Universiteit Utrecht

# The influence of symmetry on the recall performances of known brand logos

Bachelor thesis

(Liberal Arts and Sciences: Cognitive and neurobiological psychology, UU)

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## Abstract

**The aim of this thesis is to shed further light on the effects of visual brand logo (a-) symmetry on recall performances. The primary question of this thesis is: *Do people remember and recall known symmetric brand logos better than known asymmetric brand logos?* The primary prediction of this thesis is that exposure to visually symmetric (vs. asymmetric) brand logos will increase memory and recall performance. The experiment of this thesis consisted of two parts that were both executed in an experimental tool called OpenSesame. The aim of the first part was to distinguish which brand logos participants know and which not. The second part of the experiment established which brand logos the participants remembered and recalled.**

**Results of the second experiment suggest that symmetry does not increase recall performances in the brand logos task since the p value, that was found after conducting a repeated measure ANOVA analysis in R-studio, was bigger than 0.05 (F = 0.91; P = 0.347). Therefore there is no credible evidence that people remember and recall known symmetric brand logos better than known asymmetric brand logos and it is more evidential that the $H_0: \mu_1 = \mu_2$ is true. This result does not align with the previous given theories that structured (less complex) patterns are recalled better than complex patterns (Kemps, 2001). In further research a more and larger heterogeneous group should be assembled to give more reliable results with greater power and precision. Furthermore, there is a possibility that the brand logos used in this study were to easy and that the series in the first experiment were not long enough. Further research is needed to create a better understanding on visual brand symmetry since this research does not contribute sufficient enough to the acquisition of more knowledge. Lastly, the results of this thesis can be placed in a broader context within the field of artificial intelligence. AI solutions combined with knowledge on how consumers perceive brand logos could enable marketing researchers with the tools to provide a personalised brand logo to every individual. These personalized logos would them be so tailored to the individual's visual processes that branding becomes way more effective.**

**Key words: symmetry, visual processing, visual brand logos, recall performances, cognitive science, working memory, visio-spatial sketchpad, asymmetry**

# Table of contents

# 1. Introduction

Marketers have long realized that strong brands offer major competitive advantages. The way brands visually present themselves, i.e. through their logos, marketing and promotional material undoubtedly has an enormous effect on their effective branding (Henderson, Cote, Leong, & Schmitt, 2003; Bajaj & Bond, 2017). Key elements of such strong brands are an original and distinctive brand personality and a strong and well-designed brand logo (Keller, 1993; Jiang et al. 2016). Most firms therefore spent a substantial amount of their resources on a distinctive visual design, since it is widely known that successful brands are instantly recognizable because of their characteristic visual elements (Krishna & Schwarz, 2014).
By creating a distinguishable visual design, brands not only gain a positive attitude towards themselves, but also create a specific brand association, which is positively related to brand equity. A high level of brand equity is linked to a highly perceived brand quality, which leads to loyal consumers who choose a certain brand above other competing brands (Yoo et al. 2000; Bajaj & Bond, 2017).

Jennifer Aaker describes in her paper 'Dimensions of Brand Personality' that we can speak of brand association when a person is able to link a brand to a certain product category and associate the product to a certain product class (Aaker, 1997). Additionally, brand association involves associating different memories to that brand (Keller, 2003). For consumers to gain these brand associations it is imperative for them to first be aware of a brand (Aaker, 1997). These memories could be influenced and enhanced by the design properties of visual marketing stimuli, such as the colour, form and pattern of a logo (Luffarelli et al. 2019; Melawar & Saunders, 2000). For this thesis I define a logo as proposed by Salgado-Montejo et al. as a graphic design that may include an image, illustration, symbol or a text (Salgado-Montejo et al. 2014). Recently marketing research has focussed more on the importance of visual brand logo symmetry as an essential design factor (Bajaj & Bond, 2018, Marsden & Thomas, 2013).

With respect to visual brand symmetry researchers have examined what kind of effects symmetry has on brand equity and brand aesthetics (i.e. the way your brand looks, feels and is held memorable). Furthermore, studies have also focussed on the effects of visual design on other brand relevant judgments (Bajaj & Bond, 2017; Yoo, Donthu, & Lee, 2000; Loureiro, Lopes & Kaufmann, 2014). In addition a number of studies attempted to test the implications of mirror symmetry for memory processes. As in perceptual research, the general finding is that symmetrical patterns are recalled significantly better than non-symmetrical patterns (Howe & Jung, 1987).

Additional research examined how lower process fluency affects a subjective level of arousal. This research concluded that a lower process fluency, which is associated to asymmetric objects, leads to a psychological state of alertness or excitement and a higher level of subjective arousal (Blijlevens, Carbon, Mugge, & Schoormans, 2012). This suggests that both the dimensions of alertness and arousal are encoded in the initial information processing fase and that subjective arousal mostly affects long-term memory performance (Bajaj & Bond, 2017).

To the best of my knowledge, no study has examined the effects of brand logo symmetry on recall and memory processes. The aim of this current study was to shed further light on the effects of visual brand logo (a-) symmetry on recall performances. The primary question of this thesis is: *Do people remember and recall known symmetric brand logos better than known asymmetric brand logos?* This thesis hypothesis are formulated as follows: $H_0: \mu_1 = \mu_2$ and $H_1: \mu_1 \neq \mu_2$.

As suggested above, the results obtained in perceptual and memory research indicate that symmetrical patterns are recalled significantly better than asymmetrical patterns. However, the lower processing fluency of asymmetric objects leads to arousal and a state of alertness, which affects long-term memory performance (Blijlevens, Carbon, Mugge, & Schoormans, 2012). Given that there are two opposing theories about the effects of visual symmetry on recall and memory performances my primary prediction is that exposure to visually symmetric (vs. asymmetric) brand logos will increase memory and recall performance; therefore, brands will benefit from having a visual symmetric logo. This study intends to contribute to the existing body of knowledge by examining the effects of visual symmetric brand logos on memory and recall performance of customers.

The remainder of this paper is structured as follows: the next section presents the theoretical background on brain activity in response to visual stimuli and later on specifically brain activity in response to visual symmetric stimuli to give a general understanding on how visual (symmetric) stimuli processing works. Thereafter multiple models regarding our working memory will be presented and linked to visual stimuli processing and the effects of gestalt factors, such as symmetry, on stimuli complexity. Then this paper examines to what extent the perceptual fluency hypothesis has an effect on the processes that take place within the visuo-spatial working memory and what kind of stimuli fall within this hypothesis. The theoretical background part of this paper will end with examining to which extend arousal affects long-term memory performances and how this correlates with visual stimuli characteristics like symmetry. Thereafter, the methodology of the empirical study is described and the findings are presented. Subsequently, a general discussion and conclusion, including limitations and suggestions for further research, are drawn. Finally, this paper will describe the implications of the findings in relationship to artificial intelligence.

## 2. Theoretical Background

*Brain activity in response to visual symmetry*

To get a better understanding on how the brain processes visual stimuli and in particular (a-) symmetric visual stimuli this section will briefly discuss how visual stimuli processing works and which brain areas are involved and how these are associated to memory and recall performance. The processing of visual stimuli follows the route of the visual pathway.
The visual pathway is structured as follows: when light hits the retina it is converted into electrochemical signals by photoreceptor cells to be passed through a second layer and into the ganglion cells of the third layer of the retina. These ganglion cells assemble and identify information about visual stimuli such as contrast changes and colour. The resulting output from this assemblage is then send through the optic nerve to the lateral geniculate nucleus. The lateral geniculate nucleus then breaks the input from the ganglion cells into parallel streams. One stream contains information about the colour and fine structure of a stimuli and the other stream contains information about motion and contrast. The lateral geniculate nucleus consists of six layers of which the bottom two layers are called the magnocellular layers because the cells are relatively large compared to the cells of the top four layers, which are called the parvocellular layers. The cells of these two layers send their information to the primary visual cortex also known as V1. The cells in the primary visual cortex are arranged in such a way that allows the visual system to determine the location of objects in space. Furthermore the cells in the primary visual cortex are strongly activated by the position of a certain orientation. These cells therefore allow the primary visual cortex to distinguish the edges of objects in the visual world. While the primary visual cortex is improving its ability to detect lines and edges, the secondary visual cortex, known as V2, fine-tunes its colour interpretation abilities. Colour and form perception is then further processed in V3 and V4, while the inferior temporal lobe handles object and face recognition. Subsequently the parietal lobe processed spatial and motion awareness (Purves et al. 2008).

To better understand where visual symmetry processing comes in place a number of studies have researched the visual pathway to determine which brain areas are involved during visual symmetry processing. The processing of symmetric stimuli is known to be an automatic visual process that is a fundamental part of perceptual organization (Treder, 2010). The detection of symmetry is thus a visual process that is continuously applied to any given visual input and therefore affects how we see our visual surroundings (Treder, 2010).

To a certain extent, symmetry perception and its functional properties are well articulated, but its neurological basis is still mostly unknown and inadequately understood. Van der Zwan et al argued that the extrastriate areas, V1 and the binocular and monocular cells are involved in symmetry processing (van der Zwan et al. 1998). The extrastriate cortex is located next to V1 and encompasses multiple functional areas, including V3 and V4, where colour and form are also processed. The monocular and binocular cells integrate input from both the right and left eyes to create a perception of depth and orientation (Purves et al. 2008). However, the fMRI study done by van der Zwan et al. didn't find any symmetry specific activation in these earlier cortical areas during their dot pattern experiment, but the results suggested that simple cortical filters found in V1 could subserve symmetry detection (Van der Zwan et al. 1998). A follow up experiment found symmetry specific activity in more widespread network including V3, V4, V7 and the lateral occipital complex. This is in line with the research done by Treder who suggests that "symmetry detection is an automatic mechanism that applies to all visual input" (Sasaki et al, 2005).

Recently, researchers discovered that mirror symmetry in patterns or faces activates areas overlapping the lateral occipital complex, an area known for responding strongly to intact stimuli with clear shape interpretations (Grill-Spector et al. 2001; Chen et al. 2007). Recent studies researched the effects of transcranial magnetic stimulation (TMS) on perception of symmetry, because the authors argued that fMRI can only measure activity and therefore cannot provide substantial evidence for any causal relationship between brain areas and visual symmetric processing. Transcranial magnetic stimulation allows a temporary disruption and would therefore be more suitable for finding causality (Bona et al, 2014). A study done by Cattaneo et al, also focusing on the lateral occipital complex, found that bilateral disruption affected visual symmetry perception (Cattaneo et al. 2011).

As suggested above, both fMRI and TMS evidence suggests that visual symmetry is processed by a network of visual areas, rather than by one specific area. These findings are consistent with recent work that highlighted the role of prediction during visual processing.

A study done by Clark suggests that bottom-up connections convey the errors between predictions and actual sensory input that occurs during visual processing. Furthermore top down connections convey predictions about the state of our visual world (Clark, 2013). Since is has been suggested that the first responses to visual symmetric stimuli happens in high level areas, such as the lateral occipital, V3 and V4, knowledge about top-down connections is therefore key to understanding neural responses associated to visual symmetry processing (Joo, Boyton & Murray, 2012).

Concluding, functional neurological studies indicate that a network of high-level visual areas are involved in visual symmetry processing which occurs in a top-down matter. Even though this seems in contradiction to some psychophysical literature, which advocate that low-level filtering processes support symmetry detection, simple cortical filters found in V1 could explain this ambivalence (Van der Zwan et al. 1998). For this thesis it is important to understand the underlying neural processes that contribute to visual symmetry processing since it sets a basis for understanding recognition and recall performances during a memory task. These results suggest that visual symmetric brand logos are being processed in higher visual areas than asymmetric brand logos since symmetry strongly activates the lateral occipital complex (Grill-Spector et al. 2001; Chen et al. 2007). Research by Hayden and Gallant explored how high-lever areas participate in the perceptual working memory. Their results suggest that high-level neurons play a role in decision process that are essential for performing and making memory-based decisions (Hayden & Gallant, 2013). In order to get a better understanding on how symmetric brand logos are being processed and recalled knowledge of our working memory and memory-based decision-making needs to be further researched.

*Models of working memory*

Working memory consists of the retention of a small amount of information that can be held in mind and used in the execution of cognitive tasks (Baddeley, 1996); It facilitates planning, comprehension, reasoning, and problem-solving. The working memory system consists of a central executive and at least two additional subsystems, specifically the phonological loop and the visuo-spatial sketchpad. The central executive is responsible for controlling on-going processing (Baddeley, 1996); the phonological loop holds acoustically based information temporarily (Gathercole and Baddeley, 1993; Gathercole and Hitch, 1993), and the visuo-spatial sketchpad holds spatial and visual information, either internally generated by mental imagery or directly perceived, for brief periods of time.

Working memory often has to deal with complex memory span tasks, which are tasks that engage numerous parts of working memory and execute several processing demands that limits the use of for instance chunking. Chunking is the process of breaking down individual pieces of information and then group them together in a meaningful way. Since chunking is limited during a complex memory task the average span of the complex memory tasks is generally lower than in simple span tasks (Mathy, Checkaf & Nelson, 2018). Since the task in this thesis will consist of fifty brand logos that have to be remembered, this task can be seen as a complex memory span task. Multiple neurological studies suggested the need to make a distinction between the spatial and visual memory. Robert Logie therefore proposed a separation of the visual and spatial memory of the visio-spatial sketchpad and distinguished a visual cache, a dynamic rehearsal and retrieval. Logie suggests that the visuo-spatial sketchpad is not a perceptually based 'store', but visual information enters the sketchpad after it has been processed in our long-term memory (Logie, 1995).

These findings suggest that known brand logos, which will be used in this thesis, will enter the visuo-spatial sketchpad after they have been retrieved from our long-term memory. It is therefore important to explore the processing of visual symmetric stimuli in the visuo-spatial sketchpad. A new model on the visio-spatial sketchpad was formed when Pearson revised the work of Logie and included a functionally separate visual buffer in the visio-spatial sketchpad. This buffer is the medium in which conscious visual images are represented (Pearson, 2001). This model was put forward so as to avoid assigning the storage of conscious mental images and sequential visual patterns to a single representational medium. A further important feature of Pearson's model is that representations in the buffer can be generated not only from information stored in long-term memory but also loaded directly from the perceptual systems, suggesting that access to working memory can be through either perception or long-term memory. With regard to the capacity of visuo-spatial storage, the data suggest that it is limited by pattern complexity (Wilson et al., 1987; Logie et al., 1990). Research on complexity judgments of matrix patterns has in fact shown that the concept of complexity is determined by both a quantitative and a structural factor (Chipman, 1977; Ichikawa, 1985). Kemps states that "quantitative complexity includes aspects such as the number of elements in a stimulus and the size of a stimulus and that structural complexity is related to the redundancy of a stimulus". A stimulus is redundant if parts of it can be predicted from other parts. Gestalt principles including symmetry, continuation, and forms of regularity that establish redundancy (Kemps, 2001).

Concluding, these findings are important because they suggest that the brand logos used in this thesis will be processed by the visuo-spatial sketchpad after they are retrieved from long-term memory. Since the visio-spatial storage capacity is limited for stimuli that are structured more complex the hypothesis is strengthened, because symmetric brand logos are less complex than asymmetric brand logos and therefore take up less capacity in the visio-spatial sketchpad. For this reason one could assume that known symmetric brand logos are better recalled than asymmetric brand logos. These assumptions are strengthened by research done by Rachèl Kemps. Kemps explored recall performances of complex and simple sequences. The degree of complexity was determined by the three Gestalt principles as mentioned above: symmetry, repetition and continuation. Kemps discovered that structured (less complex) patterns where recalled better than complex patterns. Furthermore, Kemps showed that memory training and the creation of long-term memory representations increased the ability to recall complex paths to the same level as was initially observed for structured paths (Kemps, 2001). For the hypothesis of this thesis this finding is important to take into consideration, since it could positively affect recall performances of known asymmetric brand logos (i.e. complex stimuli). Based on these results Kemps suggested that the advantage of structured patterns could be the result of the involvement of long-term memory in the temporary holding of visuo-spatial patterns (Kemps, 2001). More specifically, Kemps suggested that long-term representations of the structure of simple sequences are evaluated during the process of retrieving sequences from the visuo-spatial sketchpad. The evaluation of simple sequences during the process of retrieving makes it easier for the visuo- spatial sketchpad to reconstruct these sequences when the capacity of the visuo- spatial sketchpad is exceeded (Kemps, 2001). This conclusion is therefore in line with the suggestion that the visio-spatial sketchpad can hold more items when the path holds some form of redundancy (i.e. is less complex).

*The perceptual fluency hypothesis*

Examining symmetry and its effects on visual processing from an evolutionary perspective strengthens the assumption that symmetric stimuli are process better, since they show us that symmetry is linked to a more trustworthy signal of mate quality (Grammer et al, 2003). This perspective is supported by the view that humans are in general more attracted to symmetrical bodies and faces (Rhodes et al. 1998, Bertamini et al. 2013 & Tovée et al. 2000). In addition to these perspectives preference for symmetry could also be explained by the perceptual fluency hypothesis. The perceptual fluency hypothesis proposes that fluent (i.e. easily) perceived stimuli are expected to be remembered better, regardless of actual memory performance (Rhodes & Castel, 2008). Earlier research showed that manipulation of perceptual fluency on stimuli could produce memory illusions, such as the belief that a fluent perceived stimulus is more likely to be a known item (Jacoby & Whitehouse, 1989. More recent research suggests that perceptual fluency stimulates another memory illusion: the illusion that a more fluent perceived stimuli is more likely to be remembered later on, despite the fact that ease of processing during encoding does not typically enhance later memory performances (Besken & Mulligan, 2013).  To examine this likelihood Rhodes and Castel performed an experiment in which they varied the font size of study words. They assumed that, in regard to the perceptual fluency hypothesis, a larger font would be perceived as more fluent and thus more likely to be recalled on a memory test. However the same amount of words (i.e. small font vs. large font) were recalled. Rhodes and Castel therefore concluded that the perceptual fluency hypothesis produces an illusion during memory encoding, inducing the belief that a stimuli would be easier to recall later on the basis of its current ease of perception (Rhodes & Castel, 2008). Although these results suggest that perceptual fluency plays a role in meta-memory (i.e. the knowledge of one's own memory capabilities) it contradicts the assumption that fluent stimuli are better recalled. It could therefore assume that the perceptual fluency hypothesis has no effect on the processes that take place within the visuo-spatial working memory even though the same kind of stimuli fall within this hypothesis.

Summarizing, theoretical background on neurological studies indicate that a network of high-level visual areas are involved in visual symmetry processing which occurs in a top-down matter. Research done by Hayden and Gallant suggest that high-level neurons play a role in working memory and decision processes that are needed to perform memory-based decision-making. Results found after examining working memory suggest that brand logos used in this thesis will be processed by the visuo-spatial sketchpad after they are retrieved from long-term memory. Since the visio-spatial storage capacity is limited for stimuli that are structured more complex the hypothesis is strengthened, because symmetric brand logos are less complex than asymmetric brand logos and therefore take up less capacity in the visio-spatial sketchpad. For this reason one could assume that known symmetric brand logos are better recalled than asymmetric brand logo. Furthermore the perceptual fluency hypothesis proposes that fluent perceived stimuli are expected to be remembered better, but has no effect on the processes that take place within the visuo-spatial working memory. This suggests that perceptual fluency does not have any effect on recall performances of known symmetric brand logos.

The experiments that follow are designed to explore the possibility that known symmetric brand logos are better recalled than known asymmetric brand logos. I chose to use OpenSesame for this thesis, because this tool allows me to do various tests and it is easy to use. The experiments will first distinguish which brand logos are known to the participants and which are not, to make sure that all logos that will be counted for are freely retrieved from long-term memory (Katkov, Romani, Tsodysk, 2015). All brand logos that participant evaluate as not known will be excluded from the final analysis. If these logos are not dropped there could be a change that bias for certain logos arises, which could affect the results. The aim of the second experiment was to establish which brand logos the participants remembered from experiment one and which brand logos not. This thesis predicts that most brand logos in part one will be known to the participants and that part two therefore consists of enough data to evaluate. Furthermore this thesis predicts that participants will recall more symmetric brand logos than asymmetric brand logos in the second experiment.

The chosen symmetric brand logos all conform to mirror symmetry guidelines set by Turoman et al. These researchers defined mirror symmetry as “symmetry around a plane that divides a figure into two identical images” (Turoman, Velasco, Chen, Huang, & Spence, 2017). Lastly, the second experiment consists of twenty-five new logos, which have been chosen by the researcher based upon their similarity with logos from the first experiment.

## 3. Experiment 1

The aim of the first experiment was to establish which brand logos the participant know and which brand logos not. The reason this has to be determined is to avoid bias for certain logos. All brand logos that participant evaluate as not known will be excluded from the final analysis.

### 3.1 Methods

### 3.1.1 Participants

Thirty-seven Dutch participants all known by the researcher participated. Age ranged from 18 to 56 years (mean [M]= 24.08; standard deviation [S.D.]= 6.804). Level of education ranged from VWO to WO.

### 3.1.2 Stimuli

Brand logos could be symmetrical or asymmetrical. Experiment 1 consists of twenty-five symmetric brand logos and twenty-five asymmetric brand logos. All brand logos images were resized to 320 x 320 pixels. Whereas the width was standard 320 pixels and the length was variable up to 320 pixels depending on the brand logo. Examples of a symmetric brand logo and asymmetric brand logo are shown in figure 1.

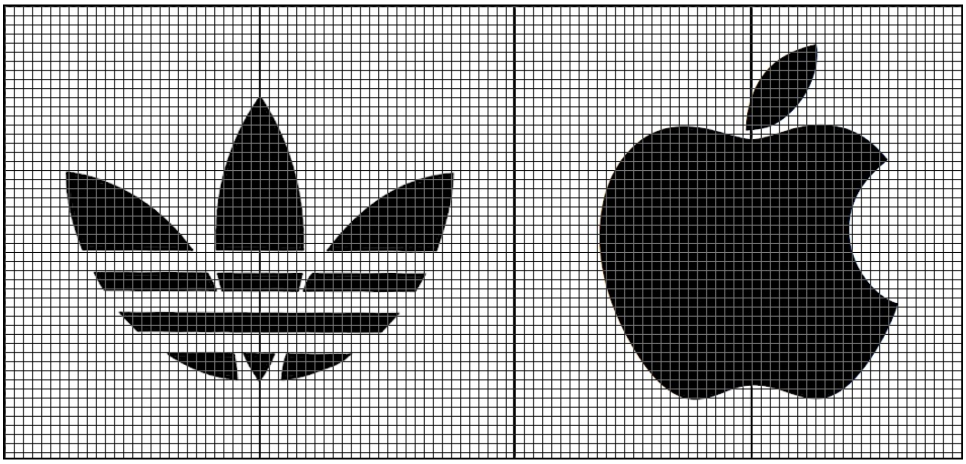

Fig 1. Examples of symmetric and asymmetric brand logos (left: symmetric, right: asymmetric).

### 3.1.3 Procedure

Subjects were tested individually in a quiet room.  Both experiment 1 as well as experiment 2 where executed through the program OpenSesame. Participants were given instructions about the first experiment through a formed consent screen. After they have read the instructions and clicked on the participate button the experiment immediately started. Participants where shown a random series of fifty brand logos, consisting of twenty-five symmetric brand logos and twenty-five asymmetric brand logos. Firstly, participants was shown a blank screen for 300 milliseconds, then a target screen for 100 milliseconds (consisting a brand logo) and then a screen consisting the following question; “Do you know this logo?”. Participants could either answer ‘yes’ by pressing the A key, and ‘no’ by pressing the L key. After a key press another blank screen was shown for 300 milliseconds and a new target screen was shown for 100 milliseconds. This loop continued until al fifty brand logos where shown and evaluated. At the end of experiment 1, participants we’re shown a new informed consent screen informing them of experiment 2. An example of a trial is shown in figure 2.

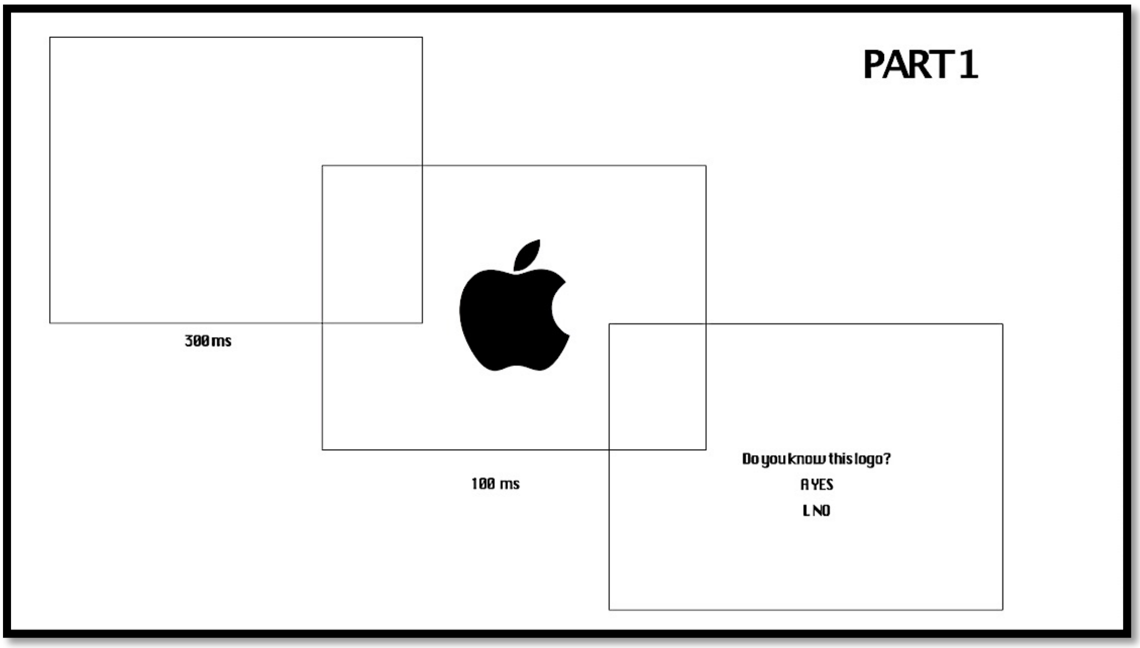


Fig 2. Example of a trial in experiment 1.

### 3.2 Results

The aim of experiment 1 was to distinguish which brand logos where known to participants and which logos are not. Results in figure 3 show that a total of 804 symmetric brand logos and 832 asymmetric brand logos where known to the participants. Furthermore 214 out of 1850 brand logos were not identified by the participants and are excluded from final analysis.

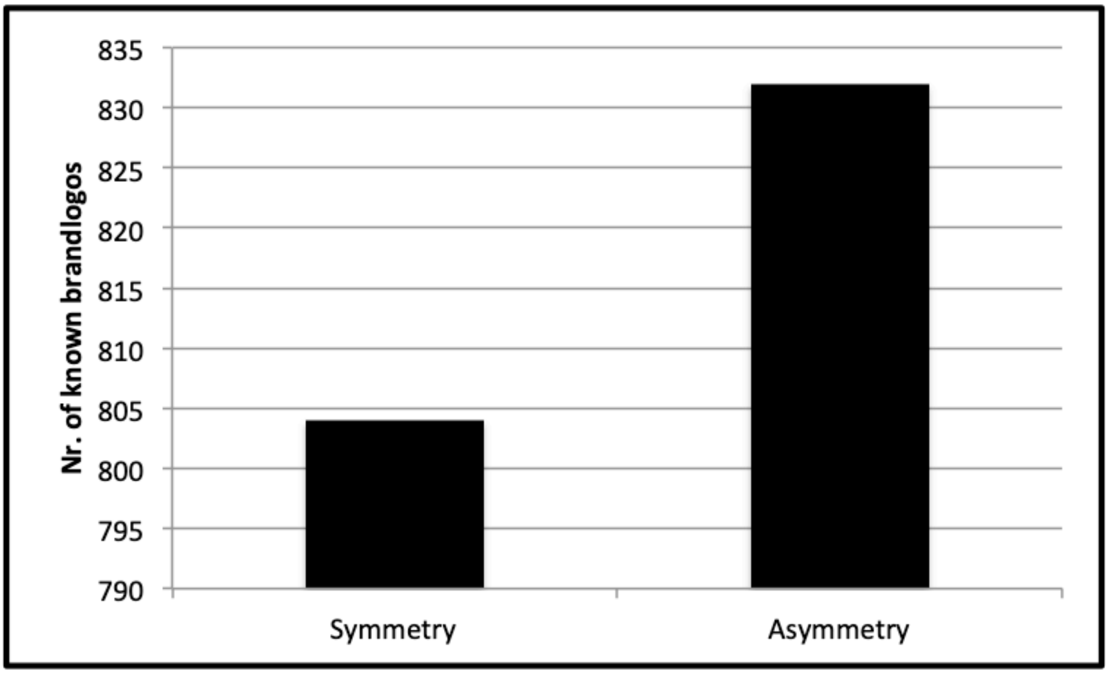


Fig 3. Total number of known brand logos for the two conditions (symmetric vs. asymmetric).

### 3.3 Discussion

This thesis predicted that most brand logos in part one would be known to the participants and that part two therefore would consist of enough data to evaluate. The results of experiment one showed that 214 out of 1850 brand logos were not identified. Brand logos that were least recognized were Vaio, General Electric, Huawai and NBC. Looking back it is subsequently not surprising that the brand logos of Vaio and NBC where less identified, since both companies focus on markets oversees. Vaio has its headquarters in Azumino, Japan and NBC is an American broadcasting company situated in New York. In my opinion General Electric and Huawai, as well as Vaio and NBC, are brands that (I) have striking design properties and (II) are general known. However, I must be aware that I am biased and that brands I know could not be known by others. For further research it would be wise to have the list of brand logos evaluated by others to reduce the chance that there are logos on it that participants do not know. Furthermore, the experiment consisted of 37 participants with age ranging from 18 to 56 years and a mean of 24.01 years old. The sample size thus consisted of relatively young adults, which could give an explanation why these certain brands where less identified. To investigate this further research will be needed.

## 4. Experiment 2

The aim of the second experiment was to establish which brand logos the participants remembered and recalled from experiment one and which brand logos not.

### 4.1 Methods

#### 4.1.1 Participants

The same participants from experiment one participated in experiment two. In experiment two participated thirty-five participants, age ranged from 18 to 56 years (mean [M]= 24.08; standard deviation [S.D.]= 6.804).

#### 4.1.2 Stimuli

Brand logos could be symmetrical, asymmetrical or random. Experiment two consists of twenty-five symmetric brand logos, twenty-five asymmetric brand logos and twenty-five random chosen brand logos. All brand logos images were resized to 320 x 320 pixels. Whereas the width was standard 320 pixels and the length was variable up to 320 pixels depending on the brand logo. The random brand logos were chosen based on their logo similarity with the symmetric and asymmetric brand logos and for the fact that they resemble a company in the same sector. Examples of a random asymmetric brand logo and random asymmetric brand logo are shown in Figure 4.

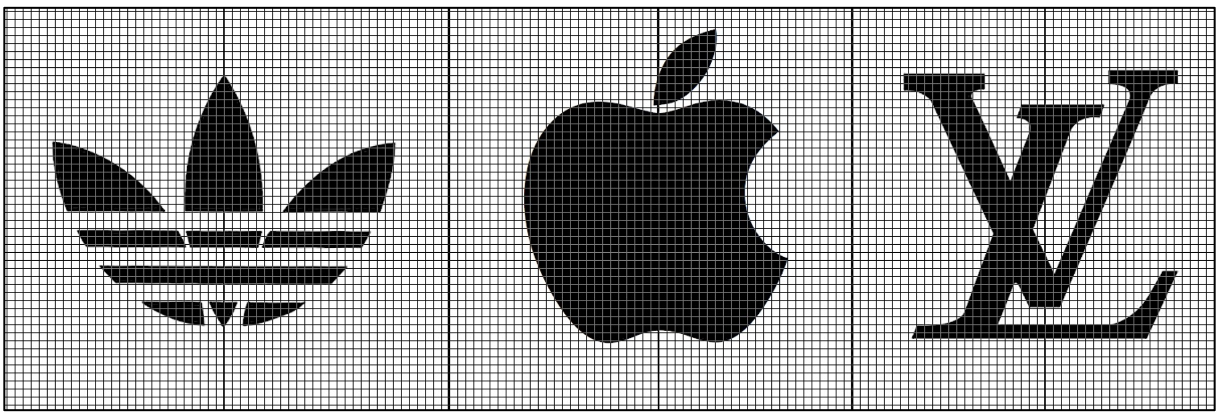

Fig 4. Examples of symmetric, asymmetric and random brand logos (from left to right: symmetric; asymmetric; random).

### 4.1.3 Procedure

Subjects were still sitting individually in a quiet room. They were again given instructions about the second experiment through a formed consent screen in OpenSesame. After they have read the instructions and clicked on the participate button the experiment immediately started. Participants where shown a random series of seventy-five brand logos, consisting of twenty-five symmetric brand logos, twenty-five asymmetric brand logos and twenty-five random brand logos. Firstly, participants was shown a blank screen for 300 milliseconds, then a target screen for 1000 milliseconds (consisting a brand logo) and then a screen consisting the following question; "Have you seen this logo during the experiment?". Participants could either answer 'yes' by pressing the A key, and 'no' by pressing the L key. After a key press another blank screen was shown for 300 milliseconds and a new target screen was shown for 1000 milliseconds. This loop continued until al seventy-five brand logos where shown and evaluated. When experiment 2 has finished the program OpenSesame automatically stops and returns to the programming screen. An example of a trial is shown in figure 5.

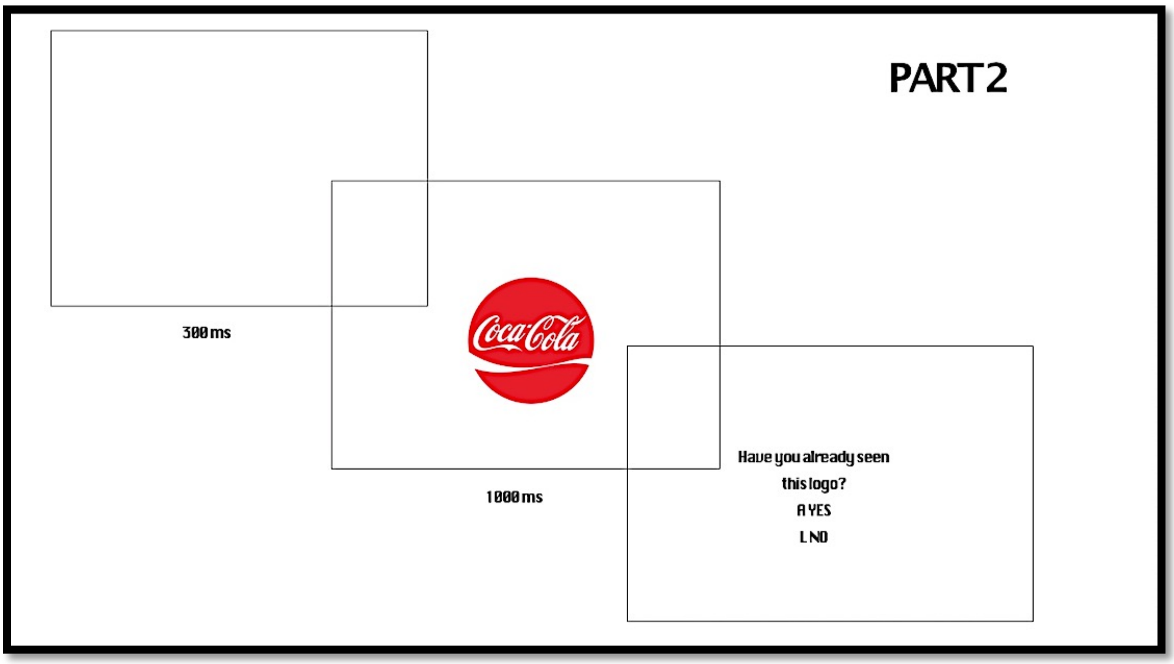


Fig 5. Example of a trial in experiment 2.

### 4.1.4 Data analysis

A repeated measure ANOVA analysis in R-studio was performed on the span obtained in the two types of conditions (symmetry and asymmetry).

### 4.2 Results

Mean span and standard error for the two conditions are shown in figure 6 and table 1. A repeated measure ANOVA analysis was performed on the span obtained in the two types conditions (symmetry and asymmetry). Statistical analyses showed no main effect on recall performances (F = 0.91; P = 0.347). Thus there is more evidence that the $H_0: \mu_1 = \mu_2$ is true.

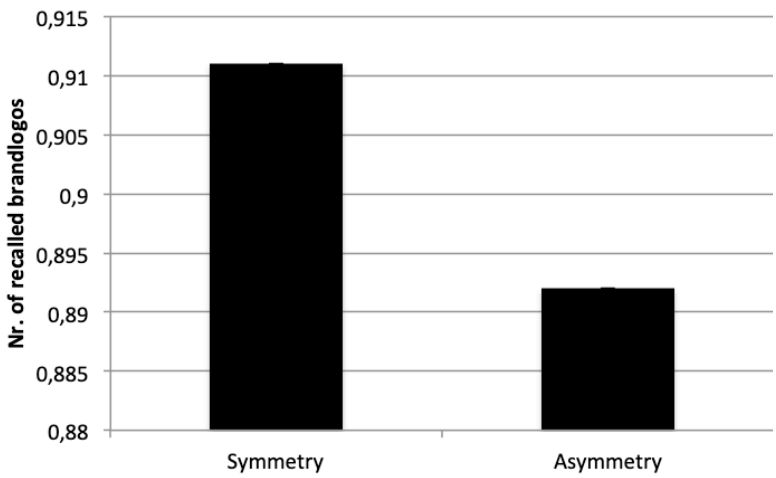


Fig. 6 Visualisation of mean correct recalled brand logos and standard error in the two types of conditions considered (symmetrical and asymmetrical) in experiment 2.

| | Symmetry | Asymmetry |
|---|---|---|
| Means | 0.911 | 0.892 |
| Stand. Error | 0.014 | 0.022 |

Table 1. Mean correct recalled brand logos and standard error in the two types of conditions considered (symmetrical and asymmetrical) in experiment 2.

## 4.3 Discussion

I found no significant advantage of symmetry on recall performances in the brand logos task since $p > 0.05$. The absence of any reliable effect of recall performances suggests that symmetry is not a major factor in the results obtained in thesis. In this respect my findings do resemble those obtained by Kemps showing that memory training and the creation of long-term memory representations increases the ability to recall complex paths to the same level as was initially observed for structured paths (Kemps, 2001). However, Kemps gives the overall conclusion that the visio-spatial sketchpad can hold more items when the path holds some form of redundancy (i.e. is less complex) and my results contradict this since there is no significant advantage of symmetry on recall performances (Kemps, 2001). Since the symmetric brand logos used in this experiment all conform to mirror symmetry guidelines my results are also not in agreement with perceptual studies that showed a strong preference for mirror symmetry when compared to horizontal or diagonal symmetry (Wenderoth, 1994).

## 5. Conclusion and general discussion

The primary question of this thesis was: *Do people remember and recall known symmetric brand logos better than known asymmetric brand logos?*

Results of the second experiment suggest that symmetry does not increase recall performances in the brand logos task since $p > 0.05$. Therefore there is no credible evidence that people remember and recall known symmetric brand logos better than known asymmetric brand logos and it is more evidential that the $H_0: \mu_1 = \mu_2$ is true. This result does not align with the previous given theories that structured (less complex) patterns are recalled better than complex patterns (Kemps, 2001).

I take into account that there are possible sources of uncertainties in my experimental approach such as sample size and sample characteristics. Since my sample consisted mostly of WO schooled students and WO graduated adutls, with only four HBO students, it could be stated that my sample is above average in remembering brand logos. The mean span for both conditions gives more propabilitie to this assumption since both means were almost equel to one (i.e. the maximum score) with an avarage standard error of 0.018. This suggests that the participants made almost no mistakes. In general participants thus were able to recall almost all fifty brand logos, which is a lot compared to the results of studies based on peoples

capacity to chunk information (Egan & Schwartz, 1979). In further research a more heterogeneous sample should be used to determine whether level of education has any influence on recall performances.
It would also be ideal to increase the sample size, since larger sample sizes give more reliable results with greater power and precision. Before I started this thesis I was aware of this, but due to corona it was unfortunately not possible to recruit more participants or to assemble a more heterogeneous group for this thesis. What should not be left unmentioned is the possibility that the brand logos used in this study were to easy and that the series in the first experiment were not long enough. This possibility can be tested by starting a new study that tests the same hypothesis but uses both more brand logos as well more complex brand logos. For marketing researchers who focussed on the importance of visual brand logo symmetry as an essential design factor it would be necessary to conduct more studies on the effects of visual brand symmetry on memory performances. Further research is needed to create a better understanding on visual brand symmetry since this research does not contribute sufficient enough to the acquisition of more knowledge.

The results of this thesis can be placed in a broader context within the field of artificial intelligence (AI). Although it is unfortunate that no significance has emerged from this study, the study itself has possible implications within the context of artificial intelligence.
AI solutions can provide marketing researchers with deeper knowledge of consumers and soon-to-be clients, allowing them to deliver the right message, to the right person, at the right time. AI solutions combined with knowledge on how consumers perceive brand logos could enable these marketing researchers with the tools to provide a personalised brand logo to every individual. These personalized logos would them be so tailored to the individual's visual processes that branding becomes way more effective. Of course the technology of AI is not that far yet, but I am not ruling out that it could one day be our reality.

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