24%) than women (19.2%), and, in addition to the triangle containing the golden ratio, women also like the other

Table 6. Preference for shapes containing golden ratio by gender.

Variable			Shape				Total
			First form	Second form	Third form	Fourth form	
Gender	Male	No.	23	27	11	35	96
		%	24.0	28.1	11.5	36.5	100.0
	Female	No.	20	31	15	38	104
		%	19.2	29.8	14.4	36.5	100.0
	Total	No.	43	58	26	73	200
		%	21.5	29.0	13.0	36.5	100.0

Table 7. Chi square – gender.

Variable- Gender	Value	df	Asymp. Sig. (2-sided)
Chi-square	0.905	3	0.824
No. of valid cases	200		

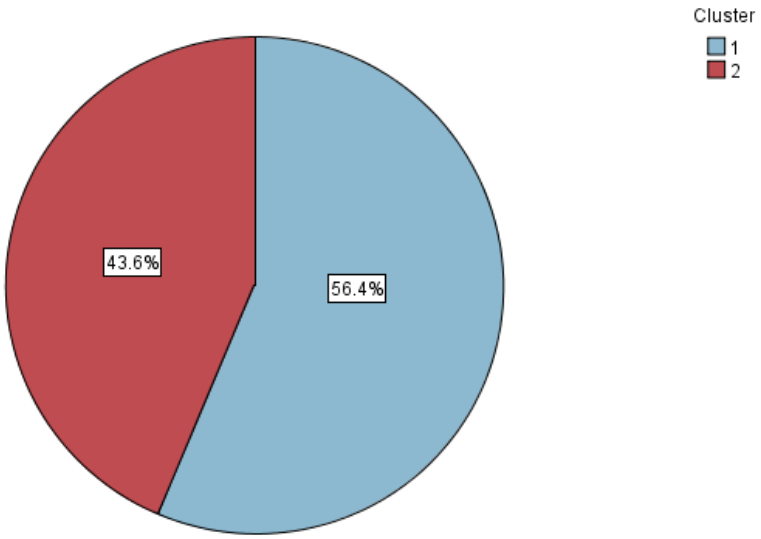
Table 8. Average age and preference for shape containing golden ratio.

Shape	Mean	N	Std. deviation
First form	23.19	43	10.901
Second form	37.07	58	21.310
Third form	11.42	26	6.622
Fourth form	41.30	73	18.772
Total	32.30	200	19.985

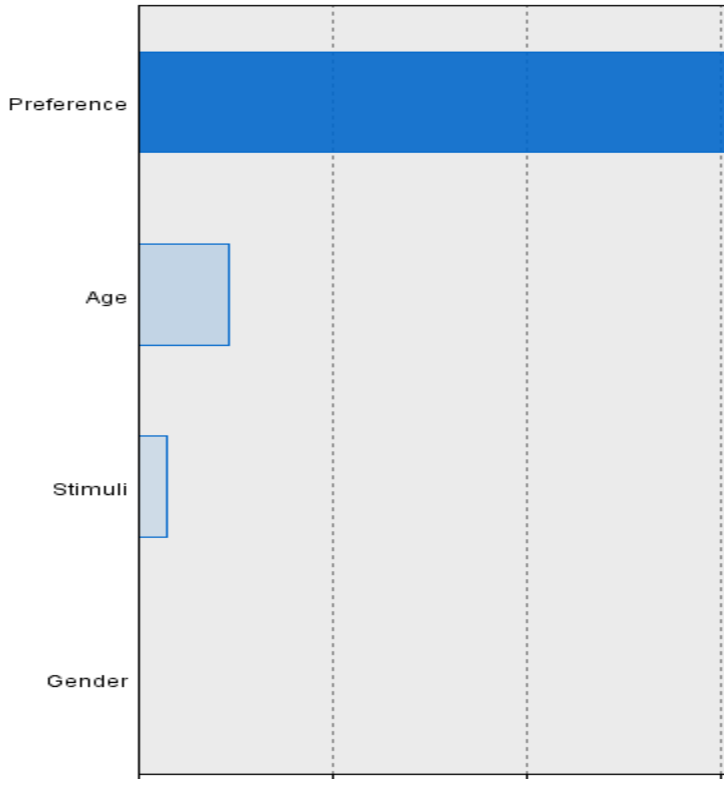
Table 9. ANOVA Average age and preference of shape containing the golden ratio.

Variable			F	Sig.
Age * Shapes	Between Groups	(Combined)	25.222	0.000

shape (Figure 2) containing the golden ratio (29.8% women vs. 28.1% men). According to Table 7, there is no influence of gender on the preference to shapes containing the golden ratio (chi square = 0.905, p = 0.824). Thus, the differences we found in the preference of shapes containing the golden ratio (the most popular is the hexagram and least popular is the triangle) are not gender-specific. According to Table 8, our youngest group (11.42) consists of respondents who prefer the triangle with the golden ratio, while the oldest group (41.30) consists of those who prefer the hexagram with the golden ratio. The difference in age between these groups is statis-tically significant (F= 25.222, p= 0.000). Thus, the pre-ference of the shape containing the golden ratio is in the function of age; simple shapes are preferred by younger age Table 9 (the triangle, followed by the rectangle, the form showed in Figure 2 and the hexagram). In order to identify specific marketing implications, the study applied the cluster analysis (two-step cluster analysis) on the obtained data. First, we will show clusters of respondent behavior regarding the presence or absence of the golden ratio in the shape that is the subject of preferences. According to Graph 1, two groups of respondents can be distinguished regarding the preference of golden ratio in the shape based on the variables that were the subject of our research. Clusters are approximately equal in size. According to Graph 2, the most important criterion for cluster formation is the preference itself (presence and absence of the golden ratio in the shape). Here, the age of respondents, the

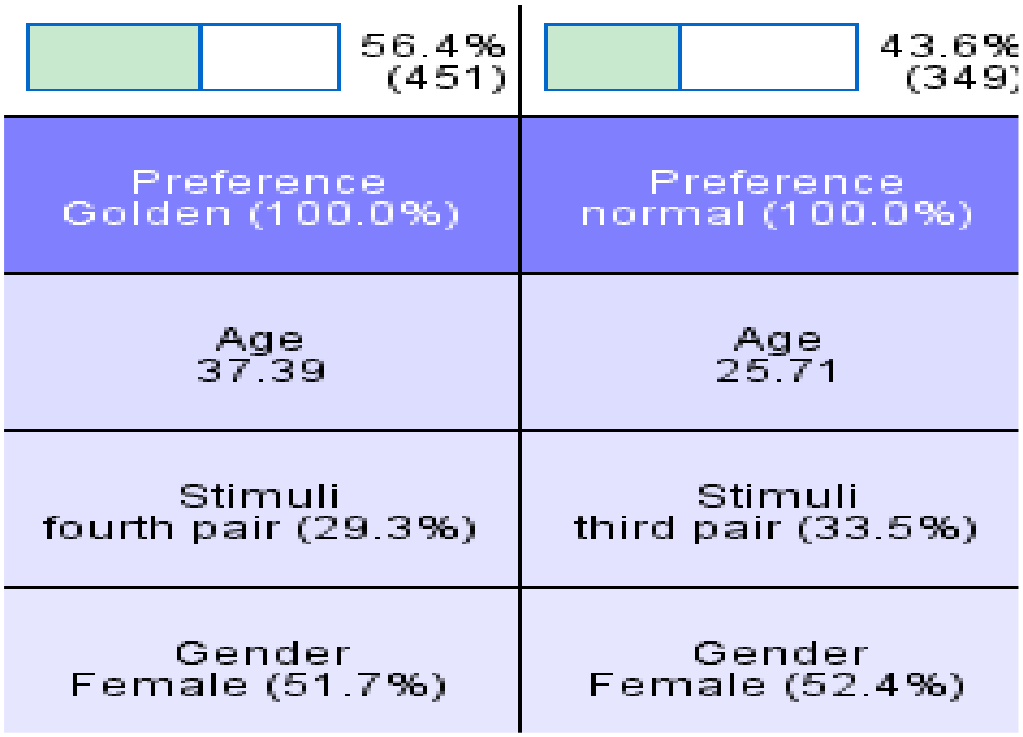


Graph 1. Cluster size.

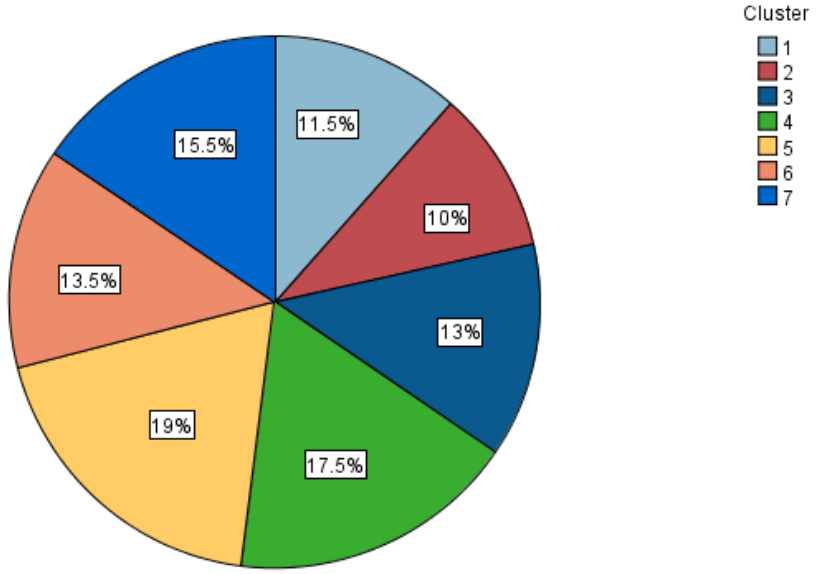


Graph 2. The importance of criteria for cluster formation.

shape and the gender were of small relevance. Graph 3 shows the clusters described by given criteria. The first cluster or the first group of respondents (56.4% of total respondents) consists of respondents who prefer only the golden ratio in the shape; their average age is 37.39 and older, and they mostly like the hexagram containing the golden ratio. The number of female respondents is slightly higher (51.7%). The second cluster (43.6% of total respondents) consists of respondents who prefer shapes without the golden ratio; their average age is



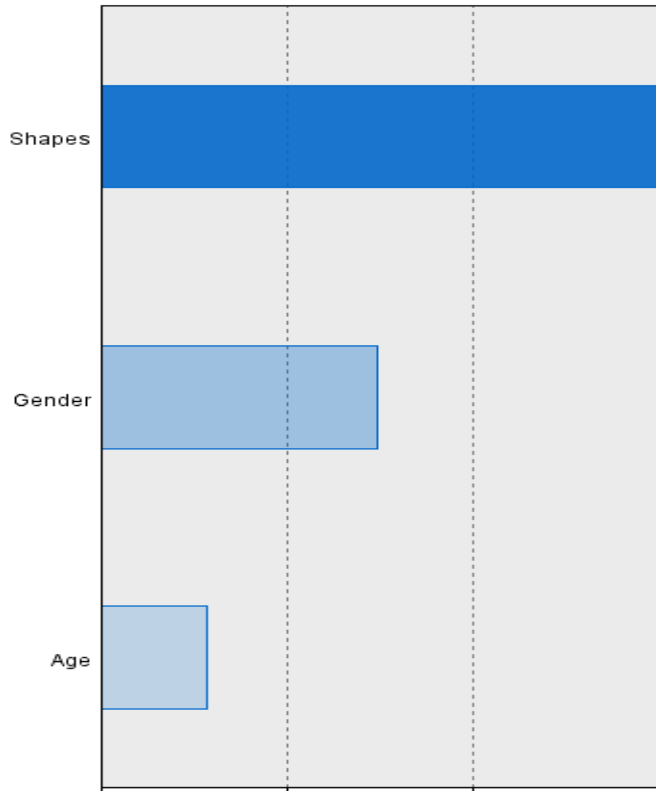
Graph 3. Clusters described by the given criteria.



Graph 4. Cluster size.

25.71, they mostly like the triangle without the golden ratio. In this cluster number of female subjects is slightly higher.

Regarding preferences of shapes containing the golden ratio, our respondents can be grouped into seven clusters (Graph 4). According to Graph 5, the preference of shapes containing the golden ratio depends on the shape itself, to a small extent on gender, while age only plays a minor role. According to Graph 6, the first group of respondents prefers only the hexagram containing the golden ratio; they are women of average age of 36.68 and they represent 19% of total respondents.



Graph 5. Importance of criteria for cluster formation.

19.0% (38)	17.5% (35)	15.5% (31)	13.5% (27)	13.0% (26)	11.5% (23)	10.0% (20)
Shapes fourth form (100.0%)	Shapes fourth form (100.0%)	Shapes	Shapes	Shapes third form (100.0%)	Shapes first form (100.0%)	Shapes first form (100.0%)
Gender Female (100.0%)	Gender Male (100.0%)	Gender Female (100.0%)	Gender Male (100.0%)	Gender Female (57.7%)	Gender Male (100.0%)	Gender Female (100.0%)
Age 36.68	Age 46.31	Age 32.58	Age 42.22	Age 11.42	Age 22.78	Age 23.65

Graph 6. Clusters by the given criteria.

The second group consists of respondents preferring the hexagram that contains the golden ratio; they are men of average age of 46.31 and they represent 17.5% of total respondents. The third group of respondents consists only of women preferring all shapes equally; their average age is 32.58 and they represent 15.5% of total respondents. The fourth group of respondents consists only of men pre-ferring all forms equally; their average age is 42.22 and they represent 13.5% of total respondents. The fifth group consists of the youngest respondents (11.42%) mixed by gender with morefemale students (57.7%) and they represent 13% of the total number of respondents preferring a triangle containing the golden ratio. The sixth group (11.5% of total

respondents) consists only of men preferring a rectangle containing the golden ratio; their average age is 22.78. The seventh group of respondents (10% of total respondents) consists only of women preferring the rectangle containing the golden ratio; their average age is approximately the same as those from the sixth group of respondents (23.65).

Conclusions

The research showed that the golden ratio generally affects consumer preferences of both male and female respondents. However, the 'triangle' is both for men and women more beautiful when built according to the principle of the golden ratio. The highest preference of golden ratio was on the fourth pair of stimuli (hexagram), regardless to the respondents' gender. Female respondents were more sensitive to the golden ratio inthe stimulus in comparison with males.

When considering the preferences for the shape of 'triangle' and the golden ratio, we could possibly talk about 'generation gap'. Namely, older respondents (age 43.42) prefer the shape of the triangle containing the golden ratio, while younger respondents (age 24.4) prefer the triangle without the golden ratio. Also, the research findings indicate that older respondents expressed the preference for shapes containing the golden ratio. However, when it comes to older participants, an extremely important observation relates to the necessity to combine the effect of shape and the golden ratio which significantly increases the appeal of product for older respondents. Marketing implications of these results are very interesting, that is, if we want to pack a product in a container which shape contains the golden ratio, we must take into account both the form of packaging and the age and gender of potential customers in order to achieve the strongest effect of preferences.

In addition to the stated preference of shapes containing the golden ratio, the most significant results show differences between younger respondents (children) and much older respondents. This indicates that research findings showed that children prefer more simple shapes-the shape of 'triangle' is followed by the shape of 'rectangle' and small number of complex forms, while older respondents prefer more complex shapes, for example, 'hexagram'. This phenomenon can be explained by Gestalt psychology, that is, according to the Gestalt principle, the primacy of perception belongs to the totality rather than to its parts. Thus, the perception is organized in sets formed by the experience ('learning to see'), through its enrichment, a perceptual experience can embrace an increasing number of stimuli (complex form) (Wolfgang, 1947; Sternberg, 1996), thus, the fact that young adult (children) consumers prefer simpler shapes should not be a surprise. Furthermore, there is a clearly profiled child-consumers' market, with its specific economic characteristics, and above all the specific way of meeting the needs, desires and participation in the process of consumption, it becomes apparent that for this market segment it is necessary to create a specific marketing strategy and a specific offer structure based on it. (World Population prospects, 2006). The fact that children's purchasing power increases worldwide (Lindstrom and Seybold, 2003; Evans and Toth, 2003) should not be overlooked as well. Furthermore, our research results seem to be more important when we consider the fact that children communicate highly visually, and the necessity to also review the aesthetic component of the product and its packaging. Marketing implications of these results are quite clear. Products aimed at older people should be packed in containers that have the shape of 'hexagram' containing the golden ratio (*complex and ornate*); products aimed at younger people, especially children's population, should be packed in 'triangle'-shaped containers, with the golden ratio (*simple and attractive*).

With the "commercial beauty" in mind, as well as the association of 'aesthetic' and 'economic' values in daily life, this study seems to be another step towards understanding this association. Obviously, as Richard Price would say: "It seems beyond doubt that there are objects with a natural suitability to be liked or not liked, because between them and the consciousness that perceives them (contemplating mind) there is a necessary agreement and disagreement."

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