CONSUMER BEHAVIOUR: THE MODERATING ROLE OF CARTOON-LIKE CGI CHARACTER IN ADVERTISING

by

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"*TV ads may be more powerful precisely because people pay them so little heed that they do not call critical defences into play*". (Shudson, 1984)

In our everyday lives, we are all surrounded by different advertisements, coming from the digital and printed media alike. Advertising campaigns and slogans can be found by browsing the internet, using a smart phone, reading a magazine, listening to the radio or watching TV. Those are not the only places an advertisement can be found though. Advertisers have gone one step further and by placing their images on bus stops, buildings, train-and metro stations, road billboards and food packages, they are trying to catch our attention and communicate their message. Advertising is by no means a new concept. It has been practiced for thousands of years, dating back to the Ancient World, when the ancient people were communicating their messages through stones and papyruses in order to sell a product (such as herbs, spices and medicines in feudal Japan) or promote an event (such as gladiator fights in ancient Rome).

Although the concept of advertising is a whole universe on its own, having multitude of variables that need to be taken into account when creating advertising contents, there is one common denominator - sales. We can all agree that the goal of advertisements, especially in the contemporary society, is to promote sales. It is a form of communication, vastly used to try to persuade people to buy a certain product, adopt a service or take some action. Until recent years, advertisers have been trying to grab consumers attention with visual stimulations, explicit messages, convincing slogans and famous actors, and "all the advertisers did was assert that their brand is better than all the rest" (Heath R. , 2012).

We, as contemporary consumers however, have been exposed to all sorts of different aesthetically pleasing and convincing persuasion efforts, and it would appear that through years of experience, we tend to mistrust pure persuasive messages and avoid conscious scrutiny of validity of the used arguments, which eventually leads to decline in the traditional advertising effectiveness (Genco, Pohlmann, & Steidl, 2013). The modern advertising environment seems to be overcrowded with explicit communications, which can be accepted by some consumers, but rejected by the others. A variable that the traditional marketing approach seems to neglect when creating those explicit communications is the fact that we, as consumers and human beings, live in a world where multitude of cultures interact all the time. The same convincing messages and persuasive slogans a marketer articulates, could be seen as funny and interesting by some, but offensive by others. Which lead us to believe that with the expansion and integration of societies, as well as with the previously mentioned extensive experience, advertisers should incorporate flexibility to their approaches and adapt not only to the social environment, but also to the cluttered advertising settings.

In recent years, a different perspective emerged. The explicit persuasive messages targeting conscious evaluations seems to have started making way to the implicit influences, which, by the clever use of different multimodal stimulations (such as colours, music, narrative, touch and smell), aim at nonconscious consumer behaviour. The idea behind those stimulations is to "relieve" the attendant from any mental effort and conscious deliberations and give them the opportunity to create emotional connections with the advertised content or brand. Modern advertisers thrive on the plethora of research on consumers' attention, attitudes and emotions and although seen as laughable concept few decades ago (Krugman H. , 1965), this understanding plays a pivotal role in creating successful advertisements. Emotions are integral part of our lives and as much as we might be blind consumers, we are first and foremost human beings.

Regardless of the methodology a marketer adopts, the majority of contemporary ads include an attractive model, more often famous, who is either directly or indirectly interacting with a product. One assumption of the use of such model could be the notion that humans are capable of automatically creating positive emotions by observing attractive people (Eagly, Ashmore, Makhijani, & Longo, 1991) and, following the idea that emotions play important role in our behaviour as consumers, those positive emotions could lead to positive product, brand or service attitudes. Another explanation could be the trust factor - people are less likely to critically elaborate on a message or slogan, when the ad-endorser has some credentials (Priester & Petty, 1995).
But what if the ad-model is not human?
If we continue following the emotional trend and accept that people are driven by emotions, a curious opportunity to inspect their attitudes and buying behaviour in the presence of inanimate subject arises. It is also interesting from research perspective to examine the emotional reactions and cognitive load a person allocates when viewing an advertisement, containing a non-human character. Those issues could be assessed by measuring real-time pupillary responses with the use of an eye-tracking device.

It would appear that during advertising, emotions, attitudes and attention are constantly interacting and intertwining to bias, form and navigate our decisions, motivation, acceptance and purchasing behaviour, which makes the theme of advertising, a delicate, perplexing and multidimentional topic.

This study set out to explore consumers' attitudes and attention when presented with an implicit connection between a cartoon-like computer-generated human and the advertised product. The advertisement included no explicit messages or claims of how the model and the advertised product were connected. In addition, the study also concentrates on the cognitive and emotional impact of the two ad-models by measuring participants' eye-movements and pupil dilations. The purpose of this paper is to examine if **a cartoon-like computer-generated character influences differently consumers' attitudes, attention and purchase intentions in comparison to a human character.**

In order to investigate these issues, four empirical studies were developed: Study 1 and Study 4 concerns with consumers' attitudes and purchase intentions, whereas Study 2 and Study 3 - with their pupil dilations and eye movements during two consecutive exposures to the advertisement.

2. Literature Review

2.1. Advertising and Cognition

2.1.1. Neuromarketing

Neuromarketing (Genco, Pohlmann, & Steidl, 2013) is a newly emerged discipline which extends traditional marketing with combining it with neuroscienece (knowledge of brain processes). Neuromarketing aims to coherently examine consumer reactions to different stimuli and provide insight into their motivations, behaviour and attitudes. Instead of taking the direct route of advertising, which aims at conscious attention and message evaluation, neuromarketing takes on the indirect route. This route explores nonconscious cognitive mechanisms, emotions, attitudes, attention and their interaction into forming decisions and purchasing behaviours.

Advertising can influence people on many levels, both actively (high level of attention) and passively (low level of attention) (Krugman & Hartley, 1970) and this low level of attention is the main approach a neuromarketing adopts. It appears that in recent years, nonconscious influences have started to be preferred over conscious influences, because the nonconscious influences are based on emotions. They aim at reaching the customers through stimulating positive emotional states and attitudes, rather than relying on conscious attention and message evaluations. Let us take the British mobile company O2 for example. As Heath (Heath R. , 2012) explains, a successful advertising campaign does not require conscious attention and argument assessment. Instead, a well structured, well thought and executed advertisement, which contains cryptic messages, and ambiguous slogans could be far more influential than any advertisement containing a direct approach. In the O2 example presented in his book, the advertisement contained doves, dancing people and blue water with bubbles as the main visual stimulations along with the rather simple slogan "O2. See what you can do". People eventually saw this advertising attempt as weak, because they could not recall any actual meaning or any advantages over the rest of the mobile operators, such as better network or lower prices. Besides that the "blue water and bubbles are hardly characteristics one might look for in a mobile phone" (Heath R. , 2012), there was also no *novelty* (Genco, Pohlmann, & Steidl, 2013). Neither the advertisement presented a new product on the market, nor a new product category. In only a period of 4 years, however, for no apparent reason, O2 managed to become the largest telecommunication provider with millions of loyal customers without offering any substantial advantages over the competition (Vodafone, Orange, T-Mobile). This is a vivid example of how an advertisement that has no clear and explicit message can influence people on nonconscious level. If we think on it for a while, there *was* a message. In fact, there were several well-hidden messages. Doves could symbolise freedom, which could communicate to the person that by using O2 network, they are "free" to speak with their friends and loved ones and free to roam the internet. In addition, the water along with the white colour of the doves symbolise purity and flow, hence people should know that this is the best service to use. A service, that provides honesty and trust.

There are several different models of advertising: *Persuasion, Low Involvement* (Krugman H. , 1965), *Reinforcement* (Ehrenberg, 1974) and the *Elaboration Likelihood Model* (Petty & Cacioppo, 1986). Each of them follows its own restrictions. For example the *persuasion* model follows the traditional route of advertising by which it communicates clear and explicit messages about the advertised content. The traditional route however aims at conscious attention and evaluations, which is to say that the classical persuasion model has started to be less applicable to modern standards. The *low involvement model* takes the opposite route - low involvement, in the sense of low attention aims at nonconscious influence and is "unlikely to be able to work by communicating a persuasive message" (Heath R. , 2012). The *reinforced model* on the other hand works just outside those two different routes. It concerns with attitudes, built toward an already established brand or product and aims at further strengthening of those attitudes. The *Elaboration likelihood model* (ELM) is explained as " ageneral framework for "organising, categorising and understanding the effectiveness of persuasive communications" (Petty & Cacioppo, 1986), (Petty, Cacioppo, & Schumann, 1983) and it involves two different models of persuasion - *central* and *peripheral.* The central route is applicable to individuals, who possess the ability to contemplate and evaluate message arguments, whereas the *peripheral* involves the opposite type of people - those, who lack the motivation to invest cognitive efforts while exposed to persuasive messages.

2.1.2. Attention

The attention construct continues the notion of conscious-nonconscious consumer reactions. In many bodies of research (Heath, Brand, & Nairn, 2006), (Genco, Pohlmann, & Steidl, 2013), (Beattie & Mitchell, 1985), (Heath R. , 2006), (Desimone & Duncan, 1995), (Nordheilm, 2002), (D'Souza & Rao, 1995) attention is pivotal variable in advertisement perception and consumer behaviour by considering where and for how long does the attention to the advertisement fall in any given moment. We can also say that attention and consciousness are closely related, yet having different cognitive functions (Koch & Tsuchiya, 2006).

According to the traditional view, which follows the traditional marketing approach, consumer's attention must be grabbed and logical arguments must be presented (Genco, Pohlmann, & Steidl, 2013). During the presentation of such arguments, people are in a state of "high attention", which means that all their evaluations and scrutiny of the advertisement as a whole happens on conscious level. They are in charge of their own attention (Posner & Petersen, 1990) and they are *aware* that they are doing it. The non-traditional marketing approach on the other hand, takes on the opposite route - neither advertising claims, nor conscious attention should take place at any moment. Instead, the viewer should be left to "feel the ad" (Bagozzi, Gopinath, & Nyer, 1999). During those moments, people are in a state of "low attention", which means that their attention is shifted by the attended stimuli (Theeuwes, 1991) and they allocate less mental effort to criticise the advertisement.

It appears that both those attention construct can influence our future purchasing behaviour, but to different extents. For example, it seems that it strictly depends on the advertised product. If consumers are presented with something expensive, they would be more inclined to start weighting its merits and quality of the arguments in comparison to a cheap product. Moreover, cheap things are more likely to trigger consumer's curiosity.

To summarise, there are two routes an advertisement can take - the *direct route,* which aims at conscious attention and evaluation on message claims and the *indirect route,* which aims at low attention and tries to avoid any conscious deliberations on message explicitness.

A model that defines several stages of persuasion (Genco, Pohlmann, & Steidl, 2013), AIDA , dissects the advertising effectiveness into four steps: attention, interest, desire and action. This model follows the direct route and by inspecting its different stages, it proposes high attention and conscious elaboration. It would also appear that the model proposes *goal pursuit* (Austin & Jeffrey, 1996)*,* which is not typical to this high-attention route.

As already seen, the direct route implies conscious evaluation, but as researchers point out, conscious evaluation brings some limitations. For instance, by weighting argument claims, people could start developing counter-arguments (Bornstein, 1992), which could eventually lead to resistance to those claims (Heath R. , 2012).

2.1.3. Attention and Emotions

As already stated, the more we pay attention to an advertisement and weight its merits, the more we are predisposed to develop resistance to the quality of the arguments used and in contemporary advertising, this is an important step in understanding why is it that people are accepting one advertisement and rejecting another when they are both so convincing. It would appear that there are some specific cues that contribute to acceptance or refusal. Therefore, sometimes, advertisements are created in an interesting and visually rich way, adopting different techniques that communicate creativity. Such ads could include excessive use of colours or moving pictures. Other advertisements, on the other hand, are made to look stylish, which could communicate trust or dominance. Different marketers are creating their advertisements in different ways, according to their target audience with the idea that if the ad "speaks" creativity or style to the consumer, it will grab their attention and boost sales. This was seen to be a wrong concept (Heath R. , 2012) and although the adopted methods seems to be able to influence consumers, they are not influencing them on conscious level hence, those methods are unable to grab consumer attention *and* motivate his intentions at the same time. Instead, they work on nonconscious level by stimulating our emotions and not requiring our conscious attention. Advertisements that do not contain an explicit verbal or written message of the connection between the endorser and the advertised product can be seen as indirect persuasion attempts (McQuarrie & Phillips, 2005).

In order to explain emotions in the context of advertising effectiveness, it is first necessary to understand two important concepts - *familiarity* and *processing fluency* (Genco, Pohlmann, & Steidl, 2013). *Familiarity* refers to the idea that people are naturally predisposed to like things that are familiar to them. It is argued that this might be due to a feeling of security (Zajonc, 1968). The physical properties and messages that those things communicate might remain unnoticed, but they are more likely to attract attention through consumer's prior experience. Those things also require less cognitive load, hence people feel them closer and make their buying decisions around this idea.
Processing fluency is somewhat similar to familiarity in the sense that people people could be motivated to a greater extent to take some action or adopt some idea if the presented information is easy to grasp and understand. The underlined assumption is that products, services or ideas that are easy to process, are not subjected to conscious reasoning and manage to create a bridge between familiarity and trust.

Emotions, as already seen, are integral part of our lives and direct our behaviour. Through our experience, those emotions are shaped and modulated, and the emotions we invest toward advertised content are also related to low attention. It is suggested that when presented with a visually reach advertising environment, people tend to allocate their attention toward objects that are emotionally relevant to them (Damasio, Tranel, & Damasio, 1991). Emotions are also strictly individual - different people can have different emotions to the same stimuli and it is not the stimuli itself that emit particular emotion, but the attending person who is attaching some emotional property according to his or her inner world. Positive and negative emotions play important role in our behaviour and as such, positive emotions could bring positive attitudes and are often associated with reaching a desired end-state (also known as a goal (Genco, Pohlmann, & Steidl, 2013)), through the existence of personal motivation, rewards and happiness, whereas negative emotions are usually associated with failure to achieve that state (Stein, Liwag, & Wade, 1996), (Schaller & Cialdini, 1990).

Emotions are also correlated with *attitudes* (e.g., happy-unhappy, pleasant-unpleasant, interesting-uninteresting) (Bagozzi, Gopinath, & Nyer, 1999). Attitudes, in a manner similar to emotions, can be triggered by events, but unlike emotions they have weaker connection to action and require additional motivation, such as desire (Bagozzi R. , 1992). Attitudes have been found to last longer than emotions, whereas emotions are short-term and spontaneous event. In recent years, attitudes and their effect on consumer's buying behaviour has been a field of interest to many researchers (Brown & Stayman, 1992), (Mitchell & Olson, 1981), (Shimp, 1981). Their findings indicate that attitudes are function of feelings toward the ad or brand and in some instances, attitudes toward the ad are greater than those toward the brand. Those instances are when there is a something new and unfamiliar involved in comparison to established brands. Attitudes have also been found to be subject to repetition (Stayman & Aaker, 1988).

Research also shows that attitudes and arousal are mediated by ads viewing time (Olney, Holbrook, & Batra, 1991) as well as brand names (Stayman & Batra, 1991).

The impact of an advertisement could be achieved through "conditioning" (Genco, Pohlmann, & Steidl, 2013)**,** which is a state of association that can be sustained through multiple exposures. Positive emotions are associated with a given brand.

A new research area called *micro-valence analysis* (Lebrecht, Bar, Sheinberg, & Tarr, 2011)*,* (Lebrecht, Bar, Barrett, & Tarr, 2012) has emerged in recent years. It explores how people invest emotions (positive or negative) into everyday objects by measuring emotional responses to objects and how those emotions are influencing their attention in visually rich task. The findings indicate that we, as human beings, are influenced and navigated by our emotions and nonconsciously trigger them when directing our attention in visually excessive environment (such as stores).

The aspect of *beauty* was also found to play important role in the human-object emotional connection by exploring how symmetry and curvature are perceived as more likable and attractive. In their work, Genco *et al.* present an interesting example with the Italian design company Alessi (ALESSI, 2014) which creates innovative designs for everyday objects (such as plates, spoons, kettles, boards, etc.). Through their witty designs, they attribute likeable and enjoyable properties to seemingly ordinary objects, thus evoking emotional response by combining *novelty* and *familiarity*.

Beauty in addition, led researchers to debate on its unified validity. On the one hand, *beauty* can be seen as a property of the object, meaning the way the object was made (oval or sharp features, innovative design, discrete soft light, etc.). On the other hand, *beauty* can entirely be a subjective thing, applicable only to the attending person and completely different for everyone. What unifies those two views is actually the *processing fluency* (Reber, Schwarz, & Winkielman, 2004) which, as they suggest in their work, shows that objective attributes are intertwined with subjective evaluation or with other words - *beauty* is both. "Symmetry, contrast and clarity" (Genco, Pohlmann, & Steidl, 2013) are properties that contribute to *processing fluency* simply because objects, that are symmetrical, contain less information, hence they are easier to process. Likewise, visual cues that have clear foreground-background separation are considered more attractive and some colours are perceived to be more stylish than others. This bring us to the initial idea of stylish ads, and more specifically, to the idea that colour could be as influential as any other visual cue.

The same phenomenon is observed by Heath, who explains how brand attitudes formed through our emotions can be biased, by giving a good example with the people who "lavish on their cars" (Heath R. , 2012). It is evident that such attitudes and acceptances could direct observer's beliefs about the quality of the brand, the claims of the ad-endorser, etc.

2.1.4. Consumer Behaviour, Goals and Decisions

There are two important ways an advertisement can influence consumer's behaviour at a nonconscious level. The first one, as presented by Heath, is "Subconscious Associative Conditioning" which is a state of mind that occurs when "something in an advertisement triggers an emotive reaction and over time subconsciously transfers that emotive reaction to a brand" (Heath R. , 2012). This catalyst can be a character, a musical note or even an inanimate object. It was found that these stimuli have no influence on their own, but when put into a context, alongside a particular brand for instance, they can become mediators of consumer's preferences. The underlying idea is that emotional stimulation triggers people purchasing motivations (Hill & Gardner, 1987). In their award-winning paper "*O2 - The best way to win new customers*" (Maunder, Cook, Young, Udale, Hough, & Cox, 2006), using Heath's book *The Hidden Power of Advertising* (Heath R. , 2001) as a source, they stated that "emotional attachment to a brand is strongly enhanced by such non-rational non-verbal communication", which holds true to the low-attention model by suggesting that consumers, as human beings, are driven by inner mechanisms and the presence of explicit arguments is not necessary. The impact of this type of stimuli can also be associated better with the presentation of a new product or product category, and not so much with an existing one (Genco, Pohlmann, & Steidl, 2013).
The second way an advertisement can influence consumer's behaviour at a subconscious level is the one which explains the already established relationship we have with an existing brand. It is called the "Subconscious Relationship Manipulation" and it occurs when "the creativity in the ad subconsciously influences the way you feel about a brand" (Heath R. , 2012). This concept points again to the idea that advertisements, which through their design, motion, audio and narrative communicate creativity or style to the user, are able to "touch" their target audience in a deeper than conscious attention way.

A dual-processing model of mental activity was proposed by Daniel Kahneman in his award-winning book "*Thinking, Fast and Slow*" (Kahneman, 2012). The model explains two concepts of thinking and decision-making - *intuitive response* (System 1) and *logical response* (System 2). System 1 is emotional and fast, whereas System 2 is logical and slow. The book underlines the idea that people think fast when they are not consciously aware that they are thinking. Vice versa - people think slow when they actually have to think. The 1st system is associated with "spontaneity and effortlessness" and the 2nd system is associated with "deliberate control and effortfulness" (Genco, Pohlmann, & Steidl, 2013). Since *System 2* is the conscious system, consumers see their actions as conscious decisions, whereas those same actions are "seen" as nonconscious decision through *System 1*. In System 1, the decisions might not feel like decisions. Such instances could be, for example a spontaneous decision of type self-preservation

Researchers have found that consumer behaviour is mediated by "*efficiency",* which follows the trend that our brains are not willing to work hard because it consumes energy hence our evaluations and decisions are nonconscious. "*Novelty"* on the other hand, assumes that "we naturally direct our attention to new and interesting things" (Genco, Pohlmann, & Steidl, 2013) and is explained as a function of prediction error called "expectation violation" or with other words, we brand something as novel when it is not expected (Griffin, 2012) and our brains approach all that is unknown with caution.

As already seen, our brains are cautious in recklessly spending cognitive resources, so it would seem that they rely on *familiarity, processing fluency, efficiency* and *novelty* to form our decisions.
It would appear that there is a negative correlation between decisions and persuasion, mainly due to the fact that persuasive messages tend to create resistance through conscious deliberation. Yet nonconsciously, those decisions are put forth without weighting arguments, making the actual persuasive message obsolete.

2.1.4.1. Goals and Decisions

Decisions are also driven by consumer's individual *goals*. A goal is essentially an achievement, an "internal representations of desired states, where states are broadly defined as outcomes, events, or processes" (Austin & Jeffrey, 1996). Goals, attitudes and emotions are all parts of a bigger field in psychology called "appraisal theories" (Lazarus, 1991), (Smith & Ellsworth, 1985). Appraisal, as seen by Bagozzi *et al.* is an "evaluative judgement", an evaluation and interpretation that arises after comparing "an actual [emotional] state with a desired state". Appraisals can be triggered consciously and nonconsciously and are very important for the emotional formations. Lazarus (1991) distinguishes between two such formations - *goal relevance* and *goal congruence.* Two things have to be present in order for those goals to emerge. On the one hand, the person who is attending the stimuli should have invested some personal resources in the event and on the other, he or she should be able to critically judge the event.

(Bagozzi, Gopinath, & Nyer, 1999) identifies several appraisal classes in regards to goals, each of them representing a mental state in which different emotional reactions as well as responses could emerge. For example, the first class, the *outcome-desire conflicts* appears upon inability to achieve the goal in question. Negative emotions emerge and depending on the context of the goal, several responses to cope with those negative emotions could also emerge.
The second class, the *outcome-desire fulfilment* happens during the opposite outcome - when the goal is achieved. In this instance, positive emotions emerge and an inner desire to sustain or share the achievement could also happen.
The third class, *outcome-desire avoidance* happens when people are anticipating a possible negative outcome of the desired goal. In this instance, an anxiety-type negative emotions (such as fear) could emerge and a corresponding response to possibly avoid such outcome is brought forth
The last class, *outcome-desire pursuits* happens during the opposite scenario - in anticipation of positive goal outcome. It is accompanied by positive emotions and a determination to sustain the current state

Two classes of goals are proposed that are correlated with emotions (Bagozzi & Dholakia, 1998), (Pieters, Baumgartner, & Allen, 1995):
Subordinate goals - those are goals that answers the question "What is it that I strive for?". Bagozzi *et al.* give interesting example with a person who *strives* to lose body weight. Through subordinate goals, this

person sets some possible scenario of *how* to achieve his goals.
Superordinate goals - those are goals that answer the question "Why do I want to achieve that for which I strive?". Through superordinate goals, the person sets some criteria of *why* to achieve his goals.

It has also been found that goals can be pursued and achieved entirely outside consumer's conscience (Chartrand & Bargh, 1996) through *priming.*

2.1.4.2. Priming

Priming is essentially an association. The way priming works is through cascades of ideas activation, which are later associated with corresponding concepts. An interesting example is the work of the British illusionist and mentalist Derren Brown (Brown, 2007), (Brown, 2010) who constantly uses associative thinking, subliminal suggestions, misdirection and priming to "predict" people behaviour. In one of his shows, he arranged a meeting with two members of one of the biggest advertising agencies in Britain - MBA (MBA, 2014). They were escorted to the location the meeting took place, by a taxi. Along their way, nothing obvious happened which might have directed their thinking in one way or another. At the meeting, Derren asked them to come up with a poster advertising, which must include a company name, some sort of slogan and a logo. All they were given were pen and paper and they were left for half an hour to their imagination. Derren also left an envelope on the table, containing his poster ideas, which were at that point unfamiliar to the experts. What they came up with at the end was almost identical to what Derren had stored in the envelope.
The idea behind all this, as he explains, is that people working in advertising are masters of subliminal messages who know that through their ambiguous slogans and logos, we, as consumers, will register so much subconsciously that when we go into the store, for no apparent reason, some products will feel more natural and closer to us than others, although we might think that we have never had any experience with them. Likewise, in this particular example, the taxi journey, the two experts took, was in no way coincidental. Neither was the route to the meeting location. Along the way, they were purposefully exposed to various indirect visual stimuli (such as the Zoo logo when passing across the London Zoo), a group of children wearing identical t-shirts containing an image of the Zoo gates, two cartoon-like fishes drawn in a way to resemble angel wings, etc. All those cues managed to eventually find their way on paper through the nonconscious mind in the form of a poster.
Priming can be divided into *associative priming* (when thinking about one idea leads to another) and *motivational priming* (when goals are pursued all the way until reached) (Genco, Pohlmann, & Steidl, 2013).
Priming is very powerful tool for mediating consumer's attitudes and purchasing behaviour. It is vastly used virtually everywhere - in consumer's decisions to follow a new trend or not (Chang, 2010), slogan and brand evaluation (Boush, 1993), memorising textual cues (Finlay, Marmurek, & Morton, 2005), visual information (Schmitt, 1994).

2.1.5. Persuasion

The goal of all advertisements seems to be to persuade people to adopt a particular idea or a product. There are several major persuasion theories that examine information processing from different perspectives:

The Cognitive-Response Model of Persuasion

This is one of the early proposals of models of persuasion and revolves around the idea that persuasion is a function of people's cognitive responses to the content of a message (Greenwald & Mahzarin, 1995), (Wright, 1980). Those responses have been identified to arise when people are relating one message to another or the content of a message to their prior knowledge on the topic. The theory however cannot explain why is it that sometimes people are persuaded in the absence of persuasive message.

The Dual-Process Models of Persuasion

The theory emerged to address the issue of the cognitive-response model by speculating on the fact that there might be several forces controlling persuasion. The *Elaboration-likelihood Model* (Petty & Cacioppo, 1986) identifies two routes to persuasion - *central* and *peripheral*. The central route assumes that judgements are form through extensive and critical message elaboration, whereas the peripheral route follows the trend that judgements are products of intuitive and emotional assessment. There is no simple formula to calculate which of those two routes mediates persuasion, because every individual can be influenced by any number of factors contributing to his or her elaboration on the message itself. Those factors can be how much the advertisement along with the message it brings is relevant to him or her; how much of a prior knowledge is available on the current topic, etc. As influential and well accepted as this theory is, it is not without limitations. Since it builds upon the cognitive-response model, the dual-processing model is also dependent on mental effort. It would seem that it requires the participant to devote some cognitive effort to the actual message. Depending on the complexity of that message (or on the visual stimuli as a whole), this cognitive effort can be of lesser or greater demand. This demand-devote relationship sets the foundations of another persuasion theory.

Resource-Matching Theory

The Resource-Matching Theory (Anand & Sternhal, 1989) extends the Dual-Processing model by considering the "supply" and "demand" of cognitive resources. It proposes that persuasion is dependent on those two factors, where greater persuasion is achieved when they are equally met and lesser - when they deviate. The theory supports the idea that in their core, all advertising messages are made to be persuasive with the difference being in the containing material. Depending on the context of the ad, those messages are charged with different level of elaboration requirements that demand different level of cognitive resources. Therefore, allocating the appropriate level of cognitive resources, results in greater persuasion. Likewise, allocating the incorrect level of cognitive resources, results in lesser persuasion. The Resource-Matching Theory, like the previously reviewed theories, is also vulnerable. For instance, it appears to be only applicable to situations that prompt "resource-intensive, systematic message processing" (Meyers-Levy & Peracchio, 1992). This is in consistency with the Genco *et al.* and Heath's attention- and emotional models, and again underline the assumption that consumers are not inclined to spend mental effort to scrutinising a message unless they are explicitly asked to.

2.1.6. Message

A well written story or a narrative could also influence consumers attitudes by creating some emotional connection, which can then be measured in terms of arousal (intensity of the stimuli which is measured by the size of the eye pupils) or emotional valence (a like-dislike state which can be measured by facial micro-expressions)(Genco, Pohlmann, & Steidl, 2013). The underling idea behind this assumption is that a story can make people relate and care about the character(s) or events in the visual stimuli, where the immersion aspect could serve as a distracter from any conscious deliberation and logical thinking about the merits of the ad messages. According to the neuromarketing perspective, an advertisement should be a multi-modal experience that aims at stimulating as many senses as possible and not just one.

The main idea of the power a well structured and executed advertisement can have on consumer's nonconscious mind is crucial to the neuromarketing environment, communicating the notion that when there is a flow, the mind tends to drift towards the narrative direction, putting all conscious deliberation and arguments assessments to rest, preventing the building of counter-arguments and eventually resistance. As explained by Heath, the most clever thing about the successful ads is the presence of a message. The message itself can be anything. It can even be ambiguous and completely unpersuasive, but what makes all the difference is that it is there and its core role is to take away consumer's attention from the actual stimuli. In regards to message effectiveness, we can take a look into another great example from Heath's book - the Andrex puppy advertisement. It works in a similar way - the "soft, strong and long" message serves as a director, or bottom-up distracter (Genco, Pohlmann, & Steidl, 2013) while the sweet puppy is influencing our belief, acceptance and trustworthiness by "subconsciously conditioning us to feel that Andrex is a loving family-oriented company and their toilet paper, like the puppy, is soft" (Heath R. , 2012). Adnrex, however, decided to change their advertising campaign by substituting the real puppies for computer-generated ones, which could be argued if it was a correct step into "refreshing" their brand simply because people trust and love not only the product, but also the way it was presented. Heath raises the question if this change in their "proven formula" can successfully communicate the "values of softness and family love" as the original ad did. As seen so far, emotions are crucial part of consumer's decisions and the questions Heath asks are quite valid. By examining the new Andrex advertisement we see many computer generated puppies playing around and falling over themselves, but as enjoyable as that might be, it somehow fails to communicate the same emotion one feels when seeing real puppies playing with themselves. This can be due to many reasons, starting from the way their fur was animated, going through their facial expressions and movements and ending at the point when the viewer sees a computer generated puppy, singing, dancing, cooking a cake or playing a piano. Regardless of the reason, the bottom line is that this change altered the personality of this advertisement, making it much less about playfulness, innocence and comfort and more about technical achievements and creativity, which audience eventually saw as deviating and intrusive. Andrex understood that the cosmetic change diminishes the well-established, trusted and loved brand equity and brought back the real puppies.

Contemporary advertisements usually include a character, which is co-exposed with the advertised product. As already seen, this character can be a computer-generated animation, an animal or a human being. In the latter case, the most likely scenario is for the character to be of an anonymous nature, meaning that it is neither a celebrity, nor his or her name has been shown in order to avoid biases (Cronley, Kardes, Goddard, & Houghton, 1999), (Kaulingfreks & Bos, 2007).
Many bodies of research points to the fact, that the consumer is perfectly capable of forming connections between the advertised product and the endorser, although no explicit verbal or written claims about their connection are present (Lister & Wells, 2002), (Messaris, 1998). It is also suggested that a connection between the ad model and the ad product can be achieved in several ways: "the model can be depicted as using the product" (when the model is directly using the product, such as drinking a bottle of advertised water, running with advertised shoes, etc.); "the model can be depicted in the vicinity of the advertised product" (when the model is indirectly using the product, such as holding an advertised ball); "the model is depicted with only a symbolic connection to the product" (when the advertised product is shown on a separate picture, while the model is doing a different activity, which requires the product, but not directly using it) (Soederlund & Lange, 2006).

2.2. Summary

Daniel Kahneman's *System 1* and *System 2* are two different decision-making systems which describe how the conscious and nonconscious mind work together. Our intuitive judgements are controlled by *System 1* and it is considered nonconscious. Our rational judgements however are entirely conscious and controlled by *System 2.* Research indicate that consumers are using *System 1* more often than *System 2*, which lead to the emergence of new fields in marketing, that combine traditional marketing approaches with brain science. The concept of *priming* can be explained as associative thinking by which nonconscious goals and ideas are brought forth through *System 1.* Priming has been vastly employed by contemporary marketers in order to influence our attitudes, decisions and emotions. Another concept that plays important role in consumers decisions and perception are the nonconscious emotions, also known as *affective states.* Those states include Damasio's *somatic markers,* which are explained as "experiences coded in the memory" that can be accessed and triggered by priming, completely outside our awareness.

Novelty, Familiarity and *Processing Fluency* are three important concepts that also influence consumer's attitudes and decisions. Novelty concerns stimuli that are new or unexpected to us. It is also called "expectation violation". *Familiarity* refers to the idea that people like things that are familiar to them, partially due to less cognitive load and partially due to *prior experience. Processing fluency,* although similar to *familiarity*, explains that stimuli, that are easier to process, manage to avoid conscious weighting and reasoning. Consumers could see such stimuli as familiar even though they might have never had prior experience with them.

Another variable that influences our preferences and purchasing behaviour is the nonconscious *goals.* Priming can activate such goals, which are then nonconsciously pursuit entirely outside our awareness. Those goals are being pursuit either until completion or until they are forfeited. It has also been found that they can exist over long periods of time and at the same time, their strength increases.

The reviewed work also suggest that conscious (high) attention should not be achieved if the advertisements is aiming at nonconscious stimulations. During the state of high attention, people are more likely to engage in conscious deliberations on the advertisement, its premise or the quality of the message arguments, hence developing counter-arguments and building resistance. Therefore, a state of low attention is suggested to be the key to successful advertising, because during low attention we perceived the advertised content through our emotions and nonconscious mind.

2.3. Eyes Can Speak

2.3.1. Measuring Emotions

As seen by researchers, emotions are hard to measure using scales simply due to the multitude of variables that have to be taken into account. For instance, (Bagozzi, Wong, & Yi, 1998) argue that emotional assessment through bipolar scales depend also on gender and cultures and cannot be branded as universal. In other words, the relationship between negative and positive emotions is different for people coming from different cultures. Bagozzi *et al.* suggest that in a study that concerns large multicultural sample of people, a unipolar scales should be used which requires individual evaluation on each emotion separately. They also suggest using at least five, preferably seven or ten scale steps for "optimal distribution properties" across at least three, preferably four or more items.

In a different body of research (Schachter & Singer, 1962), the idea that arousal plays important role in emotions is reinforced. Visual attention and emotions are closely related to eye movements and as such, eye-tracking technologies have been adopted in the past decade to track the behaviour of the eyes when viewing visual stimuli.

2.3.2. Eye Biology and Cognition

The human nervous system is divided into two parts: the central nervous system (CNS) and the peripheral nervous system (PNS). CNS consists of the brain and the spinal cord. PNS consists of our sensory input systems and our motor execution systems. In the field of Neuromarketing, technologies that measure brain activity are vastly used. Such technologies measure signals sent from the body that, depending on the point of origin, can be slow or fast. This gives researchers insight into particular behaviour. For instance, there is an inner division in the PNS nervous system - *somatic nervous system* (SNS) and the *automatic nervous system* (ANS) (Dorland, 2011). Signals that originate from the ANS are relatively slow in comparison to signals originating from the SNS. Pupil dilation and heart rate for example are ANS signals. On the other hand, signals originating from the SNS are much faster. Those are signals like eye movements and facial expressions. ANS signals are usually automatic whereas SNS signals can be voluntary. By measuring such SNS and ANS signals, scientists can for instance, shed some light on consumer's attention, their browsing behaviour and their preferences.

LeDoux (LeDoux, 1996) explores different suggestions that there are at least five arousal systems in our brain that contribute to emotional experiences. Four of these rely on chemical components such as acetylcholine, noradrenaline, dopamine and serotonin for arousal activation and are located in the brain stem. The fifth one is located in the forebrain. The amygdala takes the role of a "central processor and interacts with the prefrontal cortex (working memory and attention), hippocampus (long-term explicit memory) and sensory cortex (perception and short-term storage) to influence emotional responses. In addition, signals from the amygdala are sent to muscles and internal organs" (Bagozzi, Gopinath, & Nyer, 1999).

During our everyday life, our eyes are in constant motion, providing us with all sorts of information. The human eye (**Fig.2.3.2**) consists of *sclera,* which is a protective layer surrounding the eye*, cornea* - a dome-shaped window that covers the pupil and the iris, *a pupil*, which is the black circle in the middle of the iris, *the lens,* which is inside of the pupil and is responsible for controlling the amount of light that enters the eye and *an iris,* which is the coloured area (NIH, 2014). On the back of the eye, there is the *retina,* which is the area where images from the surrounding world are projected upside-down. Light rays are entering the eye through the cornea and the pupil, and are converted into electrical impulses. Those impulses are sent through the optic nerve to be interpret by the brain. In the retina, there are photoreceptor cells that are divided into two types - *rods* and *cones.* Rods are unable to distinguish colours, but are responsible for our "night-vision". Rods contain a specific pigment called rhodopsin, which is sensitive to dim light. Cones are responsible for our colour vision. They on the other hand are not suited to low light environments which is the reason why we cannot distinguish colours in the dark. The human eye consists of three types of cones, each of them responsible to capturing different light wavelengths - long, medium and short. Sometimes they are also referred as RGB cones. In the visible light spectrum (400-700nm), the Red wavelength is the longest, covering about 670nm. The Green comes second with about 510nm and the Blue is the shortest - 475nm. This is however not an accurate representation of the cones simply because we are able to distinguish Indigo light which has shorter wavelength of 445nm or Violet light, which has even shorter wavelength of 400nm.

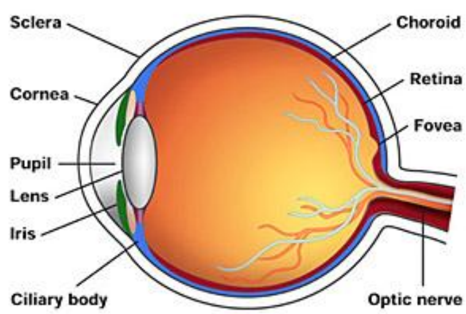


Fig. 2.3.2: *The human eye*

There is a small area of the retina called *fovea centralis.* It is responsible for the sharpest parts of the visual inspection, but since it covers only about 2 degrees of visual angle, the brain must turn the eye in order for the desired image to fall on the fovea (Westheimer & McKee, 1975). The actual movements of the eye are possible with the existence of six muscles - the *lateral rectus,* the *medial rectus*, the *inferior rectus*, the *superior rectus*, the *inferior oblique* and the *superior oblique* (Carpenter, 1988). All those muscles are responsible for left-right, up-down and rotational motions. The pupil on the other hand is regulated by two muscles - the *dilator* and the *constrictor.* It has been found that in dim light, the size of the pupil is from 6 to 8mm (MacLachlan, 2002) and in standard light environment - between 3-5mm (Wyatt, 1995).

Researchers are concerned with measuring consumer's eyes movements and pupil size when inspecting a product or a package. The underlying assumption is that our eyes are naturally attracted to interesting (instances that trigger our curiosity) or dangerous things (instances that can harm us). Different methods for tracking the eyes are adopted in order to accurately measure the desired variables. Those methods for instance can measure eye *fixations, saccades, blink rate* and *pupil dilations.*

2.3.2.1. Fixations

In their work, Genco *et al.* explain *fixations* as "moments when eyes are relatively stationary". Those fixations have been found to last between 150 and 600ms (Duchowski, 2003). Although the eye is supposed to be stationary during fixations, in reality it is not quite so. Researchers today agree on the existence of three main types of eye movements during fixation - *tremor, drifts* and *microsaccades* (Yarbus, 1967), (Spauschus, Marsden, Halliday, Rosenberg, & Brown, 1999).

Tremor is a wave-like motion of the eyes (Riggs, Ratliff, Cornsweet, & Cornsweet, 1953) with a frequency of ~90Hz (Carpenter, 1988) that is very difficult to accurately record, primarily due to the fact, that it is independent in the two eyes. Its role in vision is also unclear.
Drifts have been found to be slow motions of the eye that happen between micro-saccades. During those times, an image of the fixated object can move across dozen photoreceptors (Ratliff & Riggs, 1950). They have been found to help eyes to sustain visual fixation when there were no micro-saccades. When a moving object is being fixated, the eyes smoothly follow the object in a manner called *smooth pursuit* (Grasse & Lisberger, 1992). Depending on the velocity of the moving object, smooth pursuits may require corrective saccades in order to correct tracking errors. When a non-moving object is being fixated, another type of corrective saccadic movements, firstly introduces by Jurin in 1738 like "trembling of the eye" and later called *micro-saccades* (Darwin & Darwin, 1786), (Ditchburn & Cinsborg, 1953), (Rolfs, 2009) take place. Micro saccadic movements usually last between 2-120 arc-minutes (Duchowski, 2003). During those moments, information is being acquired where the duration and location of those fixations are valuable indicators of consumer's attention when viewing a visual stimulation. Micro-saccades have also been found to be necessary to maintain hue differences at low contrast (Ditchburn, 1980). A limitation that fixations present is the fact that often, the meaning of fixations is not entirely clear. For instance, when a person is inspecting visual stimuli, fixations on some aspects of it may indicate greater interest, but also - difficulty to interpret the information. Depending on the research context and nature of the study, it appears that longer fixations generally indicate processing difficulty while shorter fixations are indicative of processing fluency.

2.3.2.2. Saccades

Saccades are rapid eye movements lasting between 30 and 120ms (Duchowski, 2003) that bring the fovea (centre of sharp vision) from one location to another (Kowler, 2011). Saccades can also indicate cognitive effort allocated to image processing, confusion or some level of engagement. As suggested in their work, during saccadic movements, information is not acquired. Saccades are seen to be related to goals where "sudden shifts in saccade direction may represent a change in the viewer's goals" (Genco, Pohlmann, & Steidl, 2013). *Gaze paths* are explained as an end product of fixations and saccades. Gaze paths can also indicate valuable properties of consumer's attention such as efficiency of stimulus (short gaze paths) or confusion, lack of understanding and direction (long gaze paths). Saccades can be initiated voluntarily, but their path of motion cannot be changed. Saccadic movements can be influenced by number of factors: the overall structure of the scene (Torralba, Oliva, Castelhano, & Henderson, 2006), (Neider & Zelinsky, 2006); voluntary decisions to direct attention to key features of the scene (Pomplun, Reingold, & Shen, 2001), (Pomplun, 2006). The goal of Pomplun *et al.* study was to investigate the effects of task difficultly and divided attention on participants' eye movements. (Renninger, Verghese, & Coughtlan, 2007) found that people developed a strategy of looking at the most informative parts of shapes in a shape recognition environment.

Fixations and *saccadic patterns* have also been found to be dependent on tasks, goals and questions asked (Yarbus, 1967), (Elhelw, Nicolaou, Chung, Yang, & Atkins, 2008) and also, on the viewing period (Buswell, 1935). Elhelw *et al.* supported the earlier findings of task-relevance in people attention by concluding that an assessment task made people direct their attention to the most relevant parts of the viewed scene. Buswell *et al.* conducted an experiment, where participants were given a task to look at a picture and try to find a person, looking out of one of the windows of a drawn tower. Findings indicate that eye patterns are subject to "top-down" instructional controls as well as sedentary activities, locomotion, driving, ball sports and everyday activities involving multiple sub-tasks (Land, 2006).

2.3.2.3. Blinks

Blink rates and pupil dilation are valuable indicators of cognitive activity as well. Fast eye blinks, similar to saccades, can be cues to confusion whereas slow blink rates can indicate boredom or mental effort. Eye blinks are seen as a method to release focus from the attended stimuli (Genco, Pohlmann, & Steidl, 2013). Through measuring blink rate and blink duration, researchers can acquire greater understanding of "if" and "when" a visual stimuli is successfully communicating its message and directing consumer's attention. Research on blinks shows that there are three types of blinks: *reflexive* (Hall, 1945), which protect the eye from environmental intrusion, *voluntary* (Hall & Cusack, 1972), which are in response to stimuli and *inner blinks* (or also called endogenous blinks), which occur when the stimuli cannot be clearly identified (Stern, Walrath, & Goldstein, 1984). Hall (1945) found that people blink less when reading and more, when engaged in a conversation. By inspecting people, who were reading a text aloud, he found that blinks could serve as moments, when people take in information; moments, that help the brain analyze the information and prepare for more. Blinks were also found to last between 40 and 200ms (Volkmann, Riggs, & Moore, 1980). By studying blink frequencies and distribution, it has been found that blinks are correlated with cognitive activity and significantly more blinks occurred in conjunction with saccadic movements (Orchard & Stern, 1991).

2.3.2.4. Pupils

Changes in pupil size and their meanings date back as early as late 19th century, originally examined by the German scientist Dr. Wladislaus Heinrich and later carried in series of experiments (Hess & Polt, 1960), (Hess E. , 1972). Hess found strong correlations between emotions and pupil dilation. The automatic nervous system is responsible for the pupil dilations. Through years of research, it has been found that pupil dilation is not only a product of emotional involvement, but also of a cognitive activity (Hess & Polt, 1964), (Kahneman & Beatty, 1966), language complexity (Schluroff, 1982), attention (Beatty, 1982) and arousal (Sanbonmatsu & Kardes, 1988). The change in pupil diameters can be a good indicators of "emotional and cognitive reactions to stimuli" (Genco, Pohlmann, & Steidl, 2013) as well as represent an "intensive aspect" of attention (Kahneman, 1973). The state of arousal was found to increase the association between positive beliefs and attitudes (Bagozzi R. , 1994), but researchers argue that pupil dilation cannot be a valid indicator of emotional valence (liking - disliking).

For the eye-tracking results to be meaningful, the researcher must present the tested person with a task. Depending on the testing setup and context of research, this task may be as simple as "find the product on the shelf". In this situation, valuable data such as time to first fixation and gaze path can be collected, which can later be analyzed in a coherent way.

2.3.3. Eye-tracking

Eye tracking has been vastly accepted and used in visual information assessment in a number of fields - cognitive psychology, neuromarketing, human-computer interface device (Zhou, 2008). The eye-tracking devices are able to measure the point of gaze, the motion of an eye relative to the head and the size of the pupil. There are two different types of eye-tracking systems - stationary (which can be also divided into head mounted (**Fig. 2.3.3a**) and large table-top systems (**Fig. 2.3.3b**)) (Kumar & Schneider, 2009) and remote (**Fig. 2.3.3.c**). Head mounted devices that record eye movements data were firstly used by (Macworth & Thomas, 1962) to study driving and flying conditions. In their work, they used a camera mounted on the head. With the development of technology, the remote eye-trackers have started to gain popularity because it is less intrusive than head mounted displays (Klingner, Kumar, & Hanrahan, 2008), it is much more portable, people feel more comfortable (Marshall, 2002) and occasionally it is the preferred method of studying infants (Chatham, Frank, & Munakata, 2009). On the down side, the remote systems are less accurate in terms of estimating pupil diameter and require extra methods to deal with head movements.

Fig. 2.3.3a: *Head mounted eye-tracker*

Fig. 2.3.3b: *Table-top eye-tracker*

Fig. 2.3.3c: *Remote eye-tracker*

The studies of cognitive load take advantage of the current eye-tracking systems in order to measure valuable things such as pupil dilation and eye movements. It was found that when our brains acquire information, we tend to move our eyes more rapidly (Genco, Pohlmann, & Steidl, 2013). Researchers synchronise eye movements with pupil diameter to form meaningful cues into the cognitive load at each given moment. Measuring pupil size also present some difficulties, the most important of which is the ambient light. Our pupils are naturally dependent on the light intensity - they constrict when light is ample and dilate when absent. As such, in order for a meaningful data to be acquired, the working environment needs to be carefully selected and the ambient light needs to be controlled as much as possible. The most popular method for measuring changes in pupil size is with infrared video cameras. The way this works is by reflecting the emitted infrared light off the eye retina, causing the pupil to shine (**Fig. 2.3.3d**).

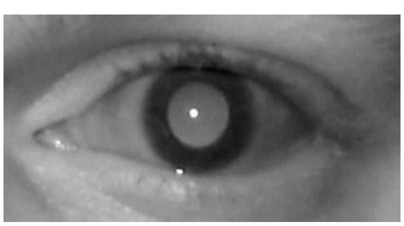


Fig. 2.3.3d: *Pupil image*

Pupils constrict and dilate according to various reasons, both cognitive and environmental. Researchers suggest that pupils dilate differently between cognitive load (Kahneman & Beatty, 1966), emotions (Goldwater, 1972), (Loewenfeld, 1993) and light. Cognitive load is associated with smallest pupil dilations of less than 0.5mm in comparison to emotional pupil dilations that are usually in a range of few millimetres.

One way to make sense of the pupil data is to measure dilation over a long periods of time, and then average the results (Pomplun & Sunkara, 2003). This approach however was considered not to be applicable for the purpose of this study, because it does not seem to be able to distinguish between rapid short-time changes in pupil size. By averaging on the whole length of the stimuli, it would have been impossible to tell which parts of the stimuli are responsible for emotional reaction on second-by-second basis. As mentioned before, gaze patterns are subject to viewing tasks (Yarbus, 1967). Task related instructions have been studied by (Duchowski A. , 2002), who proposed that a possible way to avoid the issue of task-bias is to give respondents a task, that does not rely on the creation of coherent memory representations of the viewed scene. Following the trend, this study performed eye tracking on participants completing the task of evaluating an advertisement containing a real and a computer generated characters. It was assumed that such task should not create any biases of participants gaze paths and their gaze direction should be distributed according to their perception of the stimuli itself. This way it would be possible to determine which parts of the scene attract participant's attention at each consecutive second.

2.4. Animation vs. Static Pictures

In an influential study, it was observed that in general, animations often had no advantages over still pictures (Tversky, Morrison, & Betrancourt, 2002), but when it comes to learning and problem solving, researchers argue that animation can contribute to much greater extent than static pictures simply because it presents more information. As such, people are not left to their imagination and interpretations of the visual stimuli, hence saving mental energy, avoiding misinterpretations that can lead to deficient mental models (Lewalter, 2003). Animation has found to be of particular importance when it comes to solving a problem (Mayer & Moreno, 2002), because "animation might be useful in helping your audience understand the steps in the procedure" (Weiss, Knowlton, & Morrison, 2002). On the other side of the discussion stands the fact that animation is consecutive, meaning that "one view one frame at a time, and once the animation or video has advanced beyond a given frame, it is no longer available to the viewer" (Hegarty, 2004), which was assumed to actually expands the cognitive load, hence devoting more energy. Other researchers have argued that the latter can be avoided through *prior knowledge,* because once familiar with the presented topic, one could invest less cognitive load into assessing the topic and more cognitive load into comprehending the actual animation. The presence or absence of visual cues in static pictures seems to be one of the major points in the animation-static pictures discussions, but the assumptions the researchers accept seem to be generalised. The advantages of animation over static pictures have been found to be significant when the "depicted motion in the animation explicitly refers to the topic to be learned" and when it involves a problem-solving scenario, but when the intention of the animation is to play a decorative rather than teaching role, the advantages of animation have found to be insignificant (Hoeffler & Leutner, 2007).

2.5. Model in Ads

This study examined the effectiveness of the computer-generated (CGI) model by focusing on the implicit connection between a CGI character and a product. It takes into consideration consumer's attitudes toward the advertised product, attention and purchase intentions.

By putting all those dependent variables into one study, it was believed that this approach would be helpful in understanding if and how a cartoon-like computer-generated character is perceived in the consumer's mind, in the advertisement context when there are no explicit claims about the advertised product.

Several studies examine the effects of a model on consumer's attention (Reid & Soley, 1981), purchase intentions and attitudes (Baker & Churchill, 1977). Findings indicate that product and brand attitudes are indeed mediated by the model, but their focus was to examine the difference between presence and absence of such model. A positive reaction toward advertised clothing in the presence of a model was also observed (Brumbaugh, 1993), but the attitudes toward the product have been considered to be independent from the model's physical appearance. (Soederlund & Lange, 2006) adopted a different mindset on the matter. By following the trend that "observers attribute positive characteristics to attractive people" (Eagly, Ashmore, Makhijani, & Longo, 1991), they suggest that the same emotional construct can be applied to other variables (such as attitudes toward the ad and brand (Cronley, Kardes, Goddard, & Houghton, 1999) and purchase intentions). Eagly *et al.* present that by general examination of a person advertising a product, more favourable emotions are generated in comparison to only the product. The model has also been examined to be able to produce certain reaction when it comes to his or her credibility (Priester & Petty, 2003). This is due to the fact that information, presented by an untrustworthy character is more likely to stimulate elaboration on the ad message in comparison to information, presented by a trustworthy character (Priester & Petty, 1995). In addition, the character's gender also plays role, in which scenario researchers argue if a physically attractive female model is the best approach when targeting male receivers and vice versa - if a physically attractive male model is the best option for reaching female recipients. It would appear that the majority of current research on model attractiveness concerns with how *the model* is perceived and not so much how *the product* is perceived *through* the model or with other words - how is the evaluation of both ad emotional endorser and the product advertised, influenced by emotions.

To summarise, this study assumes that the presence of a model will automatically create an emotional reaction and hypotheses that the attitudes and purchase intentions thus formed would be different between a computer-generated and a human ad-endorsers. Attention is another dependent variable, which is hypothesised to be mediated differently by the 1) different models and 2) different exposures.

2.6. CGI and the Uncanny Valley

Traditional animation has been the dominant form of animation since the early 20th Century and it was not until the beginning of 1980 when another form of animation started to emerge - the computer graphics. Although computer-generated effects have been used in films like *Tron* and *Blade Runner* since 1982, Walt Disney Pictures were the first to intertwine traditional with computer graphics animation in their movie *The Great Mouse Detective* (1986). Later years saw a blast in the usage of computer-generated effects and short-scale animations, which led to the creation of the first full-length computer-animated film - *Toy Story* (PIXAR, 1995).

For research purposes, especially in the human-computer interactions field (such as embodied conversational agents (ECA) (Casell, Sullivan, Prevost, & Churchill, 2000)), the development and usage of believable computer-generated characters appears to be a two-edged sword. On the one side, we have the advantages of a character that strongly resembles a real human being. Such character can create emotional connection with the viewer and through simulating human-specific properties, such as emotions and empathy, the artificial agent can be perceived as likable and believable (Brave, Nass, & Hutchinson, 2005). On the other, we have the disadvantages of a character that strongly resembles a real human being - it can be perceived as fake and repulsive, and can elicit unfavourable attitudes (Mori, 1970). Sometimes, researchers simply decide to be on the safe side by using caricaturisation and exaggeration in their virtual humans.
We, as human beings, are perfectly able to recognise synthetic facial expressions based on simulated emotions, simply because those expressions are purposefully created in a way, resembling those of humans (Bartneck, 2001). That recognition allows us to relate more positively to the virtual human in comparison to the absence of facial expressions (Brave, Nass, & Hutchinson, 2005). Recent finding on the impact of the lack of facial expressions in computer-generated characters on human perception and acceptance indicate that animated artificial characters can be rated as uncanny when no facial expressions are present regardless of the level of believability (Tinwell, Grimshaw, Nabi, & Williams, 2011).

The Uncanny Valley ("Bukimi No Tani") (Mori, 1970) is a hypothesis in robotics, proposed by the Japanese roboticist Masahiro Mori in 1970. The name itself, as well as the concept, essentially derive from the earlier work of Freud on "das Unheimlich" (Freud, 1919) or "the uncanny" (which is the opposite of "heimlich" or "familiar") in which he described his extreme unease when watching a prosthetic limb, or in a broader aspect, when something alien is presented in a familiar context. The Uncanny Valley theory describes how an artificial character, bearing human characteristics to different degrees, creates positive attitudes up until a point when those attitudes drastically become that of strong repulsion (**Fig.2.6**). This point is reached when the artificial character resembles a real human being to the greatest possible extent. In those instances, the character is unable to evoke empathetic response in the recipient. Mori describes the phenomenon as an attribute of familiarity - humans can build positive emotional relations to something, that is familiar and negative emotional relations to something that is unfamiliar, or uncanny. Although originally proposed for a robot-type character, the Uncanny Valley theory can be extended to any character that tries to resemble human features (such as a computer-generated one) (Schneider, Wang, & Yang, 2007) which offers interesting perspectives to contemporary animation studies. Finding from the latter study point to the idea, that the safest strategy for designing and creating a character, that is meant to interact with humans in some way (either directly like an ECA or indirectly by (re)presenting something), is to keep character's physical appearance as non-human as the study/concept requires, but at the same time - sustaining human-like traits. Although Mori had no chance to test his theory in a wide-range back in the 70s, it is evident that he considered this possibility when including the *bunraku puppet* in the graph.

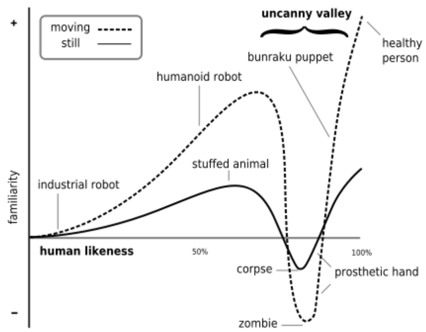


Fig. 2.6: *The Uncanny Valley*

During the designing stage of a computer-generated character, the Uncanny Valley is often taken into consideration (Weschler, 2002). As Weschler explains, a virtual character can exhibit different levels of physical realism (from Mickey Mouse through Shrek, to Aki from Final Fantasy: Spirits Within), but in the instances when this realism goes beyond 95 percent, as Mori hypothesise, there appears to be a major slope in the graph, where the slightest variance contributes to repulsiveness. Andy Jones, the *Final Fantasy* animation director also backs up this suggestion by explaining that a "replicant" (Scott, 1982) can get eerie as one "pushes further and further" into realism. This was also the reason of the creative team of Shrek to go for a less-realism for the character of Fiona: "she was beginning to look too real, and the effect was getting distinctly unpleasant" (Adamson & Jenson, 2001).

A concept explaining why a cartoon-like characters are frequently preferred over realistic characters can be found in the book *Understanding Comic* (McCloud, 1993) as well as in a study on the relationship between a character and the background (Vinayagamoorthy, Steed, & Slater, 2005). The underlined idea in both studies is that a cartoon-like character is more "flexible" and can be equally applied to photorealistic as well as cartoon settings whereas a realistic character can be perceived as uncanny if placed in a cartoon settings. In a very interesting analysis, further contributing to the notion of the Uncanny Valley, a comparison between two of the biggest computer-animated movies in film history yields the question *why is it that the breath taking and technically triumphant of them two is evoking considerably weaker viewers' positive attitudes than the other?* (Butler & Joschko, 2009). The two films in question, *Final Fantasy: The Spirits Within* (2001) and *The Incredibles* (2004), represent two acclaimed technological and animation achievements, but both take on different routes: *Final Fantasy* is "far and away the most ambitious (and expensive) attempt to render realistic digital humans to date" (Weschler, 2002) and takes the route to "ultra-realism" (Butler & Joschko, 2009). *The Incredibles* on the other hand take the route of caricature and exaggeration to convey character's personalities. The cost of creating

Final Fantasy was estimated to be $137,000,000, whereas the cost for creating *The Incredibles* was $92,000,000. It is obvious that the film, that pushed technology to its limits did cost considerably more to create, hence in theory, it should be a total blockbuster hit. Unfortunately, Mori's theory kicked in with full inertia in this example. *Final Fantasy* managed to gain a net profit of only $85,000,000, which is $50,000,000 short than what it initially cost. In comparison, *The Incredibles* achieved a net profit of $540,000,000, which is six times higher than what it originally cost. Butler *et al.* explain this phenomenon with the lack of positive attitudes toward *Final Fantasy* from the viewing community and critics. As also examines by the reviewer Jason Vice, "the film's greatest strength is also one of its biggest weaknesses. As realistic-looking as the characters are, the flat, expressionless features make them seem emotionally aloof and rather unsympathetic" (Vice, 2001). In direct comparison, *The Incredibles* received much more favourable attitudes with reviews giving the film almost perfect scores, where more often than not, superlatives such as "smooth, dynamic aesthetic" (Chen, 2004) could be observed. A key figure in Pixar explains that technological achievements should not be the only driving force in creating a computer-based animation, but also emotionally involving characters and good story (Lasseter, 1998). The Uncanny Valley theory can be quite successfully applied to the aforementioned scenario. The characters from *The Incredibles* were designed and created with cartoon style in mind, which is to say that they did not try to be as realistic as possible. They (along with the narrative) relied on real-world exaggerations in order to create some positive emotional connections with the viewer. On the Uncanny Valley graph, Butler *et al.* represent the movie as climbing toward the peak of "human likeness". Reviewers and researchers on the topic all underline the essential idea, that *The Incredibles* stimulate people to relate to the film characters - "parents relate to Bob (the father of the family) ... teenagers can identify with Bob's daughter Violet". In direct comparison, by watching *Final Fantasy,* viewers are seen to be "concerned with what is *wrong* with the animated character", rather than try to relate to them in any way.

3. Study Description

This study draws inspiration from the reviewed work on consumer behaviour and computer animation, and sets out to explore if a cartoon-like computer-generated character can be responsible for a change in consumers attention and attitudes toward the advertised product. It does so by integrating three cognitive constructs: attitudes toward the advertised product, visual attention and purchase intentions. Following the plethora of research on consumer's attitudes and attention, this study assumes that both positive and negative emotions play important role in consumer's ad-attitudes. The purpose of the present study is to explore if and how the model influences consumer's attitudes toward a product in the absence of explicit message claims. In the following four empirical studies, a comparison between a CGI and Human character in regards to product attitudes is made. Purchasing intentions as well as visual attendance were also taken into account.

For the purpose and limitations of this study, and following the notion that a very realistic computer-generated character could be responsible for creating some perceptual bias in viewers, it was decided for the model to be of a cartoon-like nature.

4. Deciding on the Approach

As already stated, this study concerns with exploring how people perceive a product, advertised by a cartoon-like computer-generated human, by taking into account attitudes, attention and purchase intentions. In order to do so, a quantitative approach, followed by an experimental design was conducted.

Following the *indirect route to advertising effectiveness* (Genco, Pohlmann, & Steidl, 2013), it was assumed that the advertisement should try to provoke some emotional reaction in the recipient, which will then lead to positive or negative product associations. The product should be an item, which is inexpensive and should belong to a familiar product category. Although one of the goals of the study is to inspect how people direct their attention in the presence of a computer-generated character (in comparison to a live actor), this should only be a measurable attribute. Therefore, attention, in the sense of conscious evaluation of the ad-claims, should not be evoked, because it can lead to biases through counter-arguments. By avoiding this scenario, it would be possible to observe if the attitudes to the advertised product have been mediated by the computer-generated actor and not by some explicit claims.
In addition, few more aspects were taken into consideration:
- there should be no explicit claims on the advantages or advantages and disadvantages (Kao, 2011) of the advertised product
- there should be no price claims
- the "attention" aspect should be exemplary of consumer's visual attendance and should reflect their eye-fixations on different portions of the advertisement at any given moment. The differences in their pupil sizes should also be assessed.
- the actor, should be co-exposed with the product by implicit connection.

4.1. Eye-tracking Options

With those restrictions in mind, the available options on eye-tracking devices that could aid this study were assessed.

Tobii X30, X60 & X120 (Tobii, 2014)

Fig.4.1a: *Tobbi X2-60 eye-tracker*

Those eye-trackers provide easy and invasive-free test environment by tracking people eyes remotely. The latest and smallest, the X2-60 provides 60Hz of sampling rate whereas the X2-30 uses a sampling rate of 30Hz. Both support up to 25" screens and they are ideal for on-screen studies that require mobility. They also have the largest tolerance to head movements and, according to the manual, they are highly accurate and have a "stable and reliable eye-tracking calibration [that] eliminates the need for recalibration during long sessions". The Tobii Studio Software is responsible for analysing the collected data. It can statistically and visually represent data, in order to make it more understandable. The software can also build gaze-points and heat maps.

NUIA eyeCharm (NUIA, 2014)

Fig.4.1b: *NUIA eyeCharm*

Fig.4.1c: *NUIA using Tobii eyeX*

NUIA eyeCharm (Natural User InterAction) initially started as a KINECT add-on (**Fig.4.1b**), but eventually saw this as inconvenient and switched to Tobii hardware (**Fig.4.1c**). At present, NUIA eyeCharm is using the latest Tobii eyeX eye-tracker along with their own NUIA software. Similarly to X2-60, this device benefits from small size and portability. As usual, it uses a near-infrared light to track the eye movements which data is then send to their eyeX engine for meaningful interpretations (eyeX, 2014). The NUIA software is able to interpret eye tracking, gesture and speech recognition, so for instance one can pop up menus by looking at them, or can pause the media player whet one tells it so. One can also navigate through their picture album by using gestures.

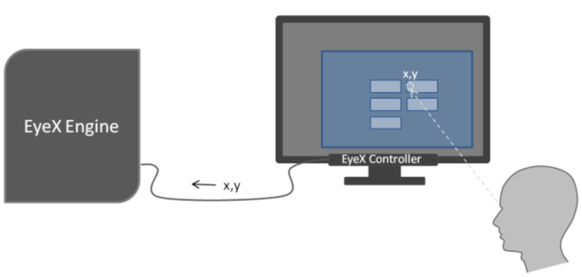


Fig.4.1d: *Eye-tracker working diagram*

EyeTech VT2 (EyeTech, 2014)

Fig.4.1e: *EyeTech VT2 eye-tracker*

EyeTech is founded in 1996, which makes it one of the oldest companies on the market. EyeTech VT2, similar to the Tobii devices, uses infrared light to track the pupils. Unlike Tobii's X2-60, it uses 80Hz of sampling rate, which basically gives it more precision. EyeTech claim to be able to achieve "excellent results no matter the lighting conditions". The eye-tracker itself has an accuracy of .5° and supports up to 30" monitor. Their software is able to represent real-time gaze points, heat and focus maps and areas of interest.

VisionTrak Desktop 300 (Polhemus, 2014)

Fig.4.1f: *Polhemus VisionTrak Desktop 300*

VisionTrak Desktop 300 is a remote eye-tracking device that collects data about pupil size and eye movement at a standard update rate of 60Hz real-time or 120Hz/240Hz high speed. It uses either 5 or 9 points calibration procedure. The software allows for the collected data to be displayed as raw or graphical formats.

The EyeTribe (TheEyeTribe, 2014)

Fig.4.1g: *The EyeTribe eye-tracker*

This tracking device utilizes a high resolution sensor, that is able to track the tiniest movements of the pupils with high precision. On their website, it is also stated that the device is precise enough at most environments and light conditions, but it is suggested that for an optimal use, it should be used indoors. It can work either with 30Hz or 60Hz sampling rate and can use up to 24" screen. One can collect data regarding eye-points as well as pupil size. The software that makes sense of the data, such as eye positions or heat maps, is not included, but EyeTribe use a cloud service platform (EyeProof, 2014) where researchers can upload the desired content for evaluation.

The EyeTribe eye-tracker was selected as the testing device due to its current availability, affordability and ability to accurately track pupil size.

4.2. Software Options

In order to create a video-based advertisement, which will consist of a CGI "actor", performing some action or motion, the following programs were used:
- ***Maya*** (Autodesk, 2014), for its modelling, rigging, texturing and animating abilities
- ***After Effects*** (Adobe, 2014), for its graphical, audio and key-framing tools
- ***Photoshop*** (Adobe, 2014), for its drawing and graphical tools

In addition, given that the eye-tracker comes with no software to extract the collected data and visually or statistically represent eye fixations, saccades and pupil sizes, two corresponding programs to address these variables were used - ***MATLAB*** (Mathworks, 2014), for its computational, analytical and visualisation abilities and ***SPSS*** (IBM, 2014) for the statistical analysis. In regards to the future MATLAB implementation, several options were taken into consideration:

- eye-fixations, saccades and pupil dilations should be visually represented for each consecutive second of advertisement footage
- the advertisement should be divided into four different regions of interest (ROI) and for each second, eye fixations within each ROI should be counted
- a method to show pupil dilations within each ROI for each second should be developed
- the program should be flexible enough to allow quick data switching between participants and evaluation between the 1st and the 2nd exposure to the ad

4.3. Advertisement Concept

Following the aforementioned considerations, the advertisement was decided to include a product, that is cheap and purchased frequently, a model that is going to use the product, a fictitious logo and some background music. Taking the pupil limitations into account, it was decided to give all the visual elements equal brightness weight. It was assumed that this way, dilation biases due to, for example, overexposed product on underexposed background should be prevented. True, there should be clear distinction between background and foreground elements, but not to the extent to which it will cause pupils to significantly dilate or constrict. Two identical advertisements were set to be developed, where the only thing changing is the actual model. One, containing a live actor and another one - containing a CGI model. As already stated, the CGI model was decided to be of a cartoon-like nature.

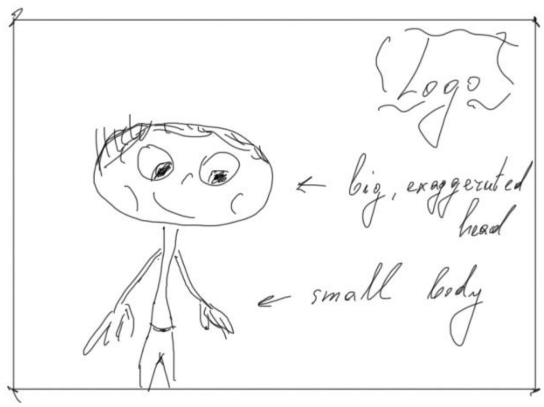


Fig.4.3a: *Concept 1*

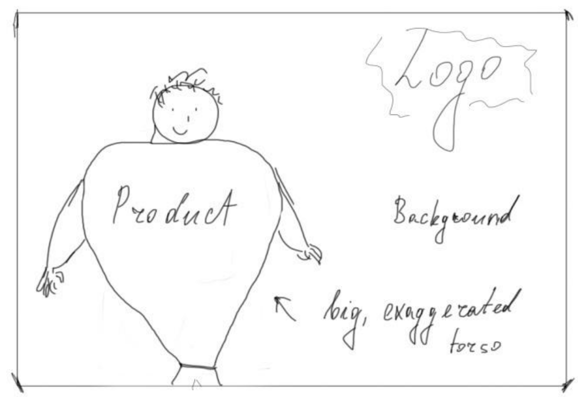


Fig.4.3b: *Concept 2*

The product was also decided to be that of clothing. For that purpose, a t-shirt from a catalogue of t-shirts (Threadless, 2014) was selected and purchased (designed by Mathiole (Mathiole, 2014)). In order to extend the scope of this study, a separate, but parallel study should explore several different clothing and accessories options and more specifically, it should investigate the impact of a CGI character on consumer's attitudes and purchase intentions in regards to a broader clothing variety.

4.4. Testing Approach

The testing procedure should include a final version of both ads, which will be seen by participants and their attitudes toward the product and purchasing intentions should be evaluated accordingly. An eye-tracking device should be used in order to measure eye movements and pupil size. As a side-study, differences in fixations and pupil diameter in participants between first and second exposures to the ad should also be examined. The sample of participants should be large enough to be statistically significant where half of the sample will be exposed to the "human ad" and the other half - to the "CGI ad". The recruitment and distribution of the participants should be random.

Another group of people should be randomly recruited and distributed for the part of the study, that includes general clothing and accessories. Their eye movements will not be measure. The attitudes toward the product as well as purchase intentions will be the only dependent variables. This sample of participants will be exposed to printed media and not a video-based advertisement.

4.5. Hypotheses

This study examines the influence of a cartoon-like CGI character on people attitudes toward the product, their attention to the advertisement and their purchase intentions. The following hypotheses were thus formed yielding several studies, testing procedures and methodologies:

H1: *A cartoon-like CGI character will elicit less favourable product attitudes and purchase intentions than a human character*

H2: *A cartoon-like CGI character will concentrate consumer's attention more toward its appearance and less toward the advertised product in comparison to a human character*

H3: *There will be significant differences in consumers' eye-path between the first and second exposure to the advertisement*

H4: *A cartoon-like CGI character will elicit less favourable product attitudes and purchase intentions than a human character in regards to general clothing and accessories*

5. Implementation

5.1. Character Creation

Two different character concepts were initially considered, both of which should have physical exaggerations - a character with a big head and a small body and a character with a normal-to-small head and big body. These concepts were mainly inspired by CGI animated movies such as *Shrek* (DreamWorks, 2001) and *The Incredibles* (PIXAR, 2004). In order to inspect which one was more suitable for the purpose of this study, both characters were created using the default toolsets in Maya.

5.1.1. First Character

5.1.1.1.Modelling

First, a character with a big head and a small body was modelled following a reference picture, courtesy of Digital Tutors (DT, 2014).

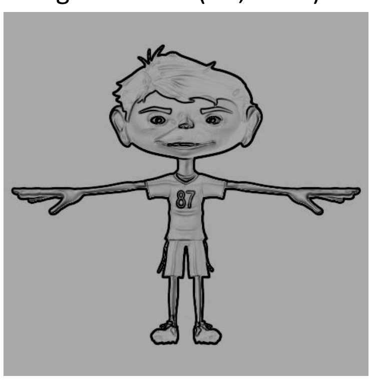


Fig.5.1.1.1a: *Cartoon character front view*

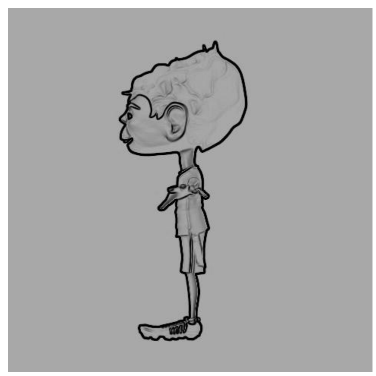


Fig.5.1.1.1b: *Cartoon character side view*

The character was modelled using different POLYGONAL as well as NURBS surfaces techniques. First, the head was blocked from a simple polygonal cube, and then a topology for the eye sockets and the mouth opening was created by adding mesh loops. At this point, and following the referenced picture, the nose was shaped into form. After that, the eyes were created separately using NURBS surface. They were fit into the head, after which eyelids were created around the eyes. The mouth was then shaped into a smiley form and by adjusting vertices and inserting more loops, in order to have more definition, mouth corners were created.

After that, a simple cube was used to create the ears, which was then sculpted into a form of an ear. In order to attach geometry to another geometry, it is necessary to make sure that both geometries have equal amount of edges or vertices. Likewise, for the ears to be able to be successfully attached to the head, several more vertices were created either with more loops or with cutting the mesh faces. The head was then given more definition and sculpted according to artistic preference, using the *sculpt geometry tool.*

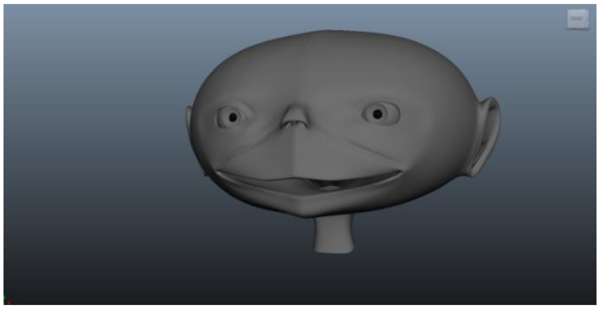


Fig.5.1.1.1c: *Cartoon character head*

After the head was finished, the body was created mainly using polygonal surfaces, following the reference picture. Once the body was shaped accordingly, some of the faces were selected and a t-shirt was extruded out of them. In order to give the illusion that the t-shirt had some plait, several edge loops were inserted which were then pushed inside and up or outside the geometry. The shorts were built in an identical manner.

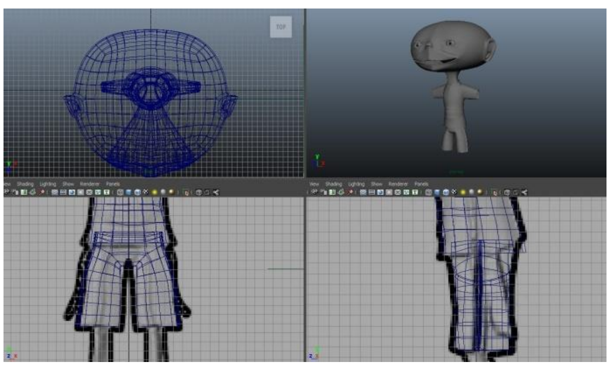


Fig.5.1.1.1d: *Cartoon character body*

The arms and legs were created from a polygon cylinder and shaped according to the reference pictures. Small bulges were created for the knees and elbows by adding more definition into those areas. Hands were modelled separately, starting from the fingers, by using a primitive cylinder again. When all the fingers were done, they were connected into one geometry and the hand was built from that geometry.

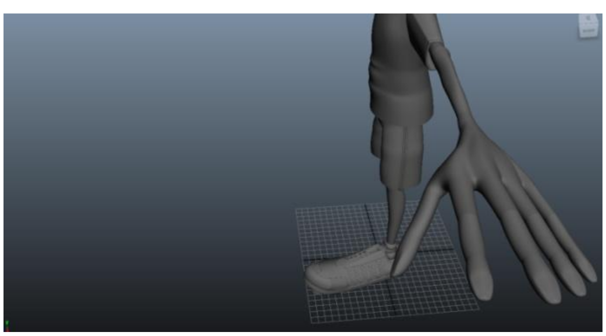


Fig.5.1.1.1e: *Cartoon character hand and shoe*

The next thing to take care about was the shoes (**Fig.5.1.1.1e**). They were made from polygon cube and shaped into form. Several faces were extruded to give some texture and detail. Since the legs were already finished, socks were also extruded from few of the bottom faces of the leg geometry.
After finishing the legs, shoes and socks, and in order to give the character some personality, teeth and a tongue were created from primitive cubes.

Fig.5.1.1.1e: *Cartoon character teeth*

The last step was to create the hair. It was made from polygonal cube and sculpted around the head in a tapered shape.

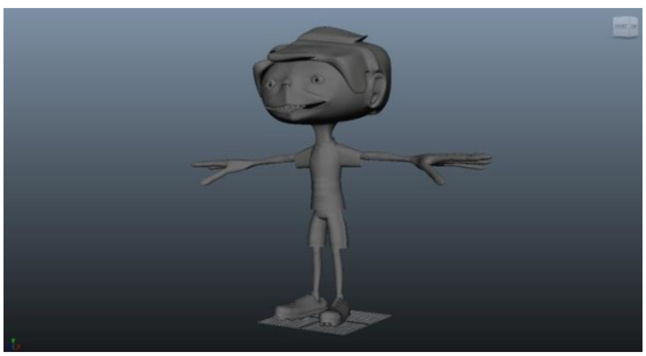
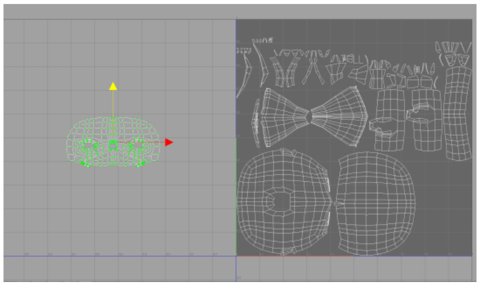


Fig.5.1.1.1f: *Cartoon character hair*

5.1.1.2. Texturing

After the model was finished and eye brows modelled, it was time for texturing. Since this is a cartoon character, no sophisticated high-resolution textures were needed. Before adding textures, however, materials such as *lambert* and *phong* had to be applied first. Each material has unique attributes such as specularity, reflection, etc., so different materials are used for the t-shirt, hair, teeth, tongue and the skin. The eyes are NERBS objects, which UVs are implicit, or with other words - there is nothing to change. UVs are how Maya understands how to put colour and texture onto a model and for the eyes, the used texture, unlike the rest of the body, was a ramp. The ramp was of *Type U* with *no interpolation,* which means that the texture is flipped to the side, so the top part of it represents the outer part of the eye, the pupil area, and the bottom part - the inner part of the eye (which is basically invisible to the viewer). Using *No Interpolation* gives us sharp edges.

After applying materials to every part of the body, a UV map of the face had to be extracted so it is correctly textured. Since during the modelling process many modifications were made, chances are the default UVs are messed up. An automatic mapping technique in order to create proper projections was applied. Once all the UVs were correctly projected, they were "sewed" together into an unfolded representation of the face.



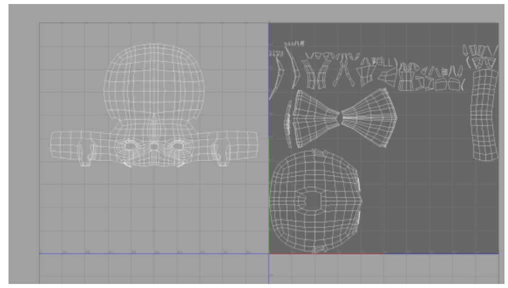


Fig.5.1.1.2a: *Face UVs*

When the UVs were done, a skin material of the type *phong* was applied to the model. For the actual colouring of the face, instead of using a simple colour, a 3D texture that was mapped to the already arranged UVs was used. The *3D Paint Tool* made the painting of some colour variations to the face possible. Such variations were different shades of pink around the eyes and the nose, freckles, blushes.

Fig.5.1.1.2b: *Cartoon character fully textured*

The last method for texturing the model was a *projection*. The *projection* itself is an external file, which is attached to a material and projected onto the body. In order to be precisely placed on the body, the projection had to be scaled up and the colours of the texture and the coloured material had to be matched.

Fig.5.1.1.2c: *A projection of the ad-product*

After the sculpting and texturing of the model were finished, it was time for rigging.

5.1.1.3. Rigging and Skinning

The advertisement's requirements dictate that there will be movements and the model will visually present or interact with the product in some way. As such, it had to be properly rigged.

The rigging process started from the legs. The goal was to have an animator-friendly rig, which will make the model behave realistically and which will greatly speed up the animation process, hence contributing to the animation flow. Switching to the *side view* window in Maya, and following the reference picture, the first joint to create was the *thigh joint,* then the *knee joint,* continuing down the chain, the *ankle joint* was created, then the *foot joint* and the rig finished with the *toe joint.* One important thing to keep in mind is that in order for Maya to know what the bending direction of the whole chain is, the joints should be placed in a slight angle. The complete joint chain was then oriented in the proper angle through the *Attribute Editor -> Joint orientation* menu and mirrored across the YZ axis using the mirror function *Behaviour* which flips the joint orientation over to the other side.

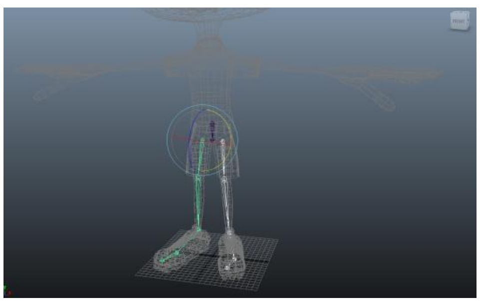


Fig.5.1.1.3a: *Cartoon character leg joints*

The hip bone was also created and by selecting it first and the two root leg joints next, we can apply a point constrain with maintain offset off. This way we make sure that the hip bone (or also called the pelvis joint) is correctly centred between the two leg joints. After that, the *pelvis* was parented to the *skeleton group* (which so far consisted of the two leg joint chains). The root joints were then parented to the *pelvis*.
A new set of joints for the spine, neck and the head were created using the *joint tool*. The *spine bone* was snapped to the *pelvis* and its end - moved to the top of the head. Using the *insert joint tool* in Maya, the needed resolution on the spine was created (torso, chest and neck). Two more joints were created for the eyes and parented to the *head bone*.

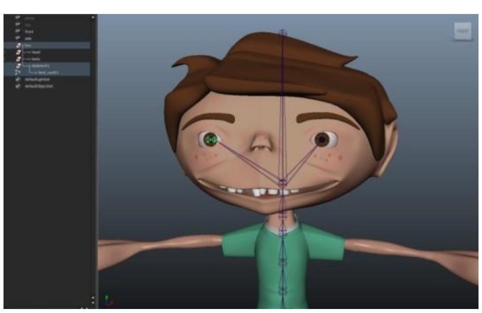


Fig.5.1.1.3b: *Cartoon character waist, chest, neck, head and eye joints*

Similar to creating the joints for the legs, the arm joints depend on the way the arm was modelled. They must follow the geometry's curvature so Maya will know where they bend. Arm joint chain was created up until the wrist and was then parented to the *chest joint*. Joints for each finger were created and oriented according to the model's posture.

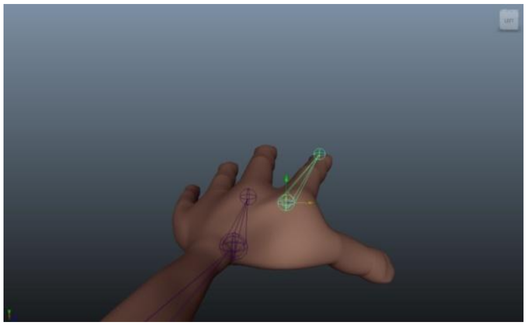


Fig.5.1.1.3c: *Cartoon character finger joints*

All the root joints for each finger were selected and parented to the *hand bone*. The *hand bone* was then parented to the *arm joint*

Fig.5.1.1.3d: *Mirrored hand and arm joints*

After the whole model was rigged, the mesh geometry had to be applied to all the joint chains. This process is called *skinning.* By selecting the desired mesh and then the bone to which it should be "glued", we can select the menu *Skin -> Bind Skin -> Smooth Bind (options).* There are several different options for the skinning process and it is important to know which one is the appropriate one for a given situation. *Joint hierarchy* option considers not only the selected joint, but also its children, whereas *Selected joints* option takes only the selected joints into consideration. The *Weight Distribution* option is also important because by selecting *Neighbours* we can prevent influence in areas, which we do not want to have any influence. This is particularly important when rigging small parts that are close together and have many joints (such as fingers), to prevent, for instance, the middle finger being influenced by the thumb joint. The *Dropoff rate* is also preventing influence on places we do not want to have influence. By selecting a higher than the default value, Maya knows that the influence a joint has, should only extent to the next joint in the chain.

Using the explained methods above, the character was skinned by selecting the desired mesh and shift-selecting the corresponding joints. The results were satisfactory, but on several occasions, the binding process created some blocky results. This is however a good thing, because we can clearly see which parts of the mesh require our further attention using a painting technique called *weight painting.*

Paint Skin Weights Tool can be accessed through the *Skin -> Edit Smooth Skin* menu and what it does is actually giving us the opportunity to refine our initial skinning outcome. Black parts indicate that the joint has no influence at that part and white parts indicate some to full influence.

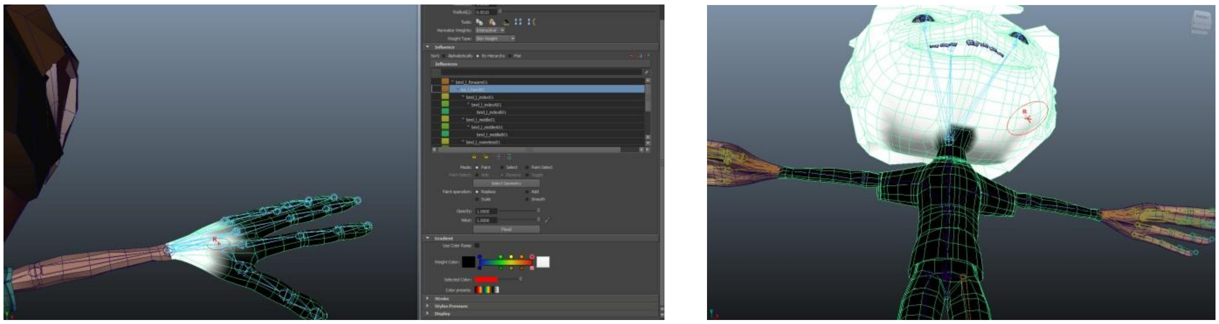


Fig.5.1.1.3e: *Paint Skin Weights Tool*

After all the weight distribution was completed and the character was properly skinned, *inverse kinematics* were inserted to the character's limbs. The menu can be accessed from *Skeleton -> IK Handle Tool.* This tool has two important options to consider - *Single-Chain Solver* and *Rotate-Plane Solver.* The *Single-Chain Solver* is quick and easy to use, but it presents a limitation - when we start to rotate the desired parent joint, the mesh starts to twist. This twist is something we cannot control. That is why the *Rotate-Plane Solver* was used. The *IK Handle* itself is a straight line, which is created between the root joint and the end joint. Four IK handles were created for the arms and the legs, which were then correspondingly renamed and grouped into one group called *iks01.* The *skeleton* group along with the *iks01* group were then combined into one group named *global01.*

5.1.1.4. Creating Control Objects

In order to ease our work during the animation period, controls had to be created. Those controls will serve as an easy-to-grab tool when moving the character around and since they are going to be different for each body part, they will also play the role of visual indications to quickly find which of them all is controlling, for instance the left knee. Controls are best done with the use of NERBS curves, because they do not appear in the final render. A good practice when creating control objects is to make the controls controlling the limbs in the form of a rectangle, the ones controlling the knees and the elbows - in the form of a sphere or a diamond (octahedron), the ones controlling the body and the head - a triangle, a different type of rectangle or a 3D box and for the ones controlling the eyes - a circle. It is also a good idea to paint all the controls responsible for the left limbs in one colour and all the controls responsible for the right limbs - in another. The controls controlling the body should also inherit their own colour. Each control should also have zeroed out transformations before proceeding further.
Several controls were created for the knees, the backbone, the chest, the pelvis, the elbows, the neck and the head, and were snapped into their corresponding places. To each of those controls, *orient constraints* were applied. This is done so we can rotate or move the joint (hence the mesh) by manipulating the control itself. A centre-of-gravity control was also made, so we can easily move the character's centre while the limbs follow the motion. Once all the major controls were done, they were grouped into a *controls01* group and stored into the *global01* group. The end joints were then parented to each corresponding control object.

For the eyes, two separate controls were created using NERBS circles, which were then combined into one control, to drive both eyes collectively.

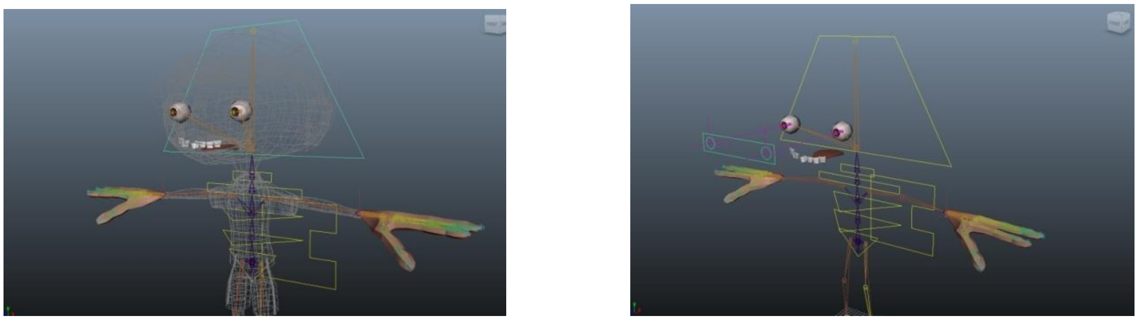


Fig.5.1.1.4a: *Centre of gravity, body, head and eyes controls*

For the fingers, ten different independent controls were created, each of them having a *parent constrains* applied according to the corresponding finger. The groups were then named correspondingly and parented to the *hand bone*. Another *parent constrain* was applied, this time to the whole group, to make sure that all the sub-groups move along with the hand. The finger joints were then oriented to the finger controls using *orient constraints.*

The last step is to refine the controls for the fingers by creating some custom attributes that will take care of all the folds (for example hand forming a fist). An attribute can be added through the *Modify -> Add Attribute* menu. The two new attributes created were named *Mid* and *End.* Depending on the way the model was made and the orientation of the joints, different rotational axes had to be applied for the thumb and the rest of the fingers. The way this is done is through the *Window -> General Editors -> Connection Editor* menu. First, the desired control was selected and placed into the *Output* (left) side and then, the mid and end finger joints were selected and loaded into the *Input* (right) side. Since we are not interested in the *orientation* or *position* of the finger, but only *rotation,* the rotation field was expanded and corresponding parts from the two windows connected. The end result is a control, which can make the finger realistically fold in three sections.

Fig.5.1.1.4b: *Finger controls and connection editor mapping*

5.1.1.5. Creating Character Sets and Animation

Last step before beginning with the animation was to create a *character set.* A character set allows us to quickly set keys on all keyable items on the rig, so for instance if we create two character sets - "lower body" and "upper body" we can assign key frames on each of them separately, without affecting the other one. This can greatly improve the animation flow.
A character set is made through the *Character -> Create Character Set* menu. After creating a character set, all the controls responsible for the lower part of the body were manually selected and a *subcharacter set* (*Character -> Create Subcharacter Set*) was created. Likewise, for all the upper body controls. At this point, all the modelling, rigging and skinning of the character were done and the model was ready for animation.

The animation process was straightforward. The character sets were already done so the character was easy to animate. Since the idea of this study is to assess if a CGI character influences differently consumers in comparison to a real character, the only thing that changes between the two advertisements must be the visual appearance of the character itself. Therefore, the movements the CGI character had to perform should be as close as possible to the movements the actor performs. Since no motion-capturing technology was used, it had to be done by key frames. During the creation of the character, a test-advertisement with an actual actor was also created. The advertisement was about a travelling agency where the actor was playing different roles and performing different actions. The movements of the actor were recorded and served as guidelines to animate the CGI character.

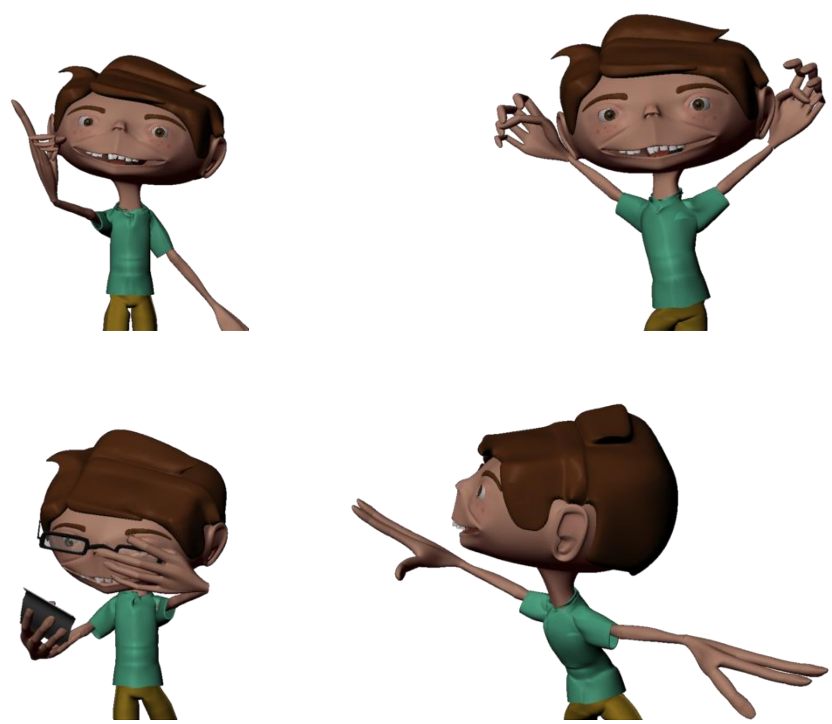


Fig.5.1.1.5a: *Different scenes and postures*

During the animation process, a 720p camera was used to monitor how much of the whole scene will be visible after the rendering.

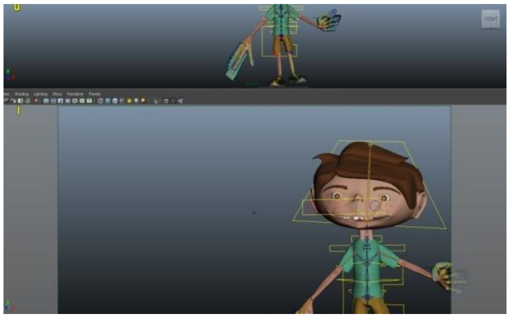


Fig.5.1.1.5b: *Animating with 720p camera*

The data acquired from the preliminary advertisement yielded some discussion about its content, direction, quality and length, so proper modification had to be made. The live actor was changed with another person and new animations were key-framed according to his movements.

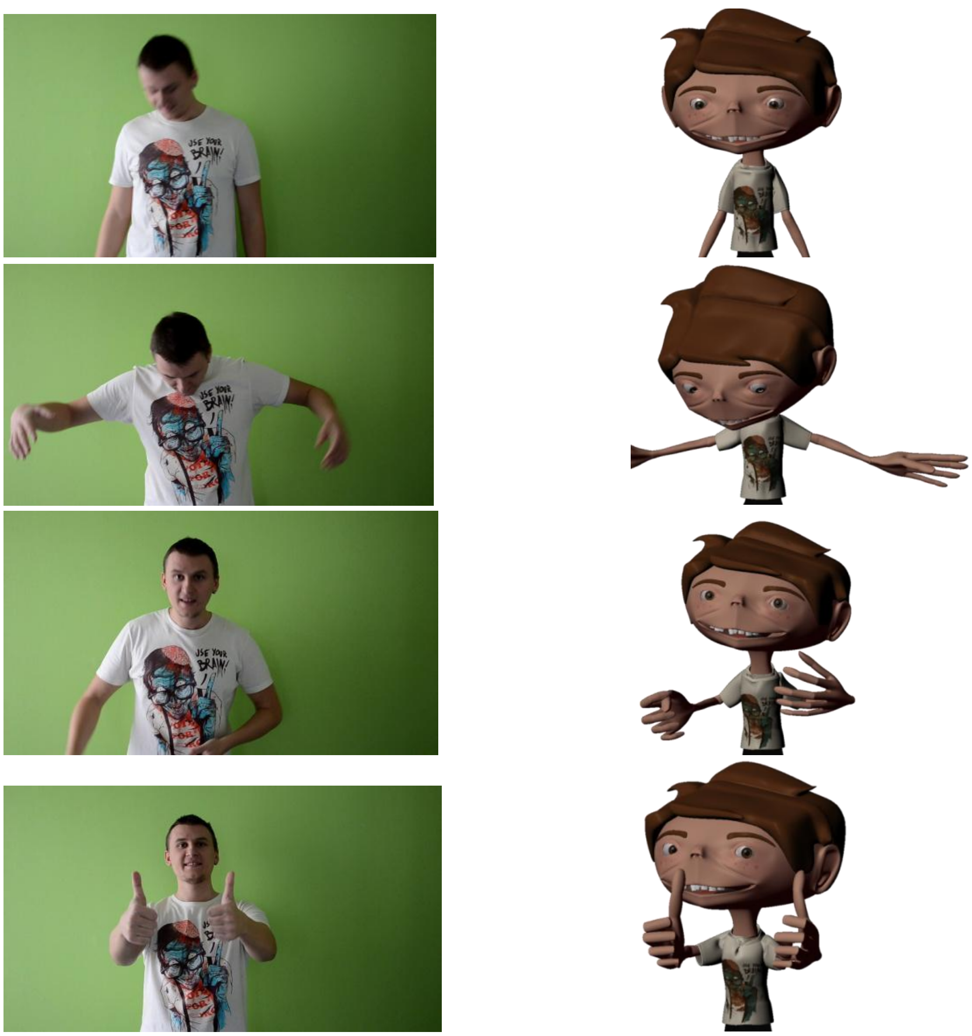


Fig.5.1.1.5c: *Final render of the product and movements*

The final result, as interesting as it might be, called forth even more discussion, mainly regarding the advertised product's proportions between the two ads. In order to avoid unwanted biases due to visual inconsistency between the characters, and taking into account that another character was also considered in the early design stage, a second character set to be modelled, rigged, skinned and animated. Besides the requirement that the new character had to be as closer to its human counterpart as possible, it also had to exaggerate specific attributes and features visible in the live model. The actor was big and muscular, so the CGI character had to exaggerate those attributes. The prior experience as well as the work on character believability (Brave, Nass, & Hutchinson, 2005), (Bartneck, 2001) and (Tinwell, Grimshaw, Nabi, & Williams, 2011) led to an important decision - facial expressions. Results from a study investigating the Uncanny Valley (Seyama, 2007) indicate that people are feeling uncomfortable when the computer-generated character exhibit abnormal features such as bizarre eyes. Although the advertising clip lasted only for 10 seconds, the live character, as a human being, is naturally expressing emotions. Thus, as suggested by the researchers in their corresponding studies, a CGI character should also be able to facially simulate different emotions. It was assumed that this way, the character would be seen as a believable agent and not a "puppet" which was the case with the previous model. The creation and animation of facial expressions were decided at the expense of the lower body part of the character, which was obscured to the viewer anyway. The animation of the movements of character had to be refined, by creating better skeleton and control system. In order to push the animation even further, make easy-to-access facial expressions and add different creases and folding to the t-shirt, it was decided on the use of *blend shapes.*

5.1.2. Second Character

A character with a normal head and a big body was modelled following a reference picture:

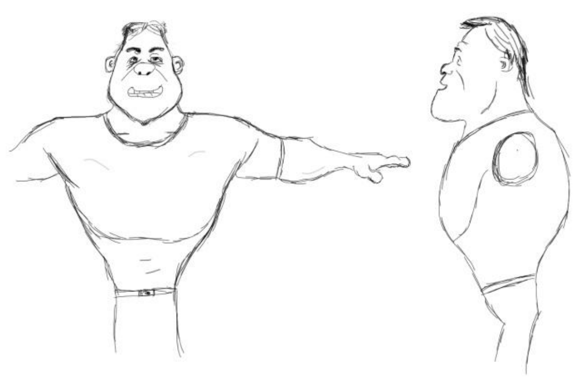


Fig.5.1.2: *Second character reference picture*

5.1.2.1.Modelling

A quick overview of the modelling process is presented in the following paragraphs, because the steps taken were almost identical to the modelling of the previous character.

It all started with modelling the face and the head. The basic flowzones the face needed were created with *polygon planes*. Those flowzones were the mouth opening, nose and eyes. By using the *split polygons tool* and *edge loops,* more detail was added later. The back of the head and the neck were extruded out of those polygons. Eyes were created with *polygon spheres* and positioned in the head. The eyelids were adjusted accordingly. Teeth were created with *polygon pipe* and some variation to each tooth was applied.

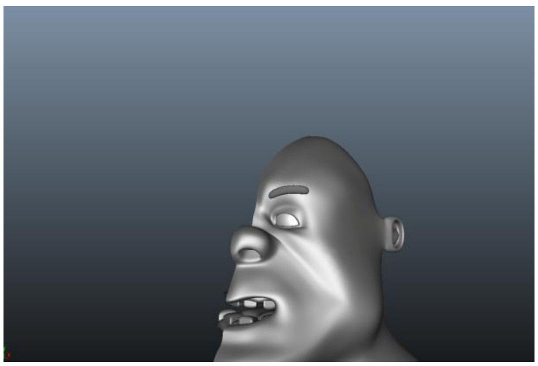


Fig.5.1.2.1a: *Head*

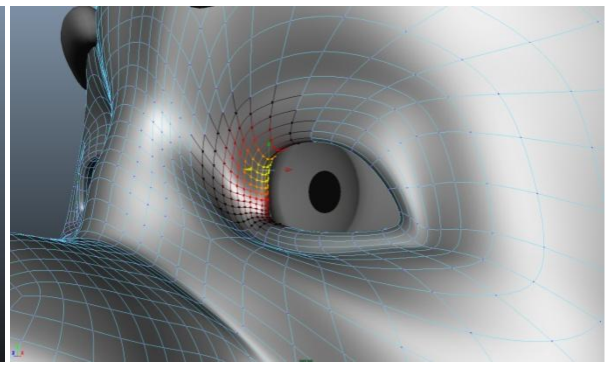


Fig.5.1.2.1b: *Adjusting the eyelids*

The body was created using *polygon cylinder* and following the reference pictures, several body flowzones were established. By establishing such zones, it is a matter of concept requirements as well as artistic preference to create either a cartoon-like character or realistic one. The difference is in the amount of detail and the anatomy correctness. The body was then sculpted into shape following those zones. The arm was extruded from the shoulder polygons up to the wrist. The hands were created separately from *polygonal cube*, which was then subdivided in order to extrude the thumb. Fingers were created separately and attached to the already modelled palm. Knuckles were also added with *edge loops.*

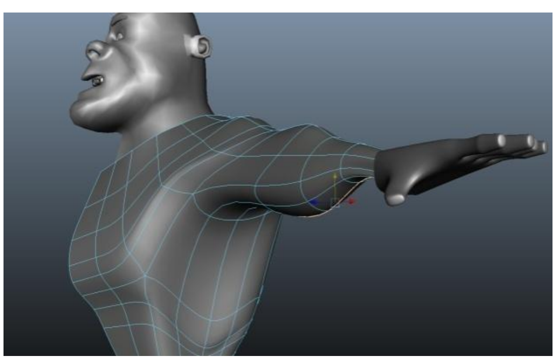


Fig.5.1.2.1c: *Body and hand*

The body was then added more definition and through the use of the *sculpt geometry tool,* it was sculpted in the desired form. A t-shirt was extruded out of the body in a similar to the previous model manner. It is easy to extrude a t-shirt, because it matches the topology of the mesh. Had the design been of a differen type of clothing, such as braces, the *cut faces tool* can be used to cut faces in a manner that does not follow the mesh topology. In this scenario, further attention and tweaking should be devoted to manage leftovers such as closeby vertecies and triangle faces.

The hair in comparison to the previous model, was done differently. The body mesh was made *live,* which means that anything which we create will no longer stick to the grid, but to the geometry. Several *NERBS curves* with different variations were then drawn on the head. They served as pathways to extrude several *polygon cylinders.* The *sculpt geometry tool* was used again to give some further variation to the hair and the face was further refined by giving it some wrinkles.

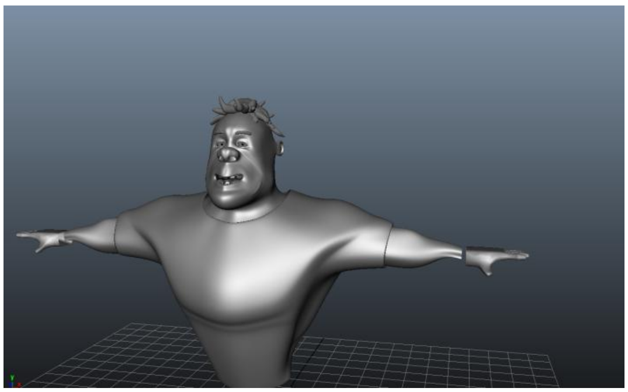


Fig.5.1.2.1d: *Model's t-shirt and hair*

5.1.2.2. Texturing

The texturing process followed the exact same steps as in the previous model. Different materials were applied to different parts of the body and each material was assigned a corresponding colour. A *ramp* method was used for texturing the eyes.

Fig.5.1.2.2: *Textures*

5.1.2.3. Rigging and Skinning

It was time for the rigging procedure. As previously mentioned, it was decided for this character to have some basic facial expressions, so the rigging had to go one-step further. This step included creating joints for the eyes, for the eyelids, for the upper jaw and for the lower jaw.
The character's body was rigged in the same as the previous character manner. The spine bone was segmented into five parts (waist, torso, chest, neck and head) and the arms, hands and fingers were rigged accordingly. Two more joints were created for the eyes where each eye consist of two extra joints for upper and lower lids. Two more joints for the mouth were also created and parented to the head bone.

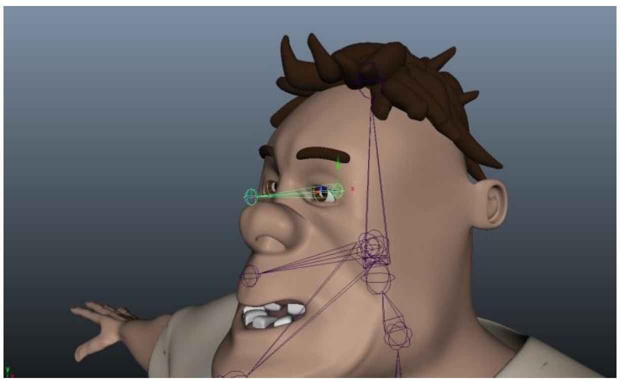
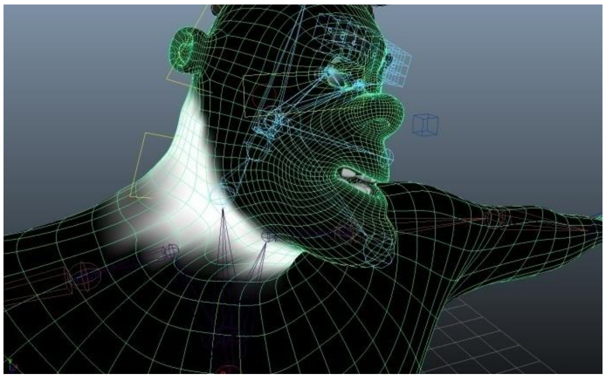


Fig.5.1.2.3a: *Character rigging*

Rigging a face can be tricky, but essentially the goal is to create organic deformers (such as fleshy eye-rigs, skins sliding effect, etc.), which in the end will contribute to the believability of the character. The character should be able to simulate as realistic facial expressions as the animation context and design concept require.
After the joints for the upper and lower jaws were created and parented to the head bone, joints for the eyes and the eyelids were made. *Point constraints* were applied in order to align the joint chains to each corresponding eye. Unlike the previous character, those joints were parented to the *upper jaw* and not to the *head bone* in this instance, because the *upper jaw* is the one driving the upper part of the head. Each eye chain was then duplicated twice and oriented to the directions of the eyelids. The lower lid joint was then rotated to 180° on the X-axis so that when we select both eyelid joints and start rotating them, they will rotate in different directions, hence creating blinking.

With all those steps, the *rigging* process was finished and it was time for *skinning* (or also known as *binding*).
First thing to bind were the teeth and the gums. A *smooth bind* method was used so they can attach to either the upper or the lower jawbone. Next followed the eyes, which were skinned to the eyebones. The upper and lower jawbones, as well as the neck and the head bones were then skinned to the head mesh. The eyelid bones however were added as influences. This way we can prevent a joint having too much influence over parts of the mesh, which should not be influenced by it. For example if we bind the mesh to the eyelids, the eyelids joints will most likely influence not only the lids, but also the brows and even the forehead. Keeping this in mind, the end joints of each lidbone were manually selected, the head

mesh was also selected and they were added as influences through the *Skin -> Edit Smooth Skin -> Add Influence* menu. At that stage, a quick evaluation of head movements and influences was made in order to see which part of the head needed to be addressed further, using the *Paint Skin Weights Tool.* By selecting the mesh, then the paint tool and last - the desired bone, we can start painting weights where needed (white) and erase - where too much (black). This technique was used also to paint some weights to the eyelids individually.



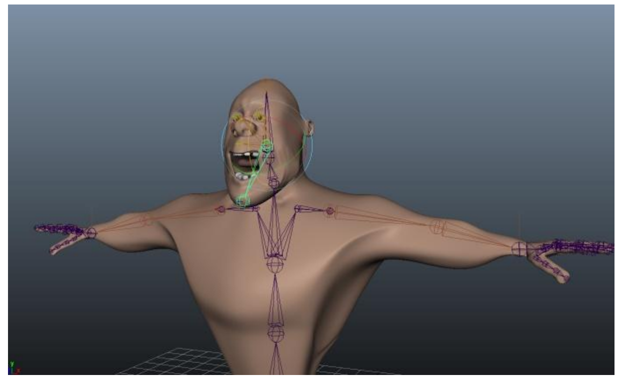


Fig.5.1.2.3b: *Paint Skin Weights Tool*

Depending on the model, design and the future animation, this can be a long process, but the final goal is to have a model whose bones are influencing the correct parts of the mesh.

Since no extra bones were created for the eyebrows, a *lattice deformer* (*Create Deformers -> Lattice*) was used in this instance. This is a quick and powerful free-form deformer that creates a cage around the desired part of a mesh. All of the mesh that should be influenced by the lattice deformer was selected by manually selecting all the faces that stand behind the eyebrows and convert that selection into vertices. The resolution of the deformer was adjusted so that we have enough segments to control both eyebrows. After that control clusters to control the different parts of the lattice were applied assigned. Three control clusters for each eyebrow were created: one, for controlling the section of the brow closest to the procerus, another one, for controlling the middle section and the last one - for the very end of the lattice. The clusters were made through the *Create Deformers -> Clusters* menu by first selecting the desired lattice vertices.

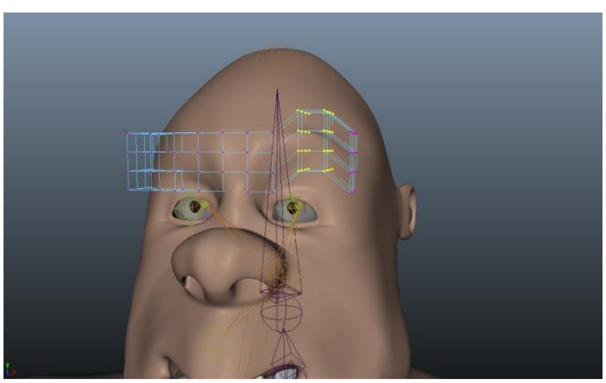


Fig.5.1.2.3c: *Eyebrow lattice*

Next thing to do was to make the eye movements more realistic. Regardless of how complex and realistic the eyeballs, if the eyes simply rotate in the eye sockets without affecting the skin around them, they would look unnatural and the character would look lifeless. The goal here is to make the upper and lower lids affected by the rotation of the eyes.
This was done by first selecting which axis should the lid move on and then *right clicking* on the selected rotational channel and selecting *Expressions* menu.

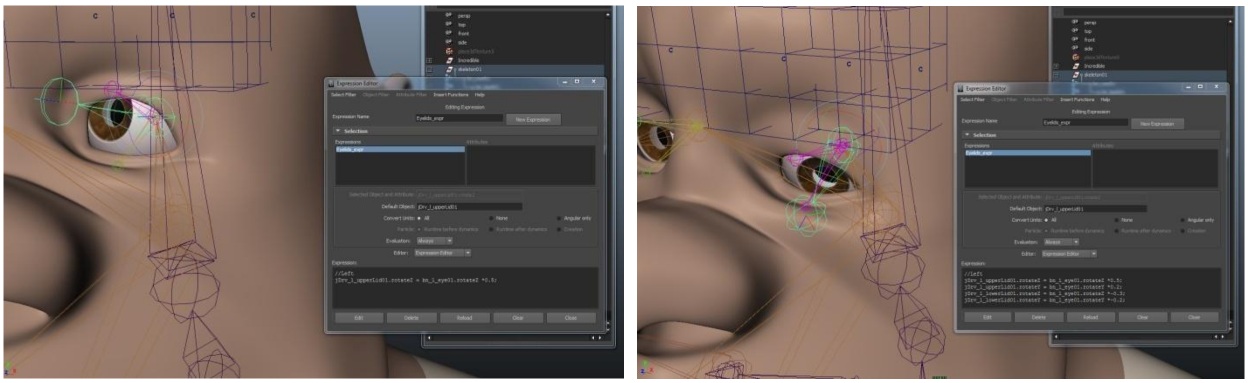


Fig.5.1.2.3d: *The Expressions menu*

Several expression entries were created for all the movements of the left and right eyelids. An expression looks like that:
[upper_lid_bone].rotateZ = [eye_bone].rz * 0.5;

The line of code can be read like this: *the upper lid bone has to be influenced by 50 % of the eye bone's rotation on the Z channel*

5.1.2.4. Creating Control Objects

Once finished with all the expressions and the skin movements, controls for the neck and the head were made using *box curves.* They were also grouped together into a *global* group and their colour was changed to yellow. Since the control was supposed to be driving both *rotation* and *position* of the neck, a *locator* was created to which a *parent constrain* was applied. The *locator* was then parented to the *neck control.* Another locator was used for the head bone in identical way and both locators were oriented to their corresponding bones using *orient constrain.*
After finishing with the neck and head controls, controls for the jawbones were created. They were then parented to the *head control* and not to the head bone. Two *locators* were also made for each jaw separately and *parent and orient constrains* were applied to each of them separately. Eye controls were also created in a similar to the previous character manner. Brow controls allowed to easy selection of the brow clusters, so for each brow cluster, separate controls were created. The clusters were then oriented using the *parent* and *scale constrains.*

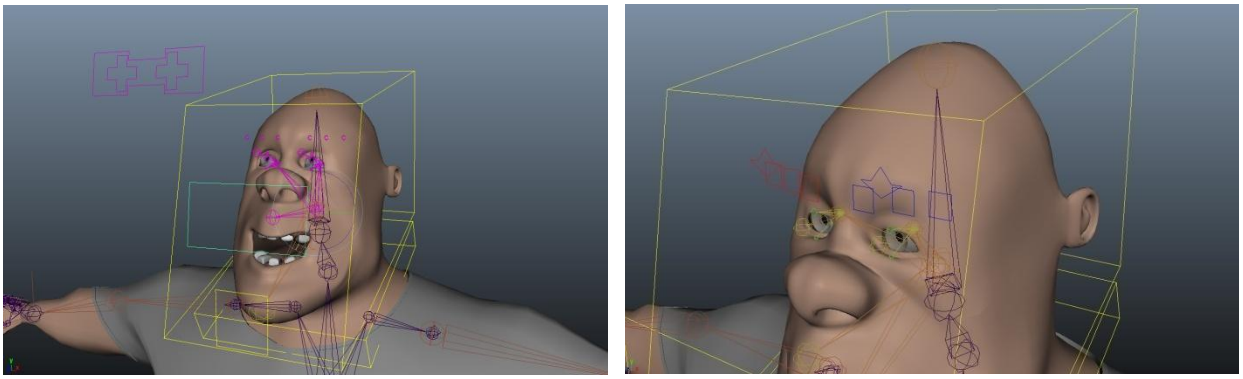


Fig.5.1.2.4a: *Head and brow controls*

After finishing with the head controls, the brows and the hair were made visible again and attached to the head using a *wrap deformer* (*Create Deformers -> Wrap*)*.* The *wrap deformer* causes geometry to follow the deformations of a mesh, which is defined as the influenced object. The *Falloff mode* was changed to *surface,* because the eyebrows are along the surface of the face.

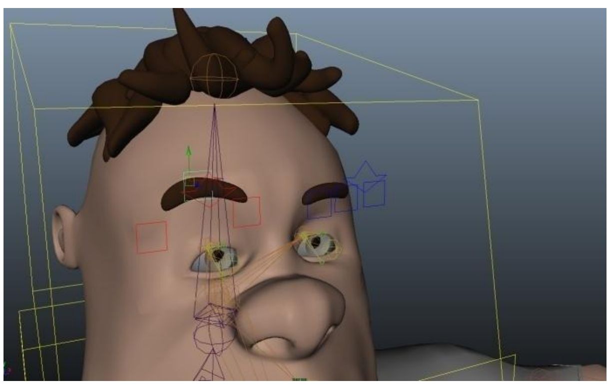


Fig.5.1.2.4b: *Attaching back the hair and the brows*

Once all the head was finished, controls for the torso, chest, elbows, hands and fingers were created in identical to the previous character manner. Realistic finger movements were also created through the *Connection Editor* menu.

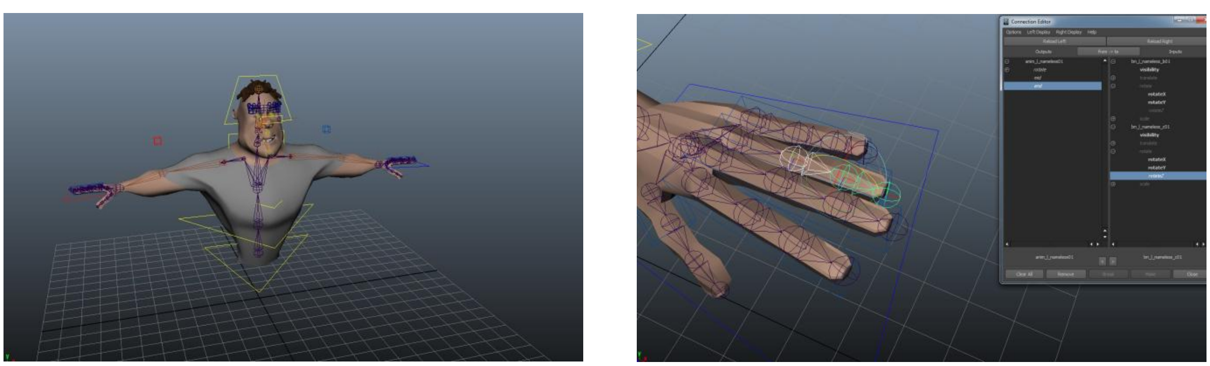


Fig.5.1.2.4c: *Body controls*

5.1.2.5. Creating Blend Shapes

The next step before starting with the animation was to create *blend shapes* for the body and the head. *Blend shapes* are important for creating key facial or body shapes. They were done by duplicating the desired mesh according to the number of different key-movements or key-expressions. In this case, two different blend shapes were created for different expressions. The duplicated meshes were moved to the side, renamed accordingly and then grouped together into the *blendShapes01* group. Different expressions (such as smile) were sculpted using the default Maya *soft select tool.*

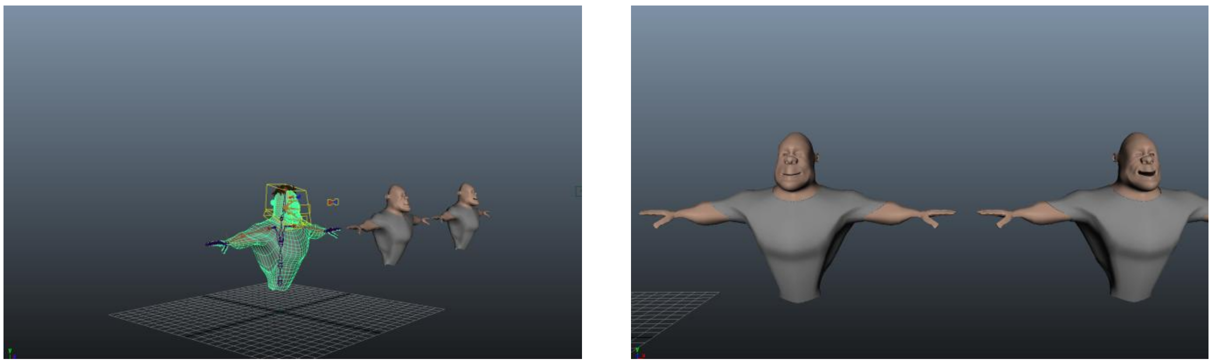


Fig.5.1.2.5a: *Blend shapes*

In order to connect the newly made blend shapes to the base character, they had to be selected in the correct order. First, the two blend shapes were selected one at a time and then - the base shape. Then, through the *Create Deformers -> Blend Shapes* menu, they were all connected. Blend shapes can be further controlled from the blend shape node in the INPUTS field. This is however inconvenient, because upon deleting the history, this field will disappear along with all the valuable information. In order to prevent that from happening and to have control over the blend shapes at any moment, a separate control through the *Connection Editor* menu was created to hold the values of those shapes.

The animation followed a similar to the previous character procedure. The movements the actor made were mimicked by the CGI character. A character set was also used to aid in the animation process. A 720p camera was used to monitor how much of the screen will be visible after rendering the scene. Using the blend shapes, few facial expressions were animated (slight surprise and a smile). The blend shapes were also used to give some textural variation to the t-shirt, making it realistically fold in different places during arm movements.

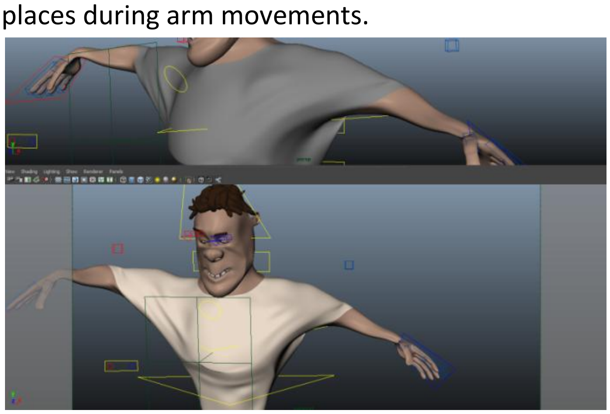


Fig.5.1.2.5b: *T-shirt creases and animation*

Two directional lights were also applied in order to give the character a cel-shading illusion, which will make it look even more cartoonish.

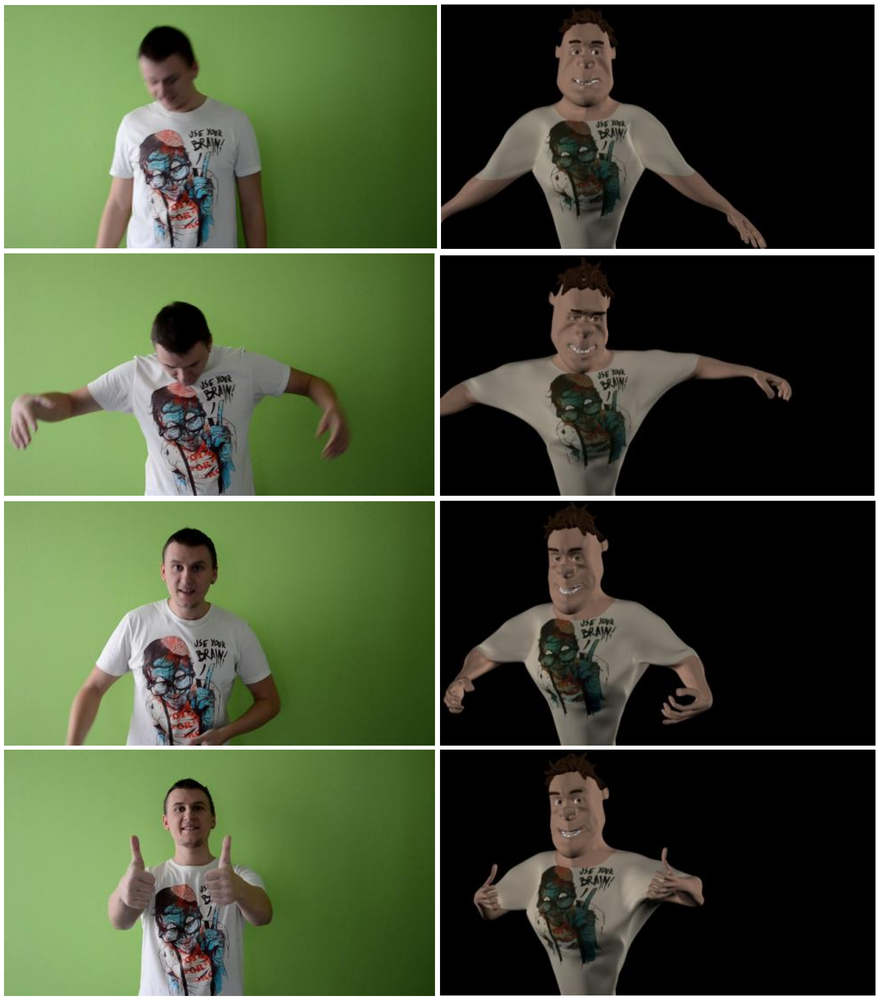


Fig.5.1.2.5c: *Final render of the product and movements*

5.2. Advertisement Creation

Once the character was animated, the animation was rendered out as a sequence of pictures. Both the sequence and the live actor footage were then imported to After Effects and the advertisement was created. A background picture that shows a shop full of t-shirts was made in Photoshop and also imported. Two identical advertisements were created using the After Effect's default toolsets. A logo was created to give the animation an advertising feeling and catchy background music inserted. An overall colour-correction was applied, the dark and bright places of the ad were addressed and all the visual elements were balanced.

Fig.5.2: *Live actor and CGI actor advertisement*

5.2.1. Booklets

As previously mentioned, the last part of the study concerned with evaluating people attitudes and purchase intentions in regards to general clothing presented by a CGI character. For that purpose, two different pictures were created for each of four different products - one with a CGI model and one with a human model. The pictures were then distributed into two different booklets so that each booklet had the opposite pictures.

Fig.5.2.1: *T-shirt, Scarf, Tie and Shirt advertisement*

5.3. EyeTribe eye-tracker and MATLAB Implementation

As previously stated, a remote eye tracker makes it possible to evaluate human attention in a non-intrusive way by measuring eye-fixations, saccades and pupil sizes. The EyeTribe tracker calculates the location where a person looks by taking into account the size of the screen and the distance between the screen and the attendant. The location is represented by XY coordinates. According to their website (TheEyeTribe, 2014), the eye-tracker's accuracy is around .5° to 1° of visual angle which in real life gives about .5 to 1cm of an on-screen error.
In order to achieve correct tracking results, the eye-tracker must be calibrated for each participant simply because each person has unique eye characteristics.

Fig.5.3a: *Eye tracker menu and calibration*

The menu to the left shows when a person is standing in the right position. If their eyes are not visible to the eye-tracker, the picture changes to red. The EyeTribe tracker has a fairly large field of view, so as long as the person is watching at the screen from the correct distance (45-75cm), it should not pose a problem. For optimal calibration results, it is recommended to place the sample eyes in the middle. The calibration process consists of 9, 12 or 16 calibration locations where a red target is displayed at different locations of the screen. The users must follow it with their eyes. When finished, the calibration result is evaluated by a ranking system and the researcher can decide if they should continue or re-calibrate. For the present study, a 14" laptop having a resolution of 1366x768 was used.

The *Options* tab consists of one of the most valuable functions of the EyeTribe SDK - the API console.

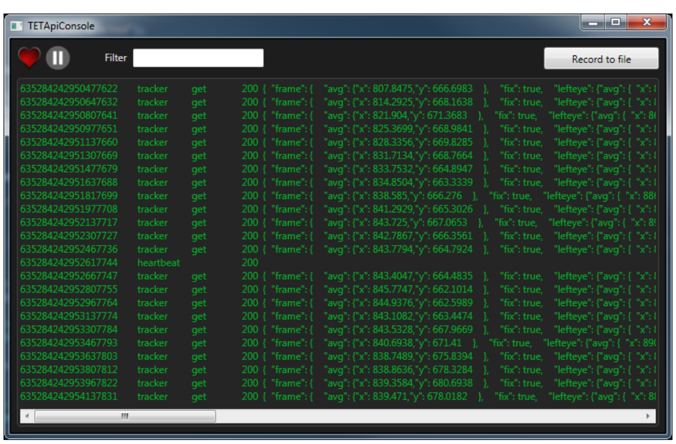


Fig.5.3b: *Eye tracker API console*

This console allows the researcher to record the streamed data received from the EyeTribe Server into a .txt file for later inspection. According to the manual, "lefteye raw" gives the raw XY coordinates for the left eye, the "lefteye avg" gives the smoothed XY coordinates for the left eye and "psize" gives the pupil size. Likewise for the right eye. There is another field, however, which is not documented. This field was found to give the combined XY coordinates for both eyes (referred as *eyesX* and *eyesY* from now one).

This study explores people eye movements and pupil dilations during viewing an advertisement. The advertising footage was 14 seconds of length. As such, this study was concerned with measuring saccades, fixations and pupil dilations for each consecutive second. The EyeTribe SDK does not include an analysis toolkit out of the box, nor does it provide any visual segmentation of the recorded data in terms of seconds. In order to extract and analyse the desired fields (eye coordinates and pupil values) out of the streamed data, MATLAB was used.
A method for assigning number of data rows to seconds of footage was adopted. Since the footage was 14 seconds long, the number of recorded rows were counted for each participant and then divided by 14. Depending on the person, this resulted in approx. 22 eye-fixations for a second. In order to evaluate this method, another division was made - 1 second was divided by 22 fixations which (again, depending on the person) gave approx. 45ms of saccade which is in conjunction with the 30-120ms range (Duchowski A. , 2003).
This understanding was important to establish, because all the MATLAB implementation was based on the number of data rows, where the goal was to have a unified code, which can be quickly and easily adapted to each participant. The eye-tracker data for each participant was then imported into Microsoft Excel. The columns for *eyesX*, *eyesY*, *left pupil* and *right pupil* values were extracted and the new data was divided into corresponding seconds. It was saved as a new file, which was then imported into MATLAB as a matrix. Following the designing stage, a corresponding code to address all the considerations was developed (see **APPENDIX** for the full code).
The code was able to load a sequence of pictures stored in one folder with the use of a *for loop*:

```
srcImages = dir('C:\Users\ICO\Documents\MATLAB\Heatmap_Statistics\cgi\*.png');
for p = 1: length(srcImages)
 filename = strcat('C:\Users\ICO\Documents\MATLAB\Heatmap_Statistics\cgi\', srcImages(p).name);
            I = imread(filename);
            imshow(I)
```

Each matrix consisted of four columns: *eyesX*, *eyesY*, *left pupil* and *right pupil.* Variables were assigned for each of them and the corresponding columns from the matrix were extracted.

```
x = P10StatisticsHuman2524(:,3);
y = P10StatisticsHuman2524(:,4);
p_left = P10StatisticsHuman2524(:,1);
p_right = P10StatisticsHuman2524(:,2);
```

An *interval* function that loops through the different columns was needed. The length of a column represented the length of the ad-footage. A function was created to jump every 22 rows (1 second):

```
interval = 22;
i1 = (p-1)*interval+1;
i2 = p*interval;
x0 = x(i1:i2,1);
 y0 = y(i1:i2,1);
PL = p_left(i1:i2,1);
PR = p_right(i1:i2,1);
```

In a manner similar to a study, that codes gaze data (Herbelin, Grillon, Ciechomski, & Thalmann, 2007), in order to measure gaze distribution, the visual field was segmented into four regions of interest (**ROI**): *head, body, logo, background.* Unlike their approach, the present study did not take into account relative distances between a fixation point and a specific sub-region of interest (such as the character eyes or specific parts of the advertised product). Instead, the ROIs served as tools to represent whole areas of the picture. The evaluation method was also different: fixations were counted according to the ROI they belonged to. The ROI holding the greatest number of fixations was then labeled as "attention region". For instance if there were 18 out of 22 fixations on the head at the 5th second of footage, the head was considered to be the attention region.

The ROIs were created with the function *rectangle* and values were assigned for the width and height of each. They were also coloured in different colours:

```
r1 =rectangle('Position',[320,30, 350, 300]); %rectangle head
r2 =rectangle('Position',[100,332, 740, 420]); %rectangle body
r3 =rectangle('Position',[770,20, 590, 250]); %rectangle logo
set(r1, 'edgecolor','b');
........
```

Another *for loop* was used to check *if* a value from the desired matrix "falls" into one of those ROIs and if so, those values were counted and shown on screen:

```
for IX = 1:length(y0)
   if (y0(IX) > 30 && y0(IX) < 330 && x0(IX) > 320 && x0(IX) < 670)
   D1 = D1+1; %where D1 = 0
    text(320,20,['pic[',num2str(p),'], headshots = ',num2str(D1)],'Color','y');
       elseif (y0(IX) > 332 && y0(IX) < 752 && x0(IX) > 100 && x0(IX) < 840)
              .........
```

A separate function was created to monitor when a fixation belonged to a given ROI and in those instances, the *minimum* and *maximum* values for each pupil were extracted and shown on screen. In order to measure dilation (or constriction), it was necessary to inspect the difference between the *minimum* and the *maximum* values for each ROI in the frame of 1 second. *PL_mm* and *PR_mm* are raw values from the 1st and 2nd columns of the matrix converted into millimetres.

```
headLeftArray(D1)= PL_mm(IX);
headRightArray(D1)=PR_mm(IX);
head_diff_PL = max(headLeftArray) - min(headLeftArray);
head_diff_PR = max(headRightArray) - min(headRightArray);
text(200,40,['PL min= ',num2str(floor(min(headLeftArray)*10)/10),'mm'],'Color','w');
text(200,55,['PL max= ',num2str(floor(max(headLeftArray)*10)/10),'mm'],'Color','w');
text(200,70,['PR min= ',num2str(floor(min(headRightArray)*10)/10),'mm'],'Color','w');
text(200,85,['PR max= ',num2str(floor(max(headRightArray)*10)/10),'mm'],'Color','w');
```

A method to inspect where the focus is at any given second was created:

```
focusArray=[D1,D2,D3,D4];
if(max(focusArray)==D1)
    fprintf('The focus is on the head. Max/Min PL = [%f ; %f]. Max/min PR = [%f ; %f]\n\n'...
      ,max(headLeftArray),min(headLeftArray),max(headRightArray),min(headRightArray));
elseif (max(focusArray)==D2).....
```

Different *texts* and *plots* were used to visualise the data on the screen and create the gaze-path along with the eye-fixations, which led to the final result:

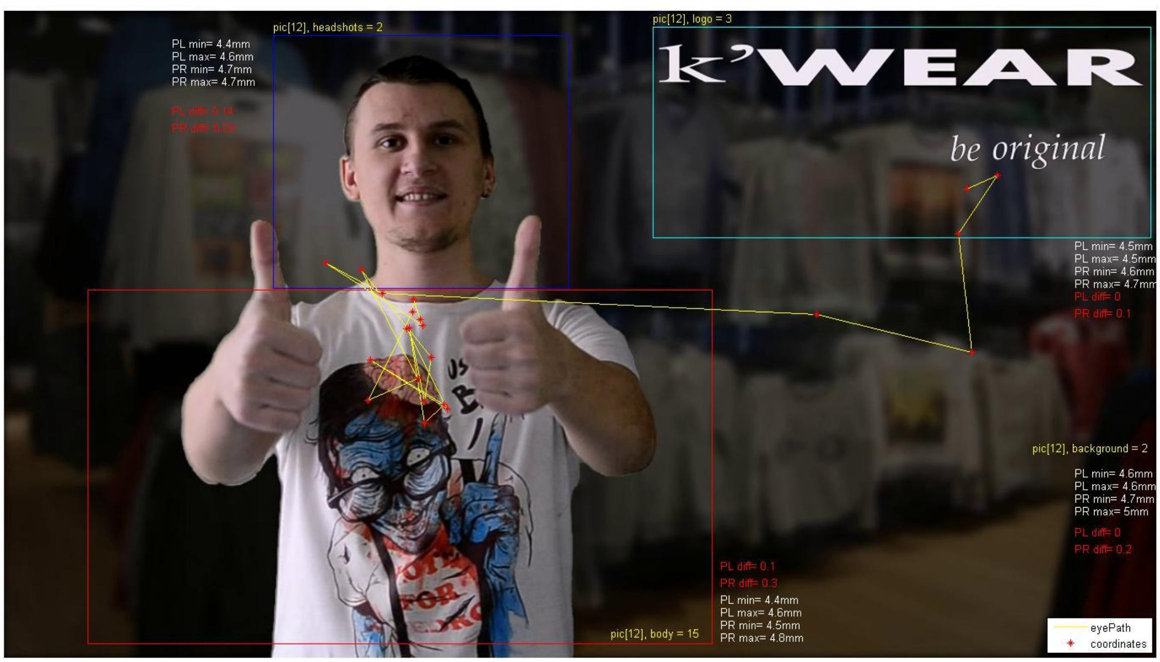


Fig.5.3c: *ROIs, eye fixations and pupil size for the last second of footage between the two ads*

Fig.5.3d: *ROIs, eye fixations and pupils size for the last second, for 1 participant, between the 1st and 2nd exposure to the ad*

From the last two pictures for example, we can see that during the *1st exposure*, the participant directed her whole attention to the head of the model (22 fixations). This is for the last second of footage. Her *minimum* values for the left and right pupils were 3.8mm and 3.6mm and the *maximum* values were 4.1mm and 4.2mm. Since there were no fixations to any other ROI, no other information is shown. During the *2nd exposure*, the same participant fixated her eyes 13 times on the *head ROI,* 7 times on the *body ROI* and 2 times on the *background ROI.* For the *head ROI,* her *minimum* pupils' diameter for the left and the right eyes were 4mm and 3.5mm and her *maximum* - 4.2mm and 4.1mm. Likewise, for the *body ROI*, her *minimum* pupils for the left and right eyes were 4mm and 3.1mm and her *maximum* - 4.1mm and 3.4mm. There was no difference in pupil diameter for the *background ROI.*

6. Methodology

6.1. TESTING PROCEDURE

6.1.1. Between-subjects Design

Before the recruitment of the test subjects, the study was divided into two major parts (four studies in total). The first part consisted of a sample of people who were exposed to the animated advertisement and their eye movements during the presentation were recorded. Each participant from that sample was shown the movie clip twice. After that, they had to answer a brief questionnaire. The second major part aimed to aid the first part, assessing participants' attitudes and purchase intentions in regards to general clothing and accessories. As such, a different sample of people was recruited who were exposed to different pictures of cartoon-like and live actors, wearing different clothes and accessories (**APPENDIX**). For both parts, and for the requirements of this study, a between-subject design was used in order to eliminate unwanted biases that might occur with the use of within-subject design.

6.1.2. Equipment

Since the eye-tracking device was portable and did not require any extra power source, and in order to conduct the testing, a mobile-approach was adopted. This approach included the use of a 14" laptop with a native resolution of 1366x768 pixels. The EyeTribe eye-tracking device was used which works only on USB 3.0. This way, the exposure to the visual stimuli as well as the acquisition of all the needed information was possible "on the go".

6.1.3. Stimuli

Two groups of people were exposed to two identical advertisements where the only thing changing was the ad-model. The first ad consisted of a cartoon-like CGI actor who was wearing the advertised product and the second - of a live actor. For the last part of the study, two different booklets were made. Each of them consisted of four different products, advertised by either a cartoon-like CGI or a human model.

6.1.4. Environmental Variables

As already stated, the testing procedure adopted a mobile approach. As such, all the collected data was more or less dependent on the environment. Although the eye-tracker was documented to perform equally well in different lighting setups, it was also suggested to avoid using it outdoors. The eye-tracker limitations were not the only variable that had to be taken into account. Regardless of its accuracy, light does affect pupil dilations and constrictions. Following those guidelines, a careful attention before each participant was paid so that no significant differences in environmental lights were present. In addition, direct sunlight was also avoided. Although not conducted in a strictly controlled environment, most of the participants took the test at the same place, at the same time of day. Differences in weather conditions were also accounted for, so cloudy days were avoided.
Another environmental variable was also taken into account - distraction. Although it is impossible to control all the distraction cues, especially in a mobile scenario, a close attention was paid to avoid too obvious variations in the environment. Such variations could have been a very interesting wallpaper in one place, which is absent in another, noise, some interesting event happening at the same time as the test, etc. Most of the testing procedure took place in closed rooms.

6.2. Hypotheses Testing

6.2.1. Experiment 1:

In order to test the different hypotheses, four empirical studies were conducted. The first study served to assess the impact of a cartoon-like CGI model on consumers' attitudes toward the product. 30 participants were randomly distributed into two groups and each of them saw the corresponding advertisement twice. After that, they received a brief questionnaire assessing their attitudes toward the advertised product, their purchase intentions, their gift-giving intentions and their familiarity with the product.

6.2.2. Experiment 2:

The second and third studies involved the use of the eye-tracking technology. The second study aimed to inspect if there was a shift in people attention in the presence of a cartoon-like CGI model in comparison to a live model. It was curious to observe whether participants will fixate their gaze more into the CGI actor and less into the advertised product in comparison to a live actor. The same sample of people was used and their eye movements and pupil differences were recorded with the help of the eye-tracking device.

6.2.3. Experiment 3:

The third study concerned with exploring how two consecutive exposures to the same advertisement directed people attention. Since advertisements are meant to be seen more than once, it was curious to observe if people fixated their gaze to different parts of the visual stimuli the second time around. The same sample of people was used and their eye movements were recorded with the use of the eye-tracking device during 1st and 2nd exposures to the corresponding advertisements.

6.2.4. Experiment 4:

The forth and last study involved different clothing and accessories. Its premise was to aid the findings of the first study by exploring if consumes' attitudes and purchase intentions were mediated by a cartoon-like CGI actor in comparison to a live actor for a variety of clothing options. A sample of 20 more participants were randomly distributed into two groups. Each of them received electronic booklet where every page contained a different product. After each picture, there was a questionnaire assessing people attitudes, purchase and gift-giving intentions.

7. Results

It should be noted that most of the participants had different number of eye-fixations varying from 22 to 28 (22 and 25 being most frequent). Since the testing methodology adopted a mobile-testing approach, it is by no means robust. Unaccounted data lost could have happened as well as acquisition of an unwanted data. The testing procedure was entirely manual and there was no automatic method to instantly stop the recording at the same time the ad-footage was finished.
That said, the number of data lines corresponding to each second were calculated and distributed according to each participant's individual fixations. For the sake of consistency however, the common number of 22 fixations was used for counting the fixations in each region of interest for each participant. This was done so that the data could be analysed based on the same criteria for everyone. It was assumed that by simply distributing more points to one ROI, the analysis would point to the fact that the ROI in question was significantly more interesting for one group in comparison to the other group when in fact, that might have not been true. Blinks were excluded from the analysis.
Another thing to keep in mind is that findings indicate that people are capable of instantly classifying a human being in regards to his or her visual appearance (Gulas & McKeage, 2000) and it is also possible for non-human objects to evoke emotional response (Damasio A. , 1999).

Before conducting all the experiments, the final version of the CGI character was given to an independent sample of 10 people for evaluation. That sample was decided to comprise of people, who had extensive experience in either one of the fields: computer graphics, computer animation, programming for games, design, art, drawing, modelling, sculpting, general games and computer-animated movies. A digital copy of the character's visual appearance as well as animation was provided and each participant's response was captured with a scale ranging from 1 (repulsive) to 10 (attractive). The mean level reached for all the participant (M = 7.9) was found to be fairly distant from the middle point of the scale (5.5), so it was assumed that the CGI character managed to avoid the *uncanny valley* and his visual appearance should not produce extreme negative reactions.

7.1. Study 1

Study 1 examined if consumers' attitudes and purchase intention were influenced by the presence of a cartoon-like CGI character.

H1: *A cartoon-like CGI character will elicit less favourable product attitudes and purchase intentions than a human character.*

For the purpose, an experimental approach was used in which the two groups were exposed to two different advertisements and their attitudinal answers were captured with a four-item 10-points *Likert* scale (Bagozzi, Wong, & Yi, 1998), similar to the one used for measuring attitude toward the ad endorser (Cronley, Kardes, Goddard, & Houghton, 1999). The scale contained the adjective pairs *dislike it - like it, unpleasant - pleasant, uninteresting - interesting* and *negative impression - positive impression.* The Cronbach's alpha (Churchill, 1979) value for this scale for both advertisements exceeded .70 and corresponding attitudinal scores were calculated.
The purchase intention was captured with two different questions - "*I would like to buy this product*" and "*I would like to give it away as a gift*". The scales for those questions ranged from 1 (do not agree) to 10 (completely agree) (Soederlund & Lange, 2006). The participants were also asked if they had seen the product before. The possible answers for this question were *Yes* and *No.*

A total of 30 participants were randomly distributed to one of the two advertisements.
The results from an independent samples *t-test* indicate that the mean level reached by the attitude toward the product in the group watching the live actor ad (M = 5.90) was almost equal to the attitude in the group, watching the cartoon-like CGI actor (M=6.05). Which is to say that *no significant difference in participants' attitudes toward the product between the two advertisements was found*; *t(28) = .26, p = .79.*
As a side-study, and in a similar to Soederlund *et al.* manner, it was curious to observe if the magnitude of the difference between the means for attitudes depend upon ad-endorser and participants' gender. For the purpose, a two-way ANOVA was performed with the two participants' groups and their sex as independent variables and the attitude toward the product as the dependent variable. Although the product attitude was higher for males (M = 6.06) than for females (M = 5.67), results indicate that neither there is any significant main effect for the treatment group on the attitudes (F(1,26) = .42, p = .52) nor any significant main effect of participant's gender (F(1,26) = .40, p = .53), thus rejecting **H1** and accepting the NULL hypothesis. Only 1% of the variability in the attitudes has being accounted by gender, which is a very small effect. The interaction was also found to be non-significant (p = .34).

Regarding the purchasing intentions, the mean values reached by the live actor (M = 3.73) were higher than by the cartoon-like CGI actor (M = 2.93), but they *were not statistically significant* (t(28) = -1.08, p = .28).

The gift-giving intentions produced similar perspective. The mean values reached by the live actor (M = 5.53) were higher than those, reached by the cartoon-like CGI actor (M = 4.26), but they were also found to be insignificant ($t(28) = -1.46$, $p = .15$).

63 percent of the participants reported that they have seen the product before.

7.1.1. Conclusion

The results indicated that there was no significant difference in attitudes toward the product between people watching an advertisement consisting of a real actor and people, watching an advertisement comprised of a cartoon-like CGI actor. In addition, no significant difference was found in their purchasing or gift-giving intentions.

7.2. Study 2

Part 1

The second study inspected if a CGI character concentrates people eye-fixations more toward its visual appearance and less toward the advertised product in comparison to a human character (*Part 1*). Since the CGI character was also animated to simulate emotions through facial expressions, the study was also curious to see if those expressions triggered a state of arousal in the viewer (*Part 2*). Gulas *et al.* findings show that humans are capable of instantly classify another human beings as likeable or repulsive based on their visual appearance. Researchers have also shown that arousal is closely related to positive emotions and pupil dilations can be indicative for a state of arousal (Stein, Liwag, & Wade, 1996), (Schachter & Singer, 1962), (Sanbonmatsu & Kardes, 1988). Besides the lighting-related pupil movements, pupils also dilate due to cognitive load (Hess & Polt, 1964). There is however a difference between cognitive dilation and arousal dilation. It has been found that a cognitive-related dilation is less than .5 mm whereas an arousal-related dilation can be of few millimetres.

H2: *A cartoon-like CGI character will concentrate consumer's attention more toward its appearance and less toward the advertised product in comparison to a human character*

In order to test the hypothesis, the picture was divided into four regions of interest (**ROI**): *head, body, logo* and *background.* One participant was excluded from the analysis due to extreme noise in his data. His corresponding pair from the other group was also excluded. Several independent samples *t-test* were conducted for each ROI:

ROI Head:
For the head region, the mean level reached for the group watching the human ad (M = 49.35) was lower than the mean level reached by the group watching the CGI ad (M = 64.28), but this difference was *not found to be statistically significant; t(26) = 1.55, p = .13.*

ROI Body:
For the body region, the mean level reached for the group watching the human ad (M = 126.57) was higher than the mean level reached by the group watching the CGI ad (M = 96.14). This difference was *found to be statistically significant; t(26) = -4.12, p = .00.*

ROI Logo:
For the logo region, the mean level reached for the group watching the human ad (M = 29.50) was lower than the mean level reached by the group watching the CGI ad (M = 39.35). This difference was also *found to be statistically significant; t(26) = 2.52, p = .01.*

ROI Background:
For the background region, the mean level reached for the group watching the human ad (M = 14.57) was higher than the mean level reached by the group watching the CGI ad (M = 13.007), but this difference was *not found to be statistically significant; t(26) = -.41, p = .67.*

7.2.1. Conclusion (*Part 1*)

Results indicate that there is a significant difference in participants' gaze distribution for the advertised product and the logo. The group watching the advertisement containing the live actor fixated their eyes more into the body region (advertised product) than the group watching the CGI actor. They also fixated their eyes more into the logo region in comparison to the group, watching the CGI ad. This leads to rejecting the NULL hypothesis and accepting **H2**.

To visually represent this difference, a heat map for each participant's gaze distribution was created using Photoshop with a custom-made brush. The brush is of a type *gradient* (from green to red). They way it works is by adding percentage of red colour every time an area is painted over.

Fig.7.2.1a: *Heat map for a pair of participants*

All the individual heat maps were then combined into one, representative of all participants' gaze distribution:

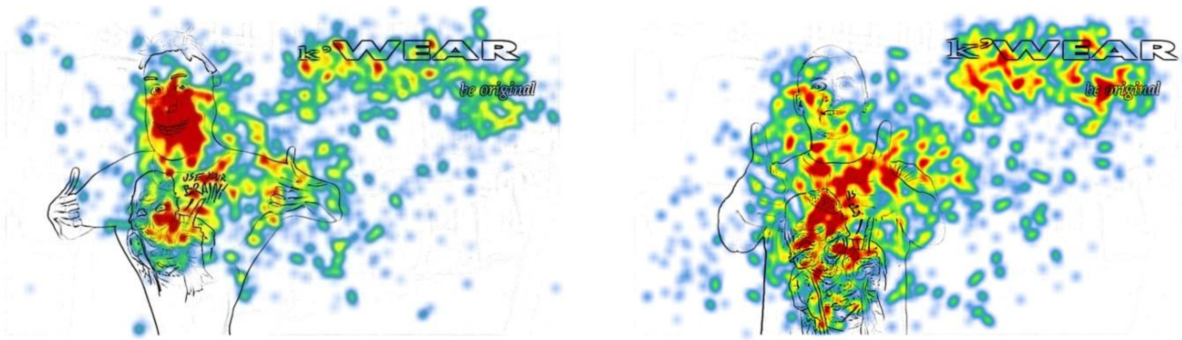


Fig.7.2.1b: *Heat map for all participants between the two groups*

7.3. Study 2

Part 2

The second part of the study is concerned with assessing the consumer's emotional response through measuring pupil differences for each region of interest. Pupils quickly constrict and dilate, so it was not deemed appropriate to analyse them as an average of the length of the whole advertisement. Instead, they were analysed within each consecutive second of ad-footage. Following the studies on emotions and arousal, and taking into consideration the mobile testing methodology as well as the unaccounted noise, a difference of less than 1mm was considered to be due to cognitive processes and a difference greater than 1mm was considered emotionally relevant.

The difference between the *minimum* and *maximum* values for each pupil, for each second within a given ROI was calculated. *Blinks* were excluded from the analysis. The length of the advertising clip was divided into seconds of footage. Since this study concerned with assessing the influence of the ad-endorser, the first 3 seconds of the footage were excluded from the analysis. In order for the analysis to make sense, another thing had to be excluded - the lack of fixations in the given ROI. For example, a raw data comparison between the first pair of people for the 3rd second of ad-footage shows that the 1st participant had no pupil dilations, but his assigned pair - had. The 1st participant had no dilations not because no dilations occurred, but because he did not fixate his eyes on the head ROI at that second. His corresponding pair however did. All pairs of people, who did not fixate their eyes into a given ROI for a given second were excluded and several independent samples *t-tests* were conducted. Since there were 10 seconds of ad-endorser presence within each advertisement, the collected data for each ROI became quite big. In order to avoid repetitiveness and for the sake of compactness and succinctness, the following paragraphs include only the statistically significant instances for each ROI (full table in **APPENDIX**).

ROI Head:

7s - the mean level reached for the *left pupil* for participants watching the CGI ad (M = .39) was higher than for those, watching the human ad (M = .08); for the *right eye* it was also higher (M = .29 vs. M = .03). The *left eye* difference was *found to be statistically significant* (t(8) = 2.98, p = .01). The *right eye* difference was also *found to be statistically significant* (t(8) = 4.09, p = .00).

ROI Body:

6s - the mean level reached for the *left pupil* for participants watching the CGI ad (M = .18) was lower than for those, watching the human ad (M = .34); for the *right eye* it was also lower (M = .39 vs M = .49). The *left eye* difference was *found to be statistically significant* (t(24) = -2.30, p = .03). The *right eye* difference however was *not found to be statistically significant* (t(24) = -.62, p = .53).

7s - the mean level reached for the *left pupil* for participants watching the CGI ad (M = .22) was lower than for those, watching the human ad (M = .36); for the *right eye* it was also lower (M = .26 vs M = .75). The *left eye* difference was *not found to be statistically significant* (t(24) = -1.32, p = .19). The *right eye* difference however was *found to be statistically significant* (t(14) = -2.65, p = .01).

8s - the mean level reached for the *left pupil* for participants watching the CGI ad (M = .18) was lower than for those, watching the human ad (M = .40); for the *right eye* it was also lower (M = .39 vs M = .62). The *left eye* difference was *found to be statistically significant* (t(22) = -2.35, p = .02). The *right eye* difference however was *not found to be statistically significant* (t(22) = -.89, p = .38).

11s - the mean level reached for the *left pupil* for participants watching the CGI ad (M = .12) was higher than for those, watching the human ad (M = .07); for the *right eye* it was also higher (M = .32 vs M = .07). The *left eye* difference was *not found to be statistically significant* (t(6) = .73, p = .48). The *right eye* difference however was *found to be statistically significant* (t(6) = 2.54, p = .04).

ROI Logo:

There was no significant difference in pupil sizes between the two groups in any given second.

ROI Background:

There was no significant difference in pupil sizes between the two groups in any given second.

7.3.1. Conclusion (*Part 2*)

The results showed that in one instance, in the 7th second of ad-footage, there was a significant difference in pupil sizes between the two groups in regards to the ***Head ROI***. Since this part of the study is interested if the CGI model's facial expressions contributed to pupil differences, a quick reference to the ad-footage containing the CGI character showed that for the 7th second, the CGI character did indeed express "surprise".

Fig.7.3.1: *Surprise*

The pupil table also showed that for that particular second, participants watching the CGI ad had higher values of pupil differences in comparison to participants, watching the live actor ad. Following the previously set cognitive-and-arousal pupil restrictions however, the difference was never higher than 1mm. This might indicate that the difference was more likely cognitive-related, rather than arousal-related. We should also keep in mind that no extra methods were implemented to filter the acquired data, which is to say that the difference could also be due to some other factors.

In regards to the ***Body ROI,*** by referencing the raw dilation table, it became apparent that in general, participants watching the advertisement containing a human character, experienced higher pupil dilations in comparison to participants watching the CGI advertisement. In more than few instances, those dilations were greater than 1mm. Some of the participants watching the human advertisements experienced dilations of 1.2mm, 1.4mm, 1.5mm, 2.4mm and even 3mm. Had the experiment been conducted in a controlled environment and had the data been carefully filtered through the use of specialised filters that eliminate noise, those values could have been understood as emotionally related. It could be argued about the validity of the results, because, for instance, in one occasion, a dilation of 1.7mm (right eye) was registered for the 6th second of CGI ad-footage. This participant's pair experienced an almost equal dilation in the same eye (1.5mm) at the same second. This could indicate arousal in both participants. Since both of them took the test at the same place, it could also indicate the presence of some environmental irritant that repeated every few seconds. It could also be due to chance. In the current state of the raw data, all those values could have been due to eye-tracker or computer hardware temporal malfunction, noise, environmental fluctuations or any other unaccounted variable.

7.4. Study 3

The third study concentrated on examining gaze differences between 1st and 2nd exposures to each advertisement.

H3: *There will be significant differences in consumers' eye-path between the first and second exposure to the advertisement*

The same sample of people as in previous studies was used. Each participant saw the advertisement twice and their eye movements were recorded for both exposures. It must be noted that besides the pair of people, that was excluded due to extreme noise, another pair was excluded due to hardware malfunction. A total of 26 participants were used for this analysis.

Several dependent samples *t-tests* were conducted for each ROI. The analysis showed that only the background ROI was found to be statistically significant fixation zone between the two exposures. Observing the means from the paired samples statistics however, it would appear that during the second time of ad-exposure, people fixated their eye more onto previously unseen parts of the ad, hence accepting **H3**. The background ROI was influenced the most. The mean scores reached for background fixations between the 1st and 2nd exposures were (M = 13.92 vs. M = 30.76) for the CGI advertisement; $t(12) = -3.53, p = .00$. For the live advertisement, they were (M = 13.84 vs. M = 31.07); $t(12) = -5.17, p = .00$.

7.4.1. Conclusion

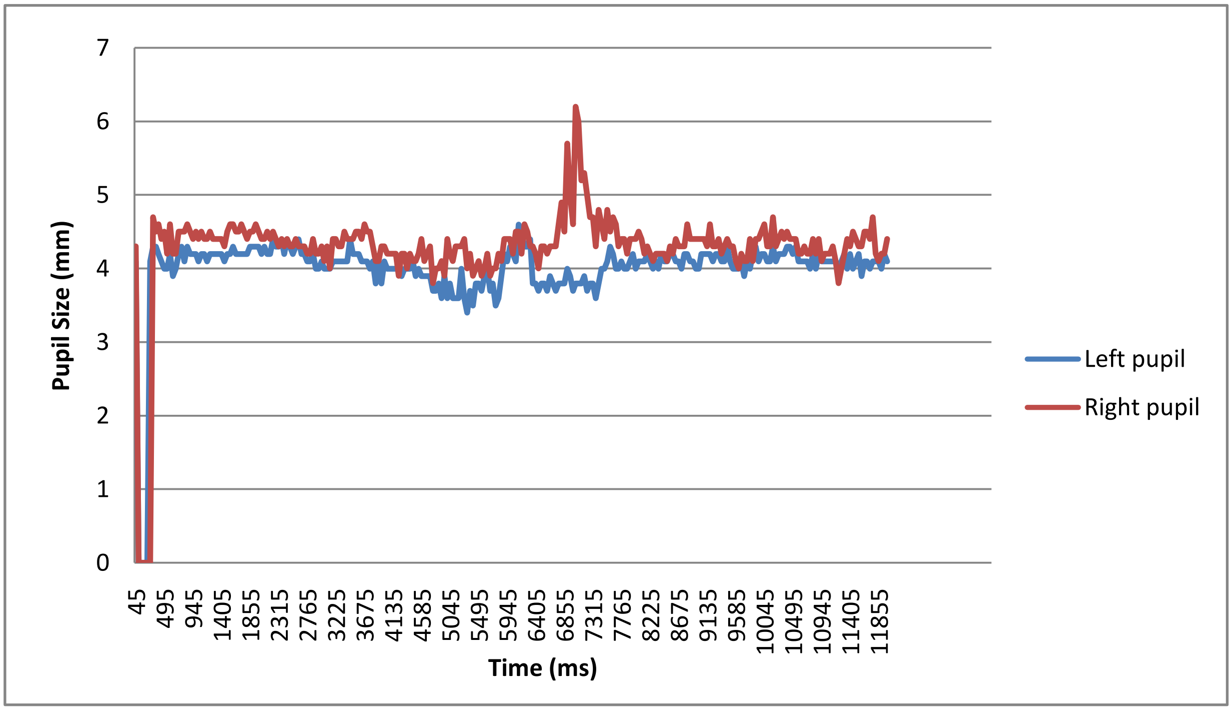
Findings point to the idea that participant's eye movements were different during the 2nd exposure to the corresponding advertisement in comparison to the 1st exposure. It would appear that people are trying to inspect as much of the visual field as possible during the 2nd viewing and they are not concentrating all their attention to either the ad model or the advertised product. This could be informative and helpful when the ad creators are putting extra visual cues in the background of their ads.

A heat map was used to visually represent one participant's eye fixations between 1st and 2nd exposures to the advertisement.

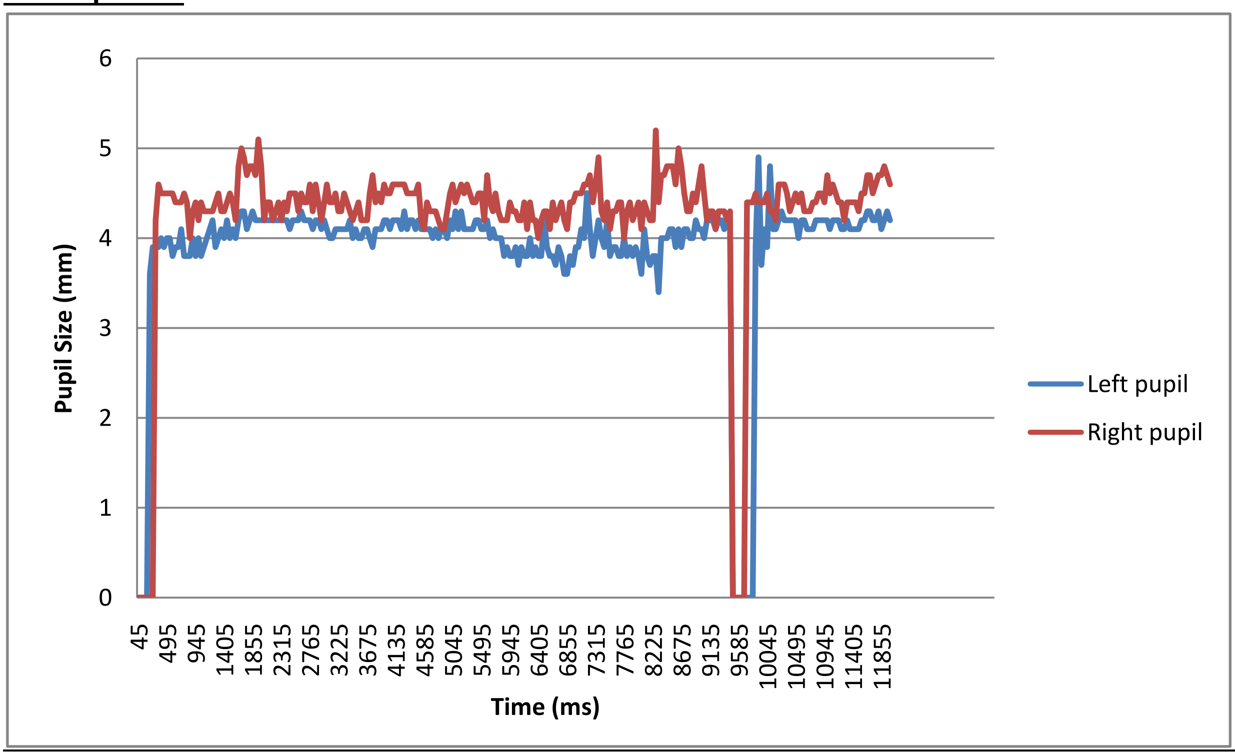
Fig.7.4.1: *Heat map for one participant between 1st and 2nd exposures*

In the following graph, a raw data of the differences in pupil dilations for one participant between 1st and 2nd exposure can be observed. Zero values correspond to blinks.

1st exposure



2nd exposure



7.5. Study 4

The forth and last study was meant to serve as an addition to the first study. As such, it was curious to observe if the notion that a cartoon-like CGI character does not influence consumer's attitudes and decisions also extends to other clothing and accessories and not only the advertised t-shirt. To examine this issue, another experimental approach was used in which a different sample of 20 participants was recruited and randomly distributed to one of two booklets. As previously mentioned, each participant received electronic booklet where there was a different product on every page (**APPENDIX**). After each picture, there was a questionnaire assessing people attitudes, purchase and gift-giving intentions.

H4: *A cartoon-like CGI character will elicit less favourable product attitudes and purchase intentions than a human character in regards to general clothing and accessories*

Participant's attitudinal scores were formed in the similar to Study 1 manner. Cronbach's alpha exceeded .70 for each of the 8 picture exposures, and corresponding attitudinal scores were calculated. Several independent samples *t-tests* were conducted for each of the test-images. For the first pair of pictures, which included the ad models from the animated sequence, the analysis showed that no significant differences in attitudes took place, which was expected; *t(18) = -1.21, p = .24*. A curious thing to observe, however was that the mean level reached by the attitudes for the group watching the booklet containing a CGI character was lower than the mean for the group watching the animated ad from Study 1 (M = 5.15 vs. M = 6.05). Likewise, the mean level reached for the people watching the booklet containing the human model was higher than the mean for the people watching the animated ad (M = 6.05 vs. M = 5.90). This might point to the idea that the CGI character was better received when put in an animated context in comparison to static picture, but as researchers suggest, his role is purely decorative, hence the advantages are insignificant (Hoeffler & Leutner, 2007).

In conjunction with the findings of Study 1, the mean levels reached for purchasing intentions (M = 3.60) and gift-giving intentions (M = 5.30) were lower for the CGI actor in comparison to the live actor (M = 4.5; M = 6.50), and they were *not found to be statistically significant; t(18) = -.81, p = .42; t(18) = -1.99, p = .06.*

Scarf

The second pair of pictures included a model, advertising a scarf.

<u>*Attitudes:*</u> The mean levels reached for the group watching the CGI model were higher (M = 5.37) than for the group watching a human model (M = 5.22). This difference was *not found to be statistically significant; t(18) = .15, p = .87.*

<u>*Purchase:*</u> The mean level reached was higher for the CGI actor (M = 3.70) than for the human actor (M = 2.7), but the difference was *not statistically significant; t(18) = 1.03, p = .29.*

<u>*Gift:*</u> The mean level reached was lower for the CGI actor (M = 5.20) than for the human actor (M = 5.90), but the difference was *not statistically significant; t(18) = -.91, p = .37.*

Tie

The third pair of pictures included a model, advertising a tie.

<u>*Attitudes:*</u> The mean levels reached for the group watching the CGI model were lower (M = 5.17) than for

the group watching a human model (M = 5.72). This difference was *not found to be statistically significant; t(18) = -.63, p = .53.*
Purchase: The mean level reached was lower for the CGI actor (M = 3.20) than for the human actor (M = 4.1), but the difference was *not statistically significant; t(18) = -.79, p = .43.*
Gift: The mean level reached was lower for the CGI actor (M = 5.40) than for the human actor (M = 6.80), but the difference was *not statistically significant; t(18) = -1.63, p = .11.*

Shirt
The third pair of pictures included a model, advertising a shirt.
Attitudes: The mean levels reached for the group watching the CGI model were lower (M = 4.97) than for the group watching a human model (M = 6.62). This difference was *not found to be statistically significant; t(18) = -2.06, p = .05.*
Purchase: The mean level reached was higher for the CGI actor (M = 4.40) than for the human actor (M = 3.90), but the difference was *not statistically significant; t(18) = .41, p = .68.*
Gift: The mean level reached was lower for the CGI actor (M = 5.40) than for the human actor (M = 6.80), but the difference was *not statistically significant; t(18) = -2.00, p = .06.*

7.5.1. Conclusion

The last part of the study aided the findings of Study 1, and indicated that a cartoon-like CGI character had no significant influence over consumers' attitudes toward the product and their purchasing intentions in comparison to a human character. The results from Study 1 and Study 4 showed that, in general, the two dependent variables had higher mean values for participants, watching the product, advertised by a human character in comparison to participants watching the CGI character, but this difference was insignificant. Thus, the use of a cartoon-like CGI character did not manage to create any significant advantage from the marketer's perspective. Study 2 and Study 3 examined participant's eye movements and pupil dilations and findings indicated that a CGI character attracts people attention more toward its appearance and less toward the advertised product than a human character. Arguably, one of his facial expressions contributed to greater pupil dilations, but as already discussed, this might have been due to unaccounted factors. Pupils also dilated more when inspecting the product, advertised by a human character and they dilated to a lesser extent, when viewing the same product, advertised by the CGI character. The two different exposures to the same advertisement had effect on participants' gaze distribution. During the first exposure, participants fixated their eyes more into the CGI actor's head and human actor's body, whereas during the second viewing, they have fixated their eyes to different portions of the screen favouring the background image.

8. Discussion, Limitations and Future Work

A combined discussion of several limitations and possible extensions is carried in the following section.

In this study, the attitude toward the product was not captured through a scale that represents consumer's emotions (Bagozzi, Gopinath, & Nyer, 1999). Although research shows that positive and negative emotions have no significant direct impact on the attitude toward the product (Soederlund & Lange, 2006), such construct could have been helpful in assessing the model's attractiveness. This study however concerned with inspecting the nonconscious, indirect impact that a CGI character had on consumers, in regards to their attitudes toward the product and purchasing intentions where the emotional assessment was decided to be through real-time measuring of pupil differences instead of scales. Since every human being has different emotions, it could be argued if the scale proposed by Bagozzi *et al.* can correctly capture each participant's emotional state. It could also be argued if *any* scale aimed at capturing emotions could accurately encapsulate all the discrete emotional states. Emotions are unique construct, which this study considered impossible to measure on a scale from 1 to 10. With the use of an eye-tracking device, however, extremely small differences in pupil sizes could be registered and according to the visual stimuli, they can be mapped to certain cognitive and emotional states. The present study assumed that an eye-tracking device could provide much more accurate emotional assessment than any scale and it could provide it in real-time.

The length of the advertising footage can also be argued to be on the short side. The time constraints of this study as well as the evaluation of the collected eye-tracker data, forced the creation of a short ad, yet short ads usually last between 30sec and 1min, which makes the total length of this study's advertisement (14 seconds) rather insufficient. In light of the findings indicating that attitudes and arousal are dependent on viewing time (Olney, Holbrook, & Batra, 1991), it could be argued if participants had enough time to comprehend the visual stimuli at all. Had the advertising content been longer, more data could have been collected, which might eventually lead to different results.

There is another thing that needs to be taken into consideration - practicality. For the premise and limitations of this study, an unfamiliar, unpaid model was used. Had the model been someone famous, it would have been much more expensive to create the advertisement. It would most likely lead to different results as well. Computer animation on the other hand could be cheaper in comparison. However, it strictly depends on the goal of the advertisement and the scope of the advertising campaign. A great actor could be much more influential than a poor CGI model and vice versa - a great computer artist with solid experience and set of skills could create a state-of-the art CGI model, which will be much more influential than a cheap actor.

The findings from this study yields further discussions and implication in the context of CGI clothing advertising, mainly because the majority if not all the clothing advertisements today include a human model. This is valid for general advertising as well. In the very few occasions where a CGI character appears as using the advertised product, as standing in the vicinity of the advertised product or simply

having a symbolic connection to the product, the model is made to look as realistic as Bruce Lee (Kotaku, 2013) or Audrey Hepburn (TheVerge, 2013).
Study 1 and Study 4 are inspecting the implicit connection between a CGI character and the product, by showing the character using the product directly, and did not consider any other forms of character-product presentations. It could be interesting from marketing as well as eye-tracking perspective a scenario, in which the character is using the advertised product indirectly. Either the model or the product could be placed in the foreground or background of the footage; the model could be seen standing next to the product or observing the product from a distance, etc. In those cases, it would be interesting to inspect if there is a difference in people attitudes between a CGI and a human character. Their gaze-patterns could also be inspected. The researcher could incorporate more visual elements and connections into the visual stimuli and examine if they had any impact on consumers attention and attitudes. For instance a small, but important visual cue could be placed in some unlikely to be seen portion of the screen and through eye-tracking technology, the researcher can inspect if that cue was seen during different exposures. The findings could then be mapped to consumer's response and it could be observed if the cue had direct (conscious) or indirect (nonconscious) role on their attitudes and purchasing behaviour.

In regards to the eye-tracking methodology, it should be mentioned that the ROIs used in this study served its purpose only to a certain extent. This is to say that the presented advertisement was a motion image, but the regions of interest were static rectangles. As such, on few occasions, the character was moving out of the boundaries of given head and body ROI. This resulted in an inaccurate counting of eye-fixations. For example, if there were any fixations to the head when it was outside the *head ROI,* they were counted as *background.* The *head* and *background* ROIs were made with a certain width that can accumulate as much as head and body movements as possible. This appears to be a rather restrictive approach simply because eye-fixations that avoided the body and the head, but were relatively close to them, were counted as belonging to those ROIs, when in fact, they were on the background. It could also be argued on the complete contamination of the data and invalidity of the used procedure, because fixations, that were in the vicinity of either the head or the body could be seen as "intentions" to see the head and the body, due to "smooth pursuit" (Grasse & Lisberger, 1992). Fixated ROIs would have worked much more accurate in a static picture, but for footage, another method to count fixations must be developed. Such method, for instance, could be a ROI, based on edge-detection. The silhouette of the character can be tracked by detecting its edges in real-time.
The eye-tracker limitations as well as the lack of filtrations used in this study should also be taken into account before discarding the results. The eye-tracker is reported to have an on-screen error of about 1cm and neither micro-saccades nor tremors or corrective saccades were measured by the device, presumably due to its 30Hz-60Hz of frequency.
Further method to represent eye-movements in real-time should be developed in MATLAB. Such method could be the use of blobs with different gradients.

An important variable which this study did not take into account was *mood.* Researchers suggest that mood plays important role in consumers' brand attitudes (Batra & Stephens, 1994) by working both at conscious and noncosncious levels. People in positive moods are less likely to consciously and deliberately produce counter-arguments about the validity of the advertisement or the presented messages simply because they are less inclined to involve their minds into cognitive-demanding tasks. Had the study included the effect of mood as a mediator, the positive or negative moods accompanying the *decision making* process could have been further explored, by delving into conscious consumer thoughts during brand choice (Bettman, 1987). Those thoughts, as suggested by researchers, examine people needs and perceptions of the "ability of each brand to meet those needs" (Gardner & Hill, 1990). Positive moods for example, have been found to be able to influence attitudes directly during low-elaboration conditions (low attention construct) and indirectly, during high-elaboration conditions (high attention construct) (Petty, Schumann, Richman, & Strathman, 1993). In a similar manner, had the study included any explicit message claims, the influence of positive and negative moods could have been explored. It was found that negative moods (sad subjects) built counter-arguments when presented with strong message claims, whereas happy subjects were equally persuaded by strong and weak message claims (Bless, Bohner, Schwarz, & Strack, 1990). Good-mood subjects were also found to be unaffected by distractions simply because they did not engage in message elaboration in comparison to bad-mood subjects.

Mood in that context could have been an important dependent variable, which could have helped analysing the different groups further.

It could be also argued if *low attention* is even possible for the restrictions of this study and when placed in a research-type context. The literature on the matter explains that *low attention* is a product of lack of arguments or explicit messages that need to be evaluated. If no explicit claims are made, people are less likely to build resistance, which can later be communicated into higher sales. There is another side that yields some discussion however. *Low attention,* if seen as a physical, visual attendance, should be explanatory for a person, who is directing his or her gaze *outside* the boundaries of the advertisement. This can occur in instances of distraction or unwillingness to physically see the actual advertisement, because we are literary surrounded by different types of advertisements in our everyday lives, which lead us to the automatic assumption that "mostly all advertisers will do is assert that their brand is better than all the rest" (Heath R. , 2012). This on the other hand forces us to overlook advertisings because "we don't expect to learn anything particularly new and interesting from it, and we frankly have better things to do with our lives" (Heath R. , 2012). From research perspective however, when participating in a study on advertising effectiveness (or any other study for that matter), participants are assumed to be willing to help the researchers on their quest. In this study for example, participants were instructed that they are about to see a brief advertisement and their eye movements will be recorded, so in this scenario, it should have been impossible for them not to pay attention simply because they have consented to participate and are consciously aware of the procedure. The testing setup consisted of 14" laptop screen, which can easily lead to distraction in comparison to, for example, 42" TV, but even so, an unwillingness to watch at the screen for 10 seconds (given there are no disturbing images on it) during a scientific procedure can be seen as rude.

It would have been interesting to observe if priming occurred. The music used in this Ad is courtesy of Peter McConnell and is originally used in the game Grim Fandango back in 1998 (LucasArts, 1998). It is an adventure game, which narrative revolves around Manuel "Manny" Calavera in his quest for saving

Mercedes "Meche" Colomar. Its settings are placed in the dark and grimy environment of the *Land of the Dead*, which departed people must cross in order to reach the *Ninth Underworld.* Since *Grim Fandango* is one of the best games of its age and holds dear memories in many gamers since that time, it would have been curious to observe if the music managed to stimulate people, who had played the game, to buy the t-shirt to a greater extent than people, who had never played it.

Finally, if we take a look at the Andrex advertisement for example, the change from "live" to "CGI" resulted in obvious negative change in consumers' attitudes and purchasing behaviour. The change could have been due to number of reasons (especially given that the animation was awkward), the one most likely being the fact that something familiar and loved was substituted for something new.
Another aspect to take into account is the familiarity with an advertisement and the product through extensive usage. The product in this ad was reported to have been seen by 63 percentages of the participants, but nobody had any prior experience with it. This should not have a major impact on their attitudes however, because the product belonged to a well established and known product category. As such, it could be argued if a cartoon-like CGI model was appropriate tool to use in the first place, especially when it concerns familiar or well established product or product category. The *novelty* aspect in this study is the presence of a CGI character, but he is placed in a context of *familiarity.* Those, as suggested by researchers, are two opposite constructs. On the one hand, we have something unexpected, unfamiliar, alien, something that naturally draws our attention (Genco, Pohlmann, & Steidl, 2013) through its features or motions (hence the findings in Study 2). This concept is then placed in the context of something familiar (the t-shirt as a form of clothing that everyone uses). This antipode is exactly the notion Freud was communicating in his work on the *Uncanny* (Freud, 1919). Therefore, the cartoon-like CGI character was unable to influence consumers' attitudes and purchase intentions not because of uncanny *appearance,* but because of uncanny *presence.* Besides, *novelty* and *familiarity* apply two completely different attention constructs - one aims at high attention and the other one - at low attention. This study was never interested in high attention and it deliberately tried to avoid it through the exclusion of explicit messages and claims as well as through implicit co-exposure of the model and the product. Had a state of high attention been brought forth by *novelty* however*,* a clash in the two attention constructs could have happened. A remnant of such clash could be the absence of attitudinal extremes. The CGI character did not produce extremely negative or extremely positive reactions in the viewers, which might be indicative to disinclined acceptance. Alas, it might also point to viewers' confusion. For instance, it would appear that the advertisement required high attention due to the presence of something new and at the same time - it required low attention due to the presence of something familiar. Regardless of the viewer, those are two different cognitive demands and it could be argued if participants managed to allocate the same amount of cognitive resources. Findings from this study showed that the persuasion factor was not higher in the presence of a cartoon-like CGI character in comparison to a human character, which leads to the notion that there was discrepancy between stimuli demand and cognitive supply, hence the reason for low persuasion (Anand & Sternhal, 1989).

Bibliography

Adamson, A., & Jenson, V. (Directors). (2001). *Shrek* [Motion Picture].

Adobe. (2014). Retrieved from http://www.adobe.com/products/aftereffects.html

Adobe. (2014). Retrieved from http://www.adobe.com/products/photoshop.html?promoid=KFNXL

ALESSI. (2014). Retrieved from http://www.alessi.com/en/

Anand, P., & Sternhal, B. (1989). Strategies for Designing Persuasive Messages: Deductions from the Resource Matching Hypothesis. *Cognitive and Affective Responses to Advertising* .

Austin, J., & Jeffrey, V. (1996). Goal Constructs in Psychology: Structure, Process and Content. *Psychological Bulletin* .

Autodesk. (2014). Retrieved from http://www.autodesk.com/products/autodesk-maya/overview

Bagozzi, R. (1994). The Effects of Arousal on the Organization of Positive and Negative Affect and Cognitions: Application to Attitude Theory. *structural Equation Modeling* .

Bagozzi, R. (1992). The Self-Regulation of Attitudes, Intentions, and Behavior. *Social Psychology Quarterly* .

Bagozzi, R., & Dholakia, U. (1998). Goal-Setting and Goal-Striving in Consumer Behavior.

Bagozzi, R., Gopinath, M., & Nyer, P. (1999). The Role of Emotions in Marketing. *Journal of the Academy of Marketing Science* .

Bagozzi, R., Wong, N., & Yi, Y. (1998). The Representation of Affect in Independent - and Interdependent-Base Cultures.

Baker, M., & Churchill, G. (1977). The Impact of Physically Attractive Models on Advertising Evaluation. *Journal of Marketing Research* .

Bartneck, C. (2001). How Convincing is Mr. Data's Smile: Affective Expressions of Machines. *User Modeling and User-Adapted Interaction* .

Batra, R., & Stephens, D. (1994). Attitudinal Effects of Ad-Evoked Moods and Emotions: The Moderating Role of Motivation. *Psychology & Marketing* .

Beattie, A., & Mitchell, A. (1985). The Relationship between Advertising Recall and Persuasion: An Experimental Investigation. *Psychological Processes and Advertising Effects* .

Beatty, J. (1982). Task-evoked Pupillary Responses, Processing Load and the Structure of Processing Resources. *Psychological Bulletin* .

Bettman, J. (1987). Processes of Adaptivity in Decisioon-Making. *Advances in Consumer Research* .

Bless, H., Bohner, G., Schwarz, N., & Strack, F. (1990). Mood and Persuasion: A Cognitive Response Analysis. *Personality and Social Psychology Bulletin* .

Bornstein, R. (1992). *Perception Without Awareness: Cognitive, Clinical and Social Perspectives.* New York.

Boush, D. (1993). How Advertising Slogans Can Prime Evaluations of Brand Extensions. *Journal of Psychology and Marketing* .

Brave, S., Nass, C., & Hutchinson, K. (2005). Computers that Care: Investigating the Effects of Orientation of Emotion Exhibited by an Embodied Computer Agent. *International Journal of Human-Computer Studies* .

Brown, D. (2010). *Confessions of a Conjuror.*

Brown, D. (2007). *Tricks of the Mind.*

Brown, S., & Stayman, D. (1992). Antecedents and Consequences of Attitude Toward the Ad: A Meta-Analysis. *Journal of Consumer Research* .

Brumbaugh, A. (1993). Physical Attractiveness and Personality in Advertising: More Than Just Pretty Face? *Advances in Consumer Research* .

Buswell, G. (1935). How People Look at Pictures: A Study of the Psuchology of Perception in Art.

Butler, M., & Joschko, L. (2009). Final Fantasy or The Incredibles: Ultra-realistic Animation, Aesthetic Engagement and the Uncanny Valley. *Animation Studies Online Journal* .

Carpenter, R. (1988). *Movements of the Eyes (2nd ed.).*

Casell, J., Sullivan, J., Prevost, S., & Churchill, E. (2000). *Embodied Conversational Agents.*

Chang, C. (2010). Making Unique Choices or Being Like Others: How Priming Self-Concepts Influence Advertising Effectiveness. *Journal of Psychology and Marketing* .

Chartrand, T., & Bargh, J. (1996). Automatic Activation of Impression Formation and Memorization Goals: Nonconscious Goal Priming Reproduces Effects of Explicit Task Instructions. *Journal of Personality and Social Psychology* .

Chatham, C., Frank, M., & Munakata, Y. (2009). Pupillometric and Behavioral Markers of a Develpmental Shift in the Temporal Dynamics of Cognitive Control. *National Academy of Science* .

Chen, J. (2004). The Incredibles. *Window to the Movies* .

Churchill, G. (1979). *A Paradigm for Developing Better Measures of Marketing Constructs.*

Cronley, M., Kardes, F., Goddard, P., & Houghton, D. (1999). Endorsing Products for the Money: he Role of the Correspondence Bias in Celebrity Advertising. *Advances in Consumer Research* .

Damasio, A. (1999). *The Feelings of What Happens: Body, Emotion and the Making of Consciousness.* London: Vintage.

Damasio, A., Tranel, D., & Damasio, H. (1991). *Somatic Markers and the Guidance of Behaviour: Theory and Preliminary Testing.* Frontal Lobe Function and Dysfunction.

Darwin, R., & Darwin, E. (1786). New Experiments on the Ocular Spectra of Light and Colours.

Desimone, R., & Duncan, J. (1995). Neural Mechanisms of Selective Visual Attention. *Annual Review of Neuroscience* .

Ditchburn, R. (1980). The Function of Small Saccades. *Vision Research* .

Ditchburn, R., & Cinsborg, B. (1953). Involuntary Eye Movements During Fixation. *Journal of Physiology* .

DreamWorks. (2001). Retrieved from http://www.dreamworksanimation.com/

D'Souza, G., & Rao, R. (1995). Can Repeating an Advertisement More Frequently than the Competition Affect Brand Preferences in a Mature Market? *Journal of Marketing* .

DT. (2014). Retrieved from www.digitaltutors.com

Duchowski, A. (2002). A Breadth-first Survey of Eye-tracking Applications. *Behavior Research Methods Instruments & Computers* .

Duchowski, A. (2003). *Eye Tracking Methodology: Theory and Practice.*

Eagly, A., Ashmore, R., Makhijani, M., & Longo, L. (1991). What is Beautiful is Good, But...: A Meta-Analytic Review of Research on the Physical Attractiveness Stereotype. *Phsychological Bulletin* .

Ehrenberg, A. (1974). Repetative Advertising and the Consumer. *Journal of Advertising Research* .

Elhelw, M., Nicolaou, M., Chung, A., Yang, G., & Atkins, M. (2008). A Gaze-Based Study for Investigating the Perception of Visual Realism in Simulated Scenes. *ACM Transactions on Applied Perception* .

EyeProof. (2014). Retrieved from http://www.eyeproof.net/

EyeTech. (2014). Retrieved from https://www.eyetechds.com/index.shtml

eyeX. (2014). Retrieved from http://developer.tobii.com/an-introduction-to-the-tobii-eyex-sdk/

Finlay, K., Marmurek, H., & Morton, R. (2005). Priming Effects in Explicit and Implicit Memory for Textual Avertisements. *Applied Psychology* .

Freud, S. (1919). The "Uncanny".

Gardner, M., & Hill, R. (1990). Consumer's Mood States and the Decision-Making Process.

Genco, S., Pohlmann, A., & Steidl, P. (2013). *Neuromarketing for Dummies.* Wiley-Brand.

Goldwater, B. (1972). Psychological Significance of Pupillary Movements. *Psychological Bulletin* .

Grasse, K., & Lisberger, S. (1992). Analysis of a Naturally Occurring Asymmetry in Vertical Smooth Pursuit Eye Movements in a Monkey. *Journal of Neurophysiology* .

Greenwald, A., & Mahzarin, R. (1995). Implicit Social Cognition: Attitude, Self-Esteem and Stereotypes. *Psychological Review* .

Griffin, E. (2012). *Expectancy Violation Theory.*

Gulas, C., & McKeage, K. (2000). Extending Social Comparison: An Examination of the Unintended Consequences of Idalized Advertising Imagery. *Journal of Advertising* .

Hall, A. (1945). The Origin and Purposes of Blinking. *British Journal of Ophthalmology* .

Hall, R., & Cusack, B. (1972). The Measurement of Eye Behavior: Critical and Selected Reviews of Voluntary Eye Movement and Blinking.

Heath, R. (2006). Emotional Persuasion. *Advertising Research* .

Heath, R. (2012). *Seducing the Subconscious - The Psychology of Emotional Influence in Advertising.* Wiley-Blackwell.

Heath, R. (2001). The Hidden Power of Advertising.

Heath, R., Brand, D., & Nairn, A. (2006). Brand Relationships: Strenghtened by Emotion, Weakend by Attention. *Journal of Advertising Research* .

Hegarty, M. (2004). Dynamic Visualizations and Learning: Getting to the Difficult Questions. *Learning and Instructions* .

Herbelin, B., Grillon, H., Ciechomski, P., & Thalmann, D. (2007). Coding Gaze Tracking Data with Chromatic Gradients for VR Exposure Therapy.

Hess, E. (1972). Pupillometrics. *Handbook of Psychophysiology* .

Hess, E., & Polt, J. (1960). Pupil Size as Related to Interest Value of Visual Stimuli. *Science* .

Hess, E., & Polt, J. (1964). Pupil Size in Relation to Mental Activity During Simple Problem-Solving. *Science* .

Hill, R., & Gardner, M. (1987). The Buying Process: Effects of and on Consumer Mood States. *Advances in Consumer Research* .

Hoeffler, T., & Leutner, D. (2007). Instructional Animation versus Static Pictures: A Meta-Analysis . *Learning and Instruction* .

IBM. (2014). Retrieved from http://www-01.ibm.com/software/analytics/spss/

James, W. (1950). The Principles of Psychology.

Kahneman, D. (1973). Attention and Effort.

Kahneman, D. (2012). *Thinking, Fast and Slow.* Macmillan.

Kahneman, D., & Beatty, J. (1966). Pupil Diameter and Load on Memory. *Science* .

Kao, D. (2011). Message Sidedness in Advertising: The Moderating Roles of Need for Cognition and Time Pressure in Persuasion. *Scandinavian Journal of Psychology* .

Kaulingfreks, R., & Bos, R. (2007). On Faces and Defacement: The Case of Kate Moss. *Business Ethics* .

Klingner, J. (2010). *Measuring Cognitive Load During Visual Task by Combining Pupillometry and Eye Tracking.*

Klingner, J., Kumar, R., & Hanrahan, P. (2008). Measuring the Task-evoked Pupillary Response with a Remote Eye Tracker.

Koch, C., & Tsuchiya, N. (2006). Attention and Consciousness: Two Distinct Brain Processes. *Trends in Cognitive Science* .

Kotaku. (2013). Retrieved from http://kotaku.com/bruce-lee-wants-you-to-be-like-water-and-drink-johnnie-715795835

Kowler, E. (2011). Eye Movements: The Past 25 Years. *Vision Research* .

Krugman, H. (1965). The Impact of Television Advertising: Learning Without Envolvement. *Public Opinion Quarterly* .

Krugman, H. (1965). The Impact of Television Advertising: Learning Without Involvement. *Public Opinion Quarterly* .

Krugman, H., & Hartley, E. (1970). Passive Learning from Television. *Public Opinion Quarterly* .

Kumar, N., & Schneider, S. (2009). A Novel Approach to video-based pupil tracking. *International Conference of Systems, Man and Cybernetics* .

Land, M. (2006). Eye Movements and the Control of Actions in Everyday Life. *Science Direct* .

Lasseter, J. (1998). Retrieved from http://www.brainyquote.com/quotes/quotes/j/johnlasset597723.html

Lazarus, R. (1991). Emotion and Adaptation. *Oxford University Press* .

Lebrecht, S., Bar, M., Barrett, L., & Tarr, M. (2012). Micro-Valences: Perceiving Affective Valence in Everyday Objects. *Frontiers in Psychology* .

Lebrecht, S., Bar, M., Sheinberg, D., & Tarr, M. (2011). Micro-Valence: Nominally Neutral Visual Objects Have Affective Valence. *Journal of Vision* .

LeDoux, J. (1996). The Emotional Brain: The Mysterious Underpinnings of Emotional Life.

Lewalter, D. (2003). Cognitive Strategies for Learning from Static and Dynamic Visuals. *Learning and Instruction* .

Lister, M., & Wells, L. (2002). Seeing Beyond Belief: Cultural studies as an Approach to Analysing the Visual . *Handbook of Visual Analysis* .

Loewenfeld, I. (1993). The Pupil: Anatomy, Physiology and Clinical Applications. *Wayne State University Press* .

LucasArts. (1998). Retrieved from http://www.lucasarts.com/support/update/grim.html

MacLachlan, C. (2002). Normal Values and Standard Deviations for Pupil Diameter and Interpupillary Distance in Subjects Aged 1 Month to 19 Years. *Ophthalmic & Physiological Optics* .

Macworth, N., & Thomas, E. (1962). Head-Mounted Eye-Movement Camera.

Marshall, S. (2002). The Index of Cognitive Activity: Measuring Cognitive Workload. *Human Factors and Power Plants* .

Mathiole. (2014). Retrieved from http://www.mathiole.com/portfolio/

Mathworks. (2014). Retrieved from http://www.mathworks.se/products/matlab/

Maunder, S., Cook, L., Young, N., Udale, B., Hough, N., & Cox, A. (2006). *O2 - The best way to win new customers? Talk to the ones you already have.* Henley-on-Thames, UK: World Advertising Research Center.

Mayer, R., & Moreno, R. (2002). Animation as an Aid to Multimedia Learning. *Educational Psychology Review* .

MBA. (2014). *MBA - Where Digital and Direct Interconnect*. Retrieved from http://www.mba.co.uk/

McCloud, S. (1993). *Understanding Comics: The Invisible Art.* Kitchen Sink Press.

McQuarrie, E., & Phillips, B. (2005). Indirect Persuasion in Advertising: How Consumers Process Metaphors Presented in Pictures and Words. *Journal of Advertising* .

Messaris, P. (1998). Visual Aspects of Media Literacy. *Journal of Communication* .

Meyers-Levy, J., & Peracchio, L. (1992). Getting na Angle in Advertising: The Effct of Camera Angle on Product Evaluation. *Journal of Marketing Research* .

Mitchell, A., & Olson, J. (1981). Are Product Attribute Beliefs the Only Mediator of Advertising Effects on Brand Attitude? *Journal of Marketing Research* .

Mori, M. (1970). The Uncanny Valley. *Energy* .

Neider, M., & Zelinsky, G. (2006). Scene Context Guides Eye Movements During Visual Search. *Vision Research* .

NIH. (2014). Retrieved from National Institute of Health: http://www.nih.gov/

Nordheilm, C. (2002). The Influence of Level of Processing on Advertising Repetition Effects. *Journal of Consumer Research* .

NUIA. (2014). Retrieved from http://www.4tiitoo.com/

Olney, T., Holbrook, M., & Batra, R. (1991). Consumer Responses to Advertising: The Effects of Ad Content, Emotions and Attitude Toward the Ad on Viewing Time. *Journal of Consumer Research* .

Olson, P. (2007). *Real-Time and Offline Filters for Eye Tracking.*

Orchard, L., & Stern, J. (1991). Blinks as an Index of Cognitive Activity During Reading. *Integrative Physiological and Behavioral Science* .

Petty, R., & Cacioppo, J. (1986). *The Elaboration Likelihood Model of Persuasion.*

Petty, R., Cacioppo, J., & Schumann, D. (1983). Central and Peripheral Routes to Advertising Effectiveness: The Moderating Role of Involvement. *Journal of Consumer Research* .

Petty, R., Schumann, D., Richman, S., & Strathman, A. (1993). Positive Mood and Persuasion: Different Roles for Affect Under High- and Low-Elaboration Conditions. *Attitudes and Social Cognition* .

Pieters, R., Baumgartner, H., & Allen, D. (1995). A Means-End Chain Approach to Consumer Goal Structures. *International journal of Research in Marketing* .

PIXAR. (1995). Retrieved from http://www.pixar.com/

PIXAR. (2004). Retrieved from http://www.pixar.com/

Polhemus. (2014). Retrieved from http://polhemus.com/eye-tracking/visiontrak

Pomplun, M. (2006). Saccadic Selectivity in Complex Visual Search Displays. *Vision Research* .

Pomplun, M., & Sunkara, S. (2003). Pupil Dilation as an Indicator of Cognitive Workload in Human-copmuter Interaction. *Proceedings of the International Conference on HCI* .

Pomplun, M., Reingold, E., & Shen, J. (2001). Investigating the Visual Span in Comparative Search: The effects of Task Difficulty and Divided Attention. *Cognition* .

Posner, M., & Petersen, S. (1990). *The attention system of the human brain.* Annual Review of Neuroscience.

Priester, J., & Petty, R. (1995). Source Attribution and Persuasion: Perceived honesty as a Determinant of Message Scrutiny. *Personality and Social Psychology* .

Priester, J., & Petty, R. (2003). The Influence of Spokesperson Trustworthiness on Message Elaboration, Attitude Strength, and Advertising Effectiveness. *Journal of Consumer Psychology* .

Ratliff, F., & Riggs, L. (1950). Involuntary Motions of the Eye During Monocular Fixation.

Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing Fluency and Aesthetic Pleasure: Is Beauty in the Perceiver's Processing Experience? *Personality and Social Psychology* .

Reid, L., & Soley, L. (1981). Another Look at the "Decorative Female Model: The Recognition of Visual and Verbal Ad Components. *Current Issues and Research in Advertising* .

Renninger, L., Verghese, P., & Coughtlan, J. (2007). Where to Look Next? Eye Movements Reduce Local Uncertainty. *Journal of Vision* .

Riggs, L., Ratliff, F., Cornsweet, J., & Cornsweet, T. (1953). The Disappearance of Steadily Fixated Visual Test Objects.

Rolfs, M. (2009). Microsaccades: Small steps on a Long Way. *Vision Research* .

Sanbonmatsu, D., & Kardes, F. (1988). The Effect of Physiological Arousal on Information Processing and Persuasion. *Journal of Consumer Research* .

Schachter, S., & Singer, J. (1962). Cognitive, Social and Physiological Determinants of Emotional State. *Psychological Review* .

Schaller, M., & Cialdini, R. (1990). Happiness, Sadness and Helping: A Motivational Integration. *Handbook of Motivation and Cognition: Foundations of Social Behavior* .

Schluroff, M. (1982). Pupil Responses to Grammatical Complexity of Sentences. *Brain and Language* .

Schmitt, B. (1994). Contextual Priming of Visual Information in Advertisements. *Journal of Psychology and Marketing* .

Schneider, E., Wang, Y., & Yang, S. (2007). Exploring the Uncanny Valley with Japanese Video Game Characters.

Scott, R. (1982). Retrieved from http://bladerunnerthemovie.warnerbros.com/

Seyama, J. (2007). The Uncanny Valley: Effect of Realism on the Impression of Artificial Human Face. *Presence: Teleoperators and Virtual Environments* .

Shimp, T. (1981). Attitude Toward the Ad as a Mediator of consumer Brand Choice. *Journal of Advertising* .

Shudson, M. (1984). *Advertising: The Uneasy Persuasion.* London: Routledge.

Smith, C., & Ellsworth, P. (1985). Patterns of Cognitive Appraisals in Emotion. *Journal of Personality and Social Psychology* .

Soederlund, M., & Lange, F. (2006). Visual Persuasion with Physically Attractive Models in Ads.

Spauschus, A., Marsden, J., Halliday, D., Rosenberg, J., & Brown, P. (1999). The Origin of Ocular Microtremor in Man.

Stayman, D., & Aaker, D. (1988). Are All the Effects of Ad-Induced Feelings Mediated by Ad? *Journal of Consumer Research* .

Stayman, D., & Batra, R. (1991). Encoding and Retrieval of Ad Affect in Memory. *Journal of Marketing Research* .

Stein, N., Liwag, M., & Wade, E. (1996). A Goal-Based Approach to Memory for Emotional Events: Implementations for Theories of Understanding and Socializition. *Emotion: Interdisciplinary Perspectives* .

Stern, J., Walrath, L., & Goldstein, R. (1984). The Endogenous Eyeblink. *Psychophysiology* .

Theeuwes, J. (1991). *Exogenous and endogenous control of attention - the effect of visual onsets and offsets.* Perception & Psychophysics.

TheEyeTribe. (2014). Retrieved from https://theeyetribe.com/

TheVerge. (2013). Retrieved from http://www.theverge.com/2013/2/28/4039144/audrey-hepburn-resurrected-for-galaxy-chocolate-commercial

Threadless. (2014). Retrieved from https://www.threadless.com/profile/445545/mathiole/designs

Tinwell, A., Grimshaw, M., Nabi, D., & Williams, A. (2011). Facial Expression of Emotion and Perception of the Uncanny Valley in Virtual Characters. *Computers in Human Behavior* .

Tobii. (2014). Retrieved from http://www.tobii.com/en/eye-tracking-research/global/products/hardware/tobii-x2-60-eye-tracker/tobii-x2-60-features/

Torralba, A., Oliva, A., Castelhano, M., & Henderson, J. (2006). Contexual Guidance of Eye movements and Attention in Real-World Scenes: The Rola of Global Features in Object Search. *Psychological Review* .

Tversky, B., Morrison, J.-B., & Betrancourt, M. (2002). Animation: Can It Faciliate? *International journal of Human Computer Studies* .

Vice, J. (2001). Final Fantasy: The Spirits Within. *Movie Review* .

Vinayagamoorthy, V., Steed, A., & Slater, M. (2005). Building Characters: Lessons Drawn from Virtual Environments.

Volkmann, F., Riggs, L., & Moore, R. (1980). Eyeblinks and Visual Suppression. *Science* .

Weiss, R.-E., Knowlton, D.-S., & Morrison, G.-R. (2002). Principles for Using Animation in Computer-based Instruction: Theoretical Heuristics for Effective Design. *Computers in Human Behavior* .

Weschler, L. (2002). Why Is This Man Smiling?

Westheimer, G., & McKee, S. (1975). Visual Acuity in the Presence of Retinal-image Motion. *Journal of the Optical Society of America* .

Wright, P. (1980). Message-Evoked Thoughts: Persuasion Research Using Thought Verbalizations. *Journal of Consumer Research* .

Wyatt, H. (1995). The Form of the Human Pupil. *Vision Research* .

Yarbus, A. (1967). Eye Movements and Vision.

Zajonc, R. (1968). Attitudinal Effects of Mere Exposure. *Journal of Personality and Social Psychology* .

Zhou, Y. (2008). Design of Eye tracking System for Real Scene. *Pacific-Asia Workshop on Computational Intelligence and Industrial Application* .

Attitudes, Purchase and Gift intentions for the Advertisement

Group Statistics

	Participants_AD	N	Mean	Std. Deviation	Std. Error Mean
Attitudes_AD	CGI	15	6.0500	1.20342	.31072
	Human	15	5.9000	1.79980	.46471
Purchase_AD	CGI	15	2.9333	1.98086	.51146
	Human	15	3.7333	2.05171	.52975
Gift_AD	CGI	15	4.2667	1.98086	.51146
	Human	15	5.5333	2.69568	.69602

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Attitudes_AD	Equal variances assumed	3.393	.076	.268	28	.790	.15000	.55902	-.99509	1.29509
	Equal variances not assumed			.268	24.433	.791	.15000	.55902	-1.00267	1.30267
Purchase_AD	Equal variances assumed	.075	.787	-1.086	28	.287	-.80000	.73636	-2.30836	.70836
	Equal variances not assumed			-1.086	27.965	.287	-.80000	.73636	-2.30844	.70844
Gift_AD	Equal variances assumed	2.748	.109	-1.467	28	.154	-1.26667	.86373	-3.03594	.50261
	Equal variances not assumed			-1.467	25.706	.155	-1.26667	.86373	-3.04308	.50975

ANOVA: Ad-endorser and Gender on Attitudes *(animated advertisement)*

Between-Subjects Factors

		Value Label	N
Participants_Gender	1.00	Male	20
	2.00	Female	10
Participants_AD	1.00	CGI	15
	2.00	Human	15

Descriptive Statistics

Dependent Variable: Attitudes_AD

Participants_Gender	Participants_AD	Mean	Std. Deviation	N
Male	CGI	5.9722	1.03414	9
	Human	6.1591	1.57430	11
	Total	6.0750	1.32809	20
Female	CGI	6.1667	1.52206	6
	Human	5.1875	2.43563	4
	Total	5.7750	1.87620	10
Total	CGI	6.0500	1.20342	15
	Human	5.9000	1.79980	15
	Total	5.9750	1.50624	30

Tests of Between-Subjects Effects

Dependent Variable: Attitudes_AD

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3.074[a]	3	1.025	.425	.737	.047
Intercept	891.514	1	891.514	369.570	.000	.934
Participants_Gender	.976	1	.976	.405	.530	.015
Participants_AD	1.015	1	1.015	.421	.522	.016
Participants_Gender * Participants_AD	2.198	1	2.198	.911	.349	.034
Error	62.720	26	2.412			
Total	1136.813	30				
Corrected Total	65.794	29				

a. R Squared = .047 (Adjusted R Squared = -.063)

Attitudes, Purchase and Gift giving intentions for the Booklet

Group Statistics

	Participants_Booklet	N	Mean	Std. Deviation	Std. Error Mean
Attitudes_Tshirt	CGI	10	5.1500	.95161	.30092
	Human	10	6.0500	2.14670	.67885
Purchase_Tshirt	CGI	10	3.6000	2.22111	.70238
	Human	10	4.5000	2.71825	.85959
Gift_Tshirt	CGI	10	5.3000	1.15950	.36667
	Human	10	6.5000	1.50923	.47726
Attitudes_Scarf	CGI	10	5.3750	2.17067	.68643
	Human	10	5.2250	2.10307	.66505
Purchase_Scarf	CGI	10	3.7000	1.82878	.57831
	Human	10	2.7000	2.31181	.73106
Gift_Scarf	CGI	10	5.2000	1.75119	.55377
	Human	10	5.9000	1.66333	.52599
Attitudes_Tie	CGI	10	5.1750	.96501	.30516
	Human	10	5.7250	2.55346	.80747
Purchase_Tie	CGI	10	3.2000	2.09762	.66332
	Human	10	4.1000	2.88483	.91226
Gift_Tie	CGI	10	5.4000	1.07497	.33993
	Human	10	6.8000	2.48551	.78599
Attitudes_Shirt	CGI	10	4.9750	2.02227	.63950
	Human	10	6.6250	1.52411	.48197
Purchase_Shirt	CGI	10	4.4000	2.63312	.83267
	Human	10	3.9000	2.80674	.88757
Gift_Shirt	CGI	10	5.4000	1.26491	.40000
	Human	10	6.8000	1.81353	.57349

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Attitudes_Tshirt	Equal variances assumed	3.901	.064	-1.212	18	.241	-.90000	.74256	-2.46005	.66005
	Equal variances not assumed			-1.212	12.406	.248	-.90000	.74256	-2.51204	.71204
Purchase_Tshirt	Equal variances assumed	.879	.361	-.811	18	.428	-.90000	1.11006	-3.23214	1.43214
	Equal variances not assumed			-.811	17.312	.429	-.90000	1.11006	-3.23880	1.43880
Gift_Tshirt	Equal variances assumed	.802	.382	-1.994	18	.062	-1.20000	.60185	-2.46444	.06444
	Equal variances not assumed			-1.994	16.879	.063	-1.20000	.60185	-2.47048	.07048
Attitudes_Scarf	Equal variances assumed	.048	.829	.157	18	.877	.15000	.95576	-1.85797	2.15797
	Equal variances not assumed			.157	17.982	.877	.15000	.95576	-1.85812	2.15812
Purchase_Scarf	Equal variances assumed	.443	.514	1.073	18	.298	1.00000	.93214	-.95836	2.95836
	Equal variances not assumed			1.073	17.094	.298	1.00000	.93214	-.96582	2.96582
Gift_Scarf	Equal variances assumed	.037	.849	-.917	18	.372	-.70000	.76376	-2.30461	.90461
	Equal variances not assumed			-.917	17.953	.372	-.70000	.76376	-2.30491	.90491
Attitudes_Tie	Equal variances assumed	6.578	.019	-.637	18	.532	-.55000	.86321	-2.36355	1.26355

	Equal variances not assumed			-.637	11.519	.536	-.55000	.86321	-2.43952	1.33952
Purchase_Tie	Equal variances assumed	2.250	.151	-.798	18	.435	-.90000	1.12793	-3.26969	1.46969
	Equal variances not assumed			-.798	16.438	.436	-.90000	1.12793	-3.28594	1.48594
Gift_Tie	Equal variances assumed	2.215	.154	-1.635	18	.119	-1.40000	.85635	-3.19912	.39912
	Equal variances not assumed			-1.635	12.253	.127	-1.40000	.85635	-3.26156	.46156
Attitudes_Shirt	Equal variances assumed	.953	.342	-2.060	18	.054	-1.65000	.80078	-3.33238	.03238
	Equal variances not assumed			-2.060	16.730	.055	-1.65000	.80078	-3.34158	.04158
Purchase_Shirt	Equal variances assumed	.143	.710	.411	18	.686	.50000	1.21701	-2.05684	3.05684
	Equal variances not assumed			.411	17.927	.686	.50000	1.21701	-2.05759	3.05759
Gift_Shirt	Equal variances assumed	2.921	.105	-2.002	18	.061	-1.40000	.69921	-2.86898	.06898
	Equal variances not assumed			-2.002	16.081	.062	-1.40000	.69921	-2.88164	.08164

MATLAB Source Code

```
srcImages = dir('C:\Users\ICO\Documents\MATLAB\Heatmap_Statistics\human\*.png');
x = P10StatisticsHuman2524(:,3);
y = P10StatisticsHuman2524(:,4);
p_left = P10StatisticsHuman2524(:,1);
p_right = P10StatisticsHuman2524(:,2);

interval = 22;

for p = 1: length(srcImages)
   headLeftArray = [];
   headRightArray = [];
   bodyLeftArray = [];
   bodyRightArray = [];
   logoLeftArray = [];
   logoRightArray = [];
   bckgLeftArray = [];
   bckgRightArray = [];
   focusArray =[];
   D1 = 0;
   D2 = 0;
   D3 = 0;
   D4 = 0;

   filename = strcat('C:\Users\ICO\Documents\MATLAB\Heatmap_Statistics\human\', srcImages(p).name);
             I = imread(filename);
             figure(p)

  imshow(I)
             hold on

   i1 = (p-1)*interval+1;
   i2 = p*interval;
   x0 = x(i1:i2,1);
   y0 = y(i1:i2,1);

   PL = p_left(i1:i2,1);
   PR = p_right(i1:i2,1);
   PL_mm = (sqrt(PL/3.14))*2;
   PR_mm = (sqrt(PR/3.14))*2;

  r1 =rectangle('Position',[320,30, 350, 300]); %rectangle head
  r2 =rectangle('Position',[100,332, 740, 420]); %rectangle body
  r3 =rectangle('Position',[770,20, 590, 250]); %rectangle logo


  for IX = 1:length(y0)
   if (y0(IX) > 30 && y0(IX) < 330 && x0(IX) > 320 && x0(IX) < 670)
      D1 = D1+1;
      headLeftArray(D1)= PL_mm(IX);
      headRightArray(D1)=PR_mm(IX);
    elseif (y0(IX) > 332 && y0(IX) < 752 && x0(IX) > 100 && x0(IX) < 840)
      D2 = D2+1;
```

```
bodyLeftArray(D2)= PL_mm(IX);
      bodyRightArray(D2)=PR_mm(IX);
    elseif (y0(IX) > 20 && y0(IX) < 270 && x0(IX) > 770 && x0(IX) < 1360)
       D3 = D3+1;
      logoLeftArray(D3)= PL_mm(IX);
      logoRightArray(D3)=PR_mm(IX);
    else D4 = D4+1;
      bckgLeftArray(D4)= PL_mm(IX);
      bckgRightArray(D4)=PR_mm(IX);
  end
 end

 focusArray=[D1,D2,D3,D4];

 fprintf('picture(%d), headshots = %d\n',p,D1);
 fprintf('picture(%d), body = %d\n',p,D2);
 fprintf('picture(%d), logo = %d\n',p,D3);
 fprintf('picture(%d), background = %d\n',p,D4);

 %Calculating max/min of PL&PR in focus area

 head_diff_PL = max(headLeftArray) - min(headLeftArray);
 head_diff_PR = max(headRightArray) - min(headRightArray);
 body_diff_PL = max(bodyLeftArray) - min(bodyLeftArray);
 body_diff_PR = max(bodyRightArray) - min(bodyRightArray);
 logo_diff_PL = max(logoLeftArray) - min(logoLeftArray);
 logo_diff_PR = max(logoRightArray) - min(logoRightArray);
 bckg_diff_PL = max(bckgLeftArray) - min(bckgLeftArray);
 bckg_diff_PR = max(bckgRightArray) - min(bckgRightArray);

if(max(focusArray)==D1)
     fprintf('The focus is on the head. Max/Min PL = [%f ; %f]. Max/min PR = [%f ; %f]\n\n'...
,max(headLeftArray),min(headLeftArray),max(headRightArray),min(headRightArray));
    head_diff_PL;
    head_diff_PR;
     elseif (max(focusArray)==D2)
        fprintf('The focus is on the body. Max/Min PL = [%f ; %f]. Max/min PR = [%f ; %f]\n\n'...
,max(bodyLeftArray),min(bodyLeftArray),max(bodyRightArray),min(bodyRightArray));
    body_diff_PL;
    body_diff_PR;
     elseif (max(focusArray)==D3)
        fprintf('The focus is on the logo. Max/Min PL = [%f ; %f]. Max/min PR = [%f ; %f]\n\n'...
,max(logoLeftArray),min(logoLeftArray),max(logoRightArray),min(logoRightArray));
     logo_diff_PL;
     logo_diff_PR;
 else
        fprintf('The focus is on the background. Max/Min PL = [%f ; %f]. Max/min PR = [%f ; %f]\n\n'...
,max(bckgLeftArray),min(bckgLeftArray),max(bckgRightArray),min(bckgRightArray));
     bckg_diff_PL;
     bckg_diff_PR;
 end
```

```
%Head text

  text(320,20,['pic[',num2str(p),'], headshots = ',num2str(D1)],'Color','y');
  text(200,40,['PL min= ',num2str(floor(min(headLeftArray)*10)/10),'mm'],'Color','w');
  text(200,55,['PL max= ',num2str(floor(max(headLeftArray)*10)/10),'mm'],'Color','w');
  text(200,70,['PR min= ',num2str(floor(min(headRightArray)*10)/10),'mm'],'Color','w');
  text(200,85,['PR max= ',num2str(floor(max(headRightArray)*10)/10),'mm'],'Color','w');
  text(200,120,['PL diff= ',num2str(floor(head_diff_PL*100)/100)],'Color','r');
  text(200,140,['PR diff= ',num2str(floor(head_diff_PR*100)/100)],'Color','r');

   %Body text

  text(720,740,['pic[',int2str(p),'], body = ',int2str(D2)],'Color','y');
  text(850,700,['PL min= ',num2str(floor(min(bodyLeftArray)*10)/10),'mm'],'Color','w');
  text(850,715,['PL max= ',num2str(floor(max(bodyLeftArray)*10)/10),'mm'],'Color','w');
  text(850,730,['PR min= ',num2str(floor(min(bodyRightArray)*10)/10),'mm'],'Color','w');
  text(850,745,['PR max= ',num2str(floor(max(bodyRightArray)*10)/10),'mm'],'Color','w');
  text(850,660,['PL diff= ',num2str(floor(body_diff_PL*10)/10)],'Color','r');
  text(850,680,['PR diff= ',num2str(floor(body_diff_PR*10)/10)],'Color','r');

  %Logo text

  text(770,10,['pic[',int2str(p),'], logo = ',int2str(D3)],'Color','y');
  text(1270, 280,['PL min= ',num2str(floor(min(logoLeftArray)*10)/10),'mm'],'Color','w');
  text(1270,295,['PL max= ',num2str(floor(max(logoLeftArray)*10)/10),'mm'],'Color','w');
  text(1270,310,['PR min= ',num2str(floor(min(logoRightArray)*10)/10),'mm'],'Color','w');
  text(1270,325,['PR max= ',num2str(floor(max(logoRightArray)*10)/10),'mm'],'Color','w');
  text(1270,340,['PL diff= ',num2str(floor(logo_diff_PL*10)/10)],'Color','r');
  text(1270,360,['PR diff= ',num2str(floor(logo_diff_PR*10)/10)],'Color','r');

  %Background text

  text(1220,520,['pic[',int2str(p),'], background = ',int2str(D4)],'Color','y');
  text(1270,550,['PL min= ',num2str(floor(min(bckgLeftArray)*10)/10),'mm'],'Color','w');
  text(1270,565,['PL max= ',num2str(floor(max(bckgLeftArray)*10)/10),'mm'],'Color','w');
  text(1270,580,['PR min= ',num2str(floor(min(bckgRightArray)*10)/10),'mm'],'Color','w');
  text(1270,595,['PR max= ',num2str(floor(max(bckgRightArray)*10)/10),'mm'],'Color','w');
  text(1270,620,['PL diff= ',num2str(floor(bckg_diff_PL*10)/10)],'Color','r');
  text(1270,640,['PR diff= ',num2str(floor(bckg_diff_PR*10)/10)],'Color','r');

set(r1, 'edgecolor','b');
  set(r2, 'edgecolor','r');
  set(r3, 'edgecolor','c');


  plot(x0, y0, 'Color', 'y', 'LineStyle','-', 'DisplayName', 'eyePath');
  plot(x0, y0, 'Color', 'r', 'LineStyle','*', 'DisplayName', 'coordinates');
hleg = legend('eyePath', 'coordinates');
   set(hleg, 'Location', 'SouthEast');
   legend show
   hold off
end
```

Gaze Distribution between CGI and Human Ad

Group Statistics

	Participants	N	Mean	Std. Deviation	Std. Error Mean
Head	CGI	14	64.2857	31.25928	8.35440
	Human	14	49.3571	17.89975	4.78391
Body	CGI	14	96.1429	22.56225	6.03001
	Human	14	126.5714	16.05143	4.28992
Logo	CGI	14	39.3571	10.99375	2.93820
	Human	14	29.5000	9.65362	2.58004
Background	CGI	14	13.0714	10.46212	2.79612
	Human	14	14.5714	8.40068	2.24518

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Head	Equal variances assumed	3.554	.071	1.551	26	.133	14.92857	9.62713	-4.86029	34.71743
	Equal variances not assumed			1.551	20.698	.136	14.92857	9.62713	-5.10997	34.96711
Body	Equal variances assumed	.669	.421	-4.112	26	.000	-30.42857	7.40031	-45.64012	-15.21703
	Equal variances not assumed			-4.112	23.476	.000	-30.42857	7.40031	-45.72012	-15.13702
Logo	Equal variances assumed	.054	.817	2.521	26	.018	9.85714	3.91020	1.81962	17.89467
	Equal variances not assumed			2.521	25.573	.018	9.85714	3.91020	1.81308	17.90121
Background	Equal variances assumed	.273	.606	-.418	26	.679	-1.50000	3.58596	-8.87105	5.87105
	Equal variances not assumed			-.418	24.841	.679	-1.50000	3.58596	-8.88782	5.88782

Gaze Distribution between 1st and 2nd exposures

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Head_CGI_1st	63.0000	13	32.14809	8.91628
	Head_CGI_2nd	57.0000	13	20.14117	5.58616
Pair 2	Body_CGI_1st	96.0769	13	23.48213	6.51277
	Body_CGI_2nd	92.2308	13	28.38178	7.87169
Pair 3	Logo_CGI_1st	39.3077	13	11.44104	3.17317
	Logo_CGI_2nd	40.0000	13	14.19507	3.93700
Pair 4	Bckg_CGI_1st	13.9231	13	10.37193	2.87666
	Bckg_CGI_2nd	30.7692	13	14.23115	3.94701
Pair 5	Head_Human_1st	51.0000	13	17.49762	4.85297
	Head_Human_2nd	44.7692	13	24.70882	6.85299
Pair 6	Body_Human_1st	127.2308	13	16.50835	4.57859
	Body_Human_2nd	120.8462	13	23.55436	6.53280
Pair 7	Logo_Human_1st	27.9231	13	7.95258	2.20565
	Logo_Human_2nd	23.3077	13	14.08536	3.90658
Pair 8	Bckg_Human_1st	13.8462	13	8.27492	2.29505
	Bckg_Human_2nd	31.0769	13	12.56623	3.48525

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Head_CGI_1st & Head_CGI_2nd	13	.419	.154
Pair 2	Body_CGI_1st & Body_CGI_2nd	13	.500	.082
Pair 3	Logo_CGI_1st & Logo_CGI_2nd	13	-.398	.178
Pair 4	Bckg_CGI_1st & Bckg_CGI_2nd	13	.050	.872
Pair 5	Head_Human_1st & Head_Human_2nd	13	-.013	.967
Pair 6	Body_Human_1st & Body_Human_2nd	13	-.002	.994
Pair 7	Logo_Human_1st & Logo_Human_2nd	13	.663	.013
Pair 8	Bckg_Human_1st & Bckg_Human_2nd	13	.395	.181

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Head_CGI_1st - Head_CGI_2nd	6.00000	29.93883	8.30354	-12.09185	24.09185	.723	12	.484
Pair 2	Body_CGI_1st - Body_CGI_2nd	3.84615	26.28639	7.29053	-12.03855	19.73086	.528	12	.607
Pair 3	Logo_CGI_1st - Logo_CGI_2nd	-.69231	21.48404	5.95860	-13.67498	12.29037	-.116	12	.909
Pair 4	Bckg_CGI_1st - Bckg_CGI_2nd	-16.84615	17.18937	4.76747	-27.23358	-6.45872	-3.534	12	.004
Pair 5	Head_Human_1st - Head_Human_2nd	6.23077	30.45804	8.44754	-12.17484	24.63638	.738	12	.475
Pair 6	Body_Human_1st - Body_Human_2nd	6.38462	28.79392	7.98600	-11.01538	23.78461	.799	12	.440
Pair 7	Logo_Human_1st - Logo_Human_2nd	4.61538	10.63437	2.94944	-1.81090	11.04167	1.565	12	.144
Pair 8	Bckg_Human_1st - Bckg_Human_2nd	-17.23077	12.00801	3.33042	-24.48714	-9.97440	-5.174	12	.000

Pupil Dilations (HEAD)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Head_PL_3s	Equal variances assumed	.	.	-3.727	2	.065	-.12500	.03354	-.26932	.01932
	Equal variances not assumed			-3.727	1.471	.102	-.12500	.03354	-.33256	.08256
Head_PR_3s	Equal variances assumed	.	.	-.992	2	.426	-.08000	.08062	-.42689	.26689
	Equal variances not assumed			-.992	1.031	.498	-.08000	.08062	-1.03390	.87390

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Head_PL_4s	Equal variances assumed	1.605	.223	.426	16	.676	.04000	.09387	-.15899	.23899
	Equal variances not assumed			.426	14.866	.676	.04000	.09387	-.16023	.24023
Head_PR_4s	Equal variances assumed	.521	.481	.229	16	.822	.03111	.13607	-.25735	.31957
	Equal variances not assumed			.229	14.973	.822	.03111	.13607	-.25897	.32119

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Head_PL_5s	Equal variances assumed	.	.	.204	2	.857	.02500	.12258	-.50240	.55240
	Equal variances not assumed			.204	1.087	.870	.02500	.12258	-1.26760	1.31760
Head_PR_5s	Equal variances assumed	.	.	.467	2	.686	.05000	.10700	-.41040	.51040
	Equal variances not assumed			.467	1.872	.689	.05000	.10700	-.44206	.54206

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Head_PL_6s	Equal variances assumed	2.329	.158	-.102	10	.921	-.01833	.18024	-.41994	.38327
	Equal variances not assumed			-.102	7.758	.922	-.01833	.18024	-.43624	.39957
Head_PR_6s	Equal variances assumed	1.149	.309	1.179	10	.266	.16333	.13850	-.14525	.47192
	Equal variances not assumed			1.179	8.965	.269	.16333	.13850	-.15015	.47682

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Head_PL_7s	Equal variances assumed	1.507	.254	2.982	8	.018	.30200	.10126	.06849	.53551
	Equal variances not assumed			2.982	7.336	.019	.30200	.10126	.06476	.53924
Head_PR_7s	Equal variances assumed	4.794	.060	4.098	8	.003	.25800	.06296	.11281	.40319
	Equal variances not assumed			4.098	5.470	.008	.25800	.06296	.10025	.41575

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Head_PL_8s	Equal variances assumed	.939	.370	-.654	6	.537	-.06000	.09172	-.28443	.16443
	Equal variances not assumed			-.654	4.665	.544	-.06000	.09172	-.30096	.18096
Head_PR_8s	Equal variances assumed	3.526	.110	1.414	6	.207	.15250	.10785	-.11140	.41640
	Equal variances not assumed			1.414	3.563	.238	.15250	.10785	-.16198	.46698

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Head_PL_9s	Equal variances assumed	9.176	.013	2.198	10	.053	.13167	.05991	-.00183	.26516
	Equal variances not assumed			2.198	7.040	.064	.13167	.05991	-.00984	.27317
Head_PR_9s	Equal variances assumed	.027	.873	.361	10	.726	.03167	.08780	-.16397	.22730
	Equal variances not assumed			.361	9.791	.726	.03167	.08780	-.16454	.22787

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Head_PL_10s	Equal variances assumed	4.531	.050	1.658	15	.118	.10000	.06033	-.02858	.22858
	Equal variances not assumed			1.730	11.225	.111	.10000	.05782	-.02694	.22694
Head_PR_10s	Equal variances assumed	1.570	.229	1.578	15	.135	.14486	.09179	-.05079	.34051
	Equal variances not assumed			1.645	11.420	.127	.14486	.08808	-.04813	.33785

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Head_PL_11s	Equal variances assumed	2.456	.143	.000	12	1.000	.00000	.04682	-.10202	.10202
	Equal variances not assumed			.000	8.441	1.000	.00000	.04682	-.10700	.10700
Head_PR_11s	Equal variances assumed	6.782	.023	-.280	12	.785	-.01429	.05110	-.12563	.09706
	Equal variances not assumed			-.280	9.052	.786	-.01429	.05110	-.12979	.10122

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Head_PL_12s	Equal variances assumed	.043	.839	-1.640	14	.123	-.08375	.05106	-.19326	.02576
	Equal variances not assumed			-1.640	13.631	.124	-.08375	.05106	-.19354	.02604
Head_PR_12s	Equal variances assumed	1.905	.189	-.599	14	.559	-.07500	.12514	-.34340	.19340
	Equal variances not assumed			-.599	13.476	.559	-.07500	.12514	-.34439	.19439

Pupil Dilations (BODY)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Body_PL_3s	Equal variances assumed	.799	.398	.546	8	.600	.14000	.25652	-.45152	.73152
	Equal variances not assumed			.546	5.920	.605	.14000	.25652	-.48973	.76973
Body_PR_3s	Equal variances assumed	1.166	.312	.924	8	.383	.32000	.34641	-.47882	1.11882
	Equal variances not assumed			.924	5.658	.393	.32000	.34641	-.54020	1.18020

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Body_PL_4s	Equal variances assumed	.778	.389	-.347	18	.733	-.05000	.14426	-.35308	.25308
	Equal variances not assumed			-.347	11.876	.735	-.05000	.14426	-.36468	.26468
Body_PR_4s	Equal variances assumed	.239	.631	-1.100	18	.286	-.24000	.21817	-.69837	.21837
	Equal variances not assumed			-1.100	16.164	.287	-.24000	.21817	-.70213	.22213

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Body_PL_5s	Equal variances assumed	.682	.419	-1.081	20	.292	-.19091	.17656	-.55921	.17739
	Equal variances not assumed			-1.081	13.238	.299	-.19091	.17656	-.57165	.18983
Body_PR_5s	Equal variances assumed	2.280	.147	.000	20	1.000	.00000	.16278	-.33954	.33954
	Equal variances not assumed			.000	12.161	1.000	.00000	.16278	-.35414	.35414

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Body_PL_6s	Equal variances assumed	.056	.815	-2.300	24	.030	-.16154	.07022	-.30647	-.01661
	Equal variances not assumed			-2.300	23.181	.031	-.16154	.07022	-.30674	-.01634
Body_PR_6s	Equal variances assumed	.632	.434	-.623	24	.539	-.10000	.16050	-.43125	.23125
	Equal variances not assumed			-.623	22.154	.540	-.10000	.16050	-.43272	.23272

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Body_PL_7s	Equal variances assumed	.948	.340	-1.321	24	.199	-.14615	.11067	-.37457	.08226
	Equal variances not assumed			-1.321	19.921	.202	-.14615	.11067	-.37707	.08476
Body_PR_7s	Equal variances assumed	7.789	.010	-2.655	24	.014	-.49231	.18541	-.87499	-.10963
	Equal variances not assumed			-2.655	14.184	.019	-.49231	.18541	-.88950	-.09512

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Body_PL_8s	Equal variances assumed	3.385	.079	-2.356	22	.028	-.21667	.09198	-.40741	-.02592
	Equal variances not assumed			-2.356	18.038	.030	-.21667	.09198	-.40987	-.02346
Body_PR_8s	Equal variances assumed	3.810	.064	-.893	22	.382	-.23333	.26129	-.77521	.30854
	Equal variances not assumed			-.893	13.731	.387	-.23333	.26129	-.79477	.32810

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Body_PL_9s	Equal variances assumed	9.743	.005	-1.957	22	.063	-.73333	.37469	-1.51039	.04372
	Equal variances not assumed			-1.957	11.195	.076	-.73333	.37469	-1.55627	.08960
Body_PR_9s	Equal variances assumed	.193	.665	-.601	22	.554	-.10833	.18026	-.48217	.26550
	Equal variances not assumed			-.601	21.527	.554	-.10833	.18026	-.48265	.26598

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Body_PL_10s	Equal variances assumed	1.993	.173	-.869	20	.395	-.16364	.18821	-.55623	.22895
	Equal variances not assumed			-.869	11.829	.402	-.16364	.18821	-.57436	.24709
Body_PR_10s	Equal variances assumed	2.522	.128	-1.295	20	.210	-.23636	.18250	-.61705	.14432
	Equal variances not assumed			-1.295	11.621	.220	-.23636	.18250	-.63544	.16271

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Body_PL_11s	Equal variances assumed	.000	1.000	.739	6	.488	.05000	.06770	-.11566	.21566
	Equal variances not assumed			.739	6.000	.488	.05000	.06770	-.11566	.21566
Body_PR_11s	Equal variances assumed	1.000	.356	2.554	6	.043	.25000	.09789	.01046	.48954
	Equal variances not assumed			2.554	4.716	.054	.25000	.09789	-.00627	.50627

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Body_PL_12s	Equal variances assumed	5.000	.049	.000	10	1.000	.00000	.07303	-.16272	.16272
	Equal variances not assumed			.000	8.000	1.000	.00000	.07303	-.16841	.16841
Body_PR_12s	Equal variances assumed	1.250	.290	.830	10	.426	.06667	.08028	-.11220	.24554
	Equal variances not assumed			.830	9.711	.426	.06667	.08028	-.11293	.24626

Pupil Dilations (LOGO)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Logo_PL_3s	Equal variances assumed	.771	.395	1.106	14	.287	.06250	.05650	-.05868	.18368
	Equal variances not assumed			1.106	12.529	.289	.06250	.05650	-.06002	.18502
Logo_PR_3s	Equal variances assumed	.090	.768	-.675	14	.511	-.05000	.07410	-.20893	.10893
	Equal variances not assumed			-.675	12.895	.512	-.05000	.07410	-.21022	.11022

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Logo_PL_4s	Equal variances assumed	.000	1.000	.739	6	.488	.05000	.06770	-.11566	.21566
	Equal variances not assumed			.739	6.000	.488	.05000	.06770	-.11566	.21566
Logo_PR_4s	Equal variances assumed	3.000	.134	1.414	6	.207	.10000	.07071	-.07302	.27302
	Equal variances not assumed			1.414	4.154	.228	.10000	.07071	-.09349	.29349

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Logo_PL_11s	Equal variances assumed	.045	.837	.000	10	1.000	.00000	.09068	-.20204	.20204
	Equal variances not assumed			.000	9.441	1.000	.00000	.09068	-.20367	.20367
Logo_PR_11s	Equal variances assumed	.096	.763	-1.567	10	.148	-.15000	.09574	-.36333	.06333
	Equal variances not assumed			-1.567	9.739	.149	-.15000	.09574	-.36410	.06410

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
Logo_PL_12s	Equal variances assumed	.011	.919	.270	8	.794	.04000	.14832	-.30204	.38204
	Equal variances not assumed			.270	7.834	.794	.04000	.14832	-.30330	.38330
Logo_PR_12s	Equal variances assumed	.480	.508	.671	8	.521	.06000	.08944	-.14626	.26626
	Equal variances not assumed			.671	7.824	.522	.06000	.08944	-.14707	.26707

Pupil Dilations (BACKGROUND)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
BKG_PL_3s	Equal variances assumed	7.022	.038	1.315	6	.237	.60000	.45644	-.51686	1.71686
	Equal variances not assumed			1.315	3.024	.279	.60000	.45644	-.84606	2.04606
BKG_PR_3s	Equal variances assumed	6.518	.043	.967	6	.371	.40000	.41382	-.61259	1.41259
	Equal variances not assumed			.967	3.081	.403	.40000	.41382	-.89752	1.69752

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
BKG_PL_4s	Equal variances assumed	3.357	.117	.556	6	.598	.30000	.53968	-1.02054	1.62054
	Equal variances not assumed			.556	3.737	.610	.30000	.53968	-1.24095	1.84095
BKG_PR_4s	Equal variances assumed	1.000	.356	.000	6	1.000	.00000	.05774	-.14127	.14127
	Equal variances not assumed			.000	4.800	1.000	.00000	.05774	-.15029	.15029

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BKG_PL_5s	Equal variances assumed	.	.	-1.000	2	.423	-.10000	.10000	-.53027	.33027
	Equal variances not assumed			-1.000	1.000	.500	-.10000	.10000	-1.37062	1.17062
BKG_PR_5s	Equal variances assumed	.	.	1.000	2	.423	.10000	.10000	-.33027	.53027
	Equal variances not assumed			1.000	1.000	.500	.10000	.10000	-1.17062	1.37062

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BKG_PL_7s	Equal variances assumed	.	.	1.941	2	.192	.35000	.18028	-.42567	1.12567
	Equal variances not assumed			1.941	1.742	.210	.35000	.18028	-.54671	1.24671
BKG_PR_7s	Equal variances assumed	.	.	.896	2	.465	.45000	.50249	-1.71206	2.61206
	Equal variances not assumed			.896	1.020	.533	.45000	.50249	-5.64644	6.54644

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BKG_PL_9s	Equal variances assumed	.793	.424	.231	4	.828	.13333	.57639	-1.46697	1.73364
	Equal variances not assumed			.231	3.647	.829	.13333	.57639	-1.52992	1.79659
BKG_PR_9s	Equal variances assumed	.469	.531	.254	4	.812	.16667	.65659	-1.65632	1.98965
	Equal variances not assumed			.254	3.778	.813	.16667	.65659	-1.69930	2.03264

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BKG_PL_11s	Equal variances assumed	7.218	.036	-.896	6	.405	-.22500	.25125	-.83978	.38978
	Equal variances not assumed			-.896	3.060	.435	-.22500	.25125	-1.01578	.56578
BKG_PR_11s	Equal variances assumed	.692	.437	-.277	6	.791	-.02500	.09014	-.24556	.19556
	Equal variances not assumed			-.277	5.227	.792	-.02500	.09014	-.25372	.20372

Questionnaire

Attitudes toward the Ad product:

(dislike it) 1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant) 1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting) 1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression) 1	2	3	4	5	6	7	8	9	10 (positive impression)	

PURCHASE INTENTIONS

I would like to buy this product
(do not agree) 1 2 3 4 5 6 7 8 9 10 (completely agree)

I would like to give it away as a gift
(do not agree) 1 2 3 4 5 6 7 8 9 10 (completely agree)

Have you seen the product before?

Yes
No

Booklets

Booklet 1

T-shirt

(dislike it)	1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant)	1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting)	1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression)	1	2	3	4	5	6	7	8	9	10	(positive impression)

PURCHASE INTENTIONS

I would like to buy this product

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

I would like to give it away as a gift

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

Scarf

(dislike it)	1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant)	1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting)	1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression)	1	2	3	4	5	6	7	8	9	10	(positive impression)

PURCHASE INTENTIONS

I would like to buy this product
(do not agree) 1 2 3 4 5 6 7 8 9 10 (completely agree)

I would like to give it away as a gift
(do not agree) 1 2 3 4 5 6 7 8 9 10 (completely agree)

Tie

(dislike it)	1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant)	1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting)	1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression)	1	2	3	4	5	6	7	8	9	10	(positive impression)

PURCHASE INTENTIONS

I would like to buy this product
(do not agree) 1 2 3 4 5 6 7 8 9 10 (completely agree)

I would like to give it away as a gift
(do not agree) 1 2 3 4 5 6 7 8 9 10 (completely agree)

Shirt

(dislike it)	1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant)	1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting)	1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression)	1	2	3	4	5	6	7	8	9	10	(positive impression)

PURCHASE INTENTIONS

I would like to buy this product

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

I would like to give it away as a gift

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

Booklet 2

T-shirt

(dislike it)	1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant)	1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting)	1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression)	1	2	3	4	5	6	7	8	9	10	(positive impression)

PURCHASE INTENTIONS

I would like to buy this product

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

I would like to give it away as a gift

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

Scarf

(dislike it)	1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant)	1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting)	1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression)	1	2	3	4	5	6	7	8	9	10	(positive impression)

PURCHASE INTENTIONS

I would like to buy this product

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

I would like to give it away as a gift

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

Tie

(dislike it)	1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant)	1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting)	1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression)	1	2	3	4	5	6	7	8	9	10	(positive impression)

PURCHASE INTENTIONS

I would like to buy this product
(do not agree) 1 2 3 4 5 6 7 8 9 10 (completely agree)

I would like to give it away as a gift
(do not agree) 1 2 3 4 5 6 7 8 9 10 (completely agree)

Shirt

(dislike it)	1	2	3	4	5	6	7	8	9	10	(like it)
(unpleasant)	1	2	3	4	5	6	7	8	9	10	(pleasant)
(uninteresting)	1	2	3	4	5	6	7	8	9	10	(interesting)
(negative impression)	1	2	3	4	5	6	7	8	9	10	(positive impression)

PURCHASE INTENTIONS

I would like to buy this product

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)

I would like to give it away as a gift

(do not agree)	1	2	3	4	5	6	7	8	9	10	(completely agree)