Priming cues in online product displays

Exploring the effect of visual depiction on online purchase intention

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Contents

1. Abstract

This research investigates the difference in effect between a congruent and an incongruent condition of product depiction and hand usage during internet shopping. This research investigates the difference in effect on three variables: attitude towards the product, mental simulation of using the product and purchase intention. This research uses a 2x2x2 mixed subjects design, with visual depiction and hand usage as between subject factors and product type as within factor. A survey sample of 115 participants were exposed to two product images that were either depicted congruent or incongruent to the hand usage during the experiment. All participants were exposed to one commonly online sold product and one commonly offline sold product. The depiction and congruency remained the same throughout the experiment. The results show that a congruent condition of hand usage and depiction has a significantly higher positive effect on mental simulation, as opposed to an incongruent condition. The same effect occurred for purchase intention; however, this effect was only marginally significant. Further results highlight a significant difference between the two product types - pen/book and ice-cream/computer mouse. However, this could be explained by the limitations regarding the price difference between the products and the image used to represent a match or mismatch. These findings have managerial implications in the form of web improvement to increase online product experience.

2. Introduction

In our traditional multisensory environment we are used to taste, smell, feel or hear the products before we purchase them. Over the past decade however a transition has occurred. We as consumers are purchasing ever more online. In the Netherlands, CBS (2013) has seen an increase in online purchasers from 5.9 million in 2005, to 9.8 million in 2012. In the online environment it is impossible to use all the human senses and therefore a lack of tactile interaction exists. From that point of view it is important to know how to display products online in order to increase purchase intention.

Fiore et al.(2005) mentioned that “a website may offer a wide range of benefits to customers and marketers including facilitated communications, customization of presented information, image manipulation, and entertainment" in order to enlarge the product experience.

The congruent factor between these benefits is interactivity, which insinuates that an increased interactivity results in an augmented product experience and a higher purchase intention.

The reason a higher amount of interactivity has an increased effect on purchase intention is described in the theory of grounded cognition (Barsalou 2010). This theory explains that "the environment, situations, the body (actions) and mental simulations in the brains modal systems, ground the central representation of a situation in cognition" (Barsalou, 2010 pp.716).

This theory is supported by the study of Elders and Krishna (2012) who examined the effect of blocking participants preferred hand, in combination with the visual depiction of the product (either on the preferred or non-preferred hand side). The experiment showed that displaying a piece of pie with a cake-fork situated on the side of the preferred hand, leads to a higher intention to eat the pie as compared to the cake-fork situated at the side of the non-preferred hand. However, when the preferred hand was occupied, the cake-fork situated at the side of the non-preferred hand, leads to a higher eating intention compared to the cake-fork situated at the preferred hand-side. In other words, the perception of where the fork is situated should be in line with the available hand to trigger the motor response program. This is in line with the explanation of Chartrand and Bargh (1999) who state that, due to mimicry "perception automatically activates the motor programs itself".

The experiment of Tucker and Ellis (1998) for example, showed that when participants had to judge whether a graspable object was in an upright or inverted position, the response time of participants was significantly quicker when the handle of the object was in line with the corresponding hand. Thus, if you are right handed it is easier to imagine yourself grabbing the cake fork when the cake fork is situated at the right hand side than when it is situated at the left hand side. The human brain simply finds it easier to mentally simulate a certain response when the presented situation is in line with previous experiences. Simply stated, when you are used to grasp an object with your right hand, your brain has to adjust when the handle is presented to your left hand which results in a reduced motor response.

However, as mentioned, the grounded theory as discussed by Barsalou (2010) also embeds our actions and behavioral state as influencers on behavioral intention.

Elders and Krishna (2012, pp. 999) state that their findings are directly applicable to online shopping. This research questions this conclusion by discussing the '(inter) action' variable discussed by Barsalou (2010, pp.716) who stated "the brain is utilizing the actions the body performs as external informational structure to support and complement internal representations". For every action that the body will undertake, the brain is preparing itself to undertake this action. The action itself is an interaction between the brain and the body in which the brain is registering the action of the body and uses this information to provide the brain with feedback. In this way the brain is able to complement the perception and mental simulation of the predicted outcome. When the body is conducting a task, the brain receives this feedback and is therefore able to simulate the course of the action and to prepare the next appropriate response. This (inter) action ultimately stimulates the responsiveness of the participant.

Niedenthal et al.(2005) have shown that manipulating the bodily state affects higher cognitive processes. Meaning, when the body is able to perform the action it always takes in a recognizable situation, the cognitive process goes fluidly. In other words, the brain processes the actions automatically because it recognizes the situation and is able to easily predict the outcomes and therefore the following steps. This indicates that when the bodily actions that a participant would normally perform are blocked, our mental simulation processes less fluidly, which results in a higher cognitive process instead of automatic information processing. We are forced to use higher rational decision making, instead of impulsive behavior.

Elders and Krishna propose in their study that "by occupying the perceptual resources used in motor response (in this case the hand), the ability to mentally simulate a motor response will be reduced".

The reasoning of this current study is that website users use the computer mouse to navigate the website and therefore have their hand blocked. We assume that people use their preferred hand to navigate, which would imply that the product depiction should be oriented to the non-preferred hand (since the preferred hand is blocked by the mouse). Although this sounds plausible, the 'action' variable mentioned in the grounded cognition theory makes this study question whether there could be an alternative outcome.

For the key study of Elders & Krishna, on which this research is based, participants were holding a clamp in one hand "to ensure that participants would be actively engaged in a motor response" while viewing the image on a computer screen. As mentioned earlier, the action variable of the grounded cognition theory allows the brain to receive external information. In the case of Elders & Krishna, holding the clamp should increase the simulation of holding the object displayed on the screen. An important note, and the difference between this research and the research of Elders & Krishna, is that their study did not involve any action with the computer mouse and was therefore, according to this research, rather simulating an off-line instead of an online situation.

This research ultimately questions whether the feeling of holding the mouse and using the mouse to navigate on the website (hoover over the images), transforms the mouse into a digital, on screen extension of the users own arm /hand. This research proposes that actively navigating on the website actually increases the cognitive process simply because the 'mouse arrow' on the screen is responding according to the participants' actions and provide direct feedback about these actions. We assume that when the products depiction is congruent to the navigating hand, the process fluency increases and motor response accordingly. Meaning persons will prefer product displays oriented towards the hand that they are navigating with.

Since this research is trying to discover whether the statement of Elders and Krishna is correct (outcomes are directly applicable to online shopping), this research will use its research questions as a starting point. Resulting in the following research question:

RQ: Does the orientation of an online product display have a significant effect on purchase intention when the computer mouse occupies the preferred hand during browsing?

3. Theory

3.1 Grounded cognition

The last thirty years extensive research has been conducted regarding cognitive activity, which ultimately resulted in the grounded cognition theory (Barsalou, 2008). This theory states that cognitive processes are stimulated by multiple factors and the different ideas/interpretations are simultaneously active and are triggering other ideas.

In other words, our cognition is not processing one idea/perception at the time, but multiple simultaneously. As Barsalou (2009, pp1281) describes: “During visual processing of a bicycle, neurons fire for edges and surfaces, whereas others fire for color and motion. Analogous patterns of activation in other sensory modalities represent how the bicycle might sound and feel”. These cognitive processes are according to Barsalou (2008) triggered by three key factors: bodily state, simulation and situated action.

To clarify these underlying factors we will use the simple example of smoke and fire. If you smell smoke, you will automatically think of fire. When you think of fire your body will either respond with anxiety, alertness or perhaps even excitement. After your body has reached this state you will look for its source and once you find it you either try to put it out or stay at a safe distance. This is where cognition starts to become more interesting. The mind registered smoke and automatically connected this to fire. It estimated the potential threat (small vs. large) and it created a context for future input of events that are likely to occur (encounter a small vs. large fire). Or as Barsalou (2009, pp1285) explains, “As people perceive visual objects, situated conceptualizations produce predictions about actions likely to be effective while interacting with them”. In other words, the body informed the brain about the event and the brain prepared the body for future events. This very simple example easily explains the three factors that underlay cognition and how they are triggering multiple ideas simultaneously.

The response to the fire depends, of course, on the interpretation of the size of the fire (large or small fire). In return, the interpretation of the size of the fire depends on previous experience. A fire marshal will experience a 10 meter high fire differently than a car sales man, simply because he has experienced more fires in his life and can more easily simulate what the threat might be and act accordingly.

Two of the factors that Barsalou identified have to do with the body instead of cognition. Researcher Niedenthal (2007) emphasized that cognition is physical; we think with our body, not with our brain. Starck et al (1988) already found some evidence to suggest this statement by conducting an experiment in which participants were asked to judge the level of humor of cartoons while they had to hold a pencil between their lips. The participants with a pencil between their lips were judging the cartoons as funnier than the control group.

In another experiment conducted by Dimberg et al (2002), participants were asked to create a frown on their face. The results showed that participants with a frown on their face had a stronger emotional response to images of starving children and victims of severe accidents.

In an earlier famous study, conducted by Wells and Petty (1980) participants were told that they were testing brand new headsets. They were asked to listen to radio messages and either nod or shake their heads when a disturbance would occur. Again, participants that were nodding their head, in general agreed more with the message compared to the participants that had to shake their head.

The experiments described above show perfectly the theory of grounded cognition and the way our body and brain cooperate and interact. This key element is one of the areas that this study investigated and disagrees with the outcome of Elders & Krishna. In order for a customer to look at the items sold online, an action needs to be undertaken. The customer needs to navigate through the website by utilizing one of the hands to control the mouse or hold the phone or iPad. When a person is browsing the internet by using a computer mouse, the computer mouse becomes an online extension of the bodily resources. The movement of the arm is followed by an on-screen movement of the mouse cursor. The brain is expecting feedback regarding the arm movement and when this feedback is in line with the expectation or predicted outcome the cognitive process is more fluent. However, in order to create these expectations and predict an outcome, the brain is utilizing its stored memory and utilizes previous experiences to create them.

In the previous described experiment of Wells and Petty (1980) participants automatically made the connection between approval and rejection with the corresponding physical expression (nodding/shaking). The bodily action (nodding/shaking) is affecting the mental perception. In literature, this occurrence is related to the associative brain in which we unconsciously relate our perception of reality to earlier experiences stored in our brain. We nod if we agree and shake our head when we disagree.

3.2 Associative memory

Elders and Krishna (2012, pp.989) describe how the theory of grounded cognition posits "our initial perceptions of objects are stored in memory and are simulated and or played back on subsequent encounters with not only the object itself but also representations of that object, such as verbal and visual depiction".

In 1977, Nisbett and Wilson (1977, pp.231) have questioned to what extent people are aware of, and able to report on, the true causes of their behavior. As Bargh and Morsella (2008, pp.74) state: "not very well". Bargh (1997, pp. 243) has even quantified that; "our psychological reactions from moment to moment are 99.44% automatic". As soon as we perceive our actions consciously we are already exhibiting the specific behavior. Our consciousness therefore only signals the actual behavior and direction of our actions without being fully responsible for or causing this action.

Kahneman (2011) builds on that and states that the associative memory is primarily responsible for human actions and behavior. Their research suggests that the way our brain works is based on two systems, in which system one is "responsible for automatic processes which generate impressions and tentative judgments" through the associative memory. It further explains that our perception of an object or experience is mainly judged by this associative brain which in return "might be accepted, blocked, or corrected by the controlled processes of system two".

The control system two is best known as our conscious and rational system. This part of the brain is, in contrast to the unconscious system one, consciously processing external and internal impulses that are registered by system one, and then provides a solution to an occurrence. When it is an easy task, system one automatically processes the action without system two having to interfere or consciously think about it. For example, the sum 2 + 2 does not require a lot of intensive calculation, and thus only system one is activated. Every adult has seen this sum so many times in life that it can be processed automatically, and most of us will have processed this sum instantly as soon as we turned the page, and our system one registered its presence. However, if the puzzle is more difficult and contains unfamiliar tasks to our brain, system two would be the one that is activated to solve the puzzle. For example, when someone who is not strong in mathematics is asked to multiply 23 by 45, then the brain activates system two to solve this.

This is also one of the key differences between system one and two. System one is the quick system or as Kahneman (2011) explained, the *"*what you see is all there is" system. It is making very quick judgments about a situation based on previous experiences.
Within a split second system one is trying to make sense out of a situation and tries to respond to the information that is presented, utilizing mainly the information that is directly available in stored memory, without looking at 'all' the presented information.

When a situation or question is similar to previous experiences, the brain goes on automatic pilot and lets system one act. Only in situations that are uncommon or require more attention does system two becomes actively involved. Or as Bargh and John state (2014, pp.1) "the automatic and controlled systems complement each other yet also, at times, conflict. You need to react without reflection to dodge an oncoming bus but also need to check yourself from throwing a punch at the reckless bus driver".

The reason behind the existence of system one and system two can be found in the time and effort judgments, and the according actions, would take if our brain were to be occupied with consciously thinking about every decision that has to be made. In essence our brain is hard-wired to survive. Michael et al. (2014, pp.7873) mention that "human judgments about complex natural scenes are resource-limited, and the brain has evolved to capitalize on autocorrelation in sensory signals to interpret the visual world, for example by adapting information processing to the context provided by the recent stimulation history".

The brain is automatically and unconsciously going through all the available information to come up with a comprehensive and logical story. Because time is key to survival, the human brain requires the first reasonable information that makes it possible to come up with a safe judgment.

In essence, the associative brain works according to the stored experiences. When humans start to walk they also learn the ability to stand up. When we are losing balance we adjust the position of our legs and feet. As a child you have to develop these skills but when you grow older, the process of shifting your legs and feet to stay in balance are an automated process. The human brain does not consciously think about how to keep balance during walking. The brain is wired to do this automatically by unconsciously activating the associative memory to judge the situation and send a message to the body to act accordingly.

This is of course a very simple illustration of the associative memory, but in essence describes the unconscious and automated process of this part of the brain. This human mechanism is also well established in behavioral phenomena in which judgments about a stimulus or occurrence that share conceptual or perceptual features with its precursor are made more rapidly and accurately (Posner & Snyder, 1975).

To summarize, if the brain is "primed" with a concept or perception it is more likely that a succeeding event will be judged similar to the preceded experience. In other words, when the brain perceives an action similar to a previous experienced action, it is more likely that it will prepare the body to respond in the same way as in the previous experience. Because the brain recognizes the situation, the process fluency is higher and the brain can respond on automatic pilot instead of making a more rational decision.

In the situation of internet shopping this higher processing fluency should ultimately result in a higher mental simulation of using the product, a more positive attitude towards the product and ultimately higher purchase intention. This research theorized that the cognitive process should be more fluent when utilizing the hand that is used most of the time for the most ordinary and daily actions, such as grabbing a coffee mug, grasping a spoon or using the computer mouse. This research assumes that people browse the internet with the preferred hand and therefore have more experience with browsing with this hand. This research, therefore, expects there to be a difference in effect on the dependent variables of mental simulation, attitude towards the product and purchase intention, when navigating a website with the preferred hand and non-preferred hand.

As such, this research proposes that:

H1a: Navigating the website with the preferred hand has a more positive effect on mental simulation then with the non-preferred hand.

Because this research wants to investigate whether or not there is a difference in affecting behavioral intention, this research further proposes that:

H1b: Navigating the website with the preferred hand will affect the attitude towards the product more positively then navigating with the non-preferred hand

H1c: Navigating the website with the preferred hand has a more positive effect on purchase intention then navigating with the non-preferred hand.

3.3 Associative memory and priming

The priming phenomenon described in the associate memory section is also described by Kahneman (2011) who discuss the effect of priming on "skirting" the controlled processes and creating a direct shortcut into the unconscious associative memory (what you see is all there is) which results in the desired behavior. The English dictionary explains skirting as, going around the edge of something. A priming cue goes around the controlled processes of the brain and triggers the associated memory to create an automated response without the respondents being consciously aware of their behavior.

Priming cues occur in different concepts and according to our sensory systems: visual, verbal, tactile and smell. This is in line with the grounded cognition theory that states that our actions, within an environment, prepare the brain to send a response to our body to act in the appropriate way. The following priming experiments are used to explain the phenomenon priming and how our brain prepares our body to respond. Since this research focuses on online priming cues we will discuss previous studies of the visual and tactile cues and explain how the brain unconsciously perceives these cues and the associative memory automatically responds.

3.3.1 Visual cues

The primary subject of this research is the way the products are displayed in a web shop. The images are used to provide information regarding the product and increase the shopping experience in order for customers to make a decision. Online vendors are always looking to optimize the decision making process of the customer. When it comes to decision-making, the brain operates to a large extent on automatic pilot when it encounters recognizable situations, and visual cues are a way to trigger this automated process and manage the desired behavior. As an illustration of visual cues we describe the experiment of Vohs (2006), where participants were mentally prepared for money.

The subjects were either exposed to a subtle stack of monopoly money in the background or to a screensaver that displayed floating money in a pond. Afterwards, several tasks had to be conducted. The participants in this study that were exposed to these images had a more independent attitude compared to the control group and were less willing to help fellow participants. When for example the researcher dropped a few pencils on the floor, the primed participants picked up fewer pencils than the control group. Similar outcome occurred when the participants were told that a fellow participant would join them soon and asked them to put two seats in the room. The primed participants arranged the chairs wider from each other than the control group (118cm vs. 80cm). These experiments show that simply visually registering money unconsciously triggers the associated brain (thoughts of power and individualism) which activates corresponding behavior.

The experiment of Bateson et al (2006) had a similar mental process when people were exposed to an image of either flowers or a pair of staring eyes. Employees of a school cafeteria were asked to voluntarily contribute for their tea and coffee consumption.

Above the collecting-box, researchers showed for a period of ten weeks a 150×35mm banner that alternated each week between an image of a pair of eyes and an image of flowers. The results were astonishing. For the weeks the eyes were shown, employees contributed almost three times as much than in the flower weeks.

Although this behavior happened unconsciously the researchers assume that the purely symbolic suggestion of observation (staring eyes) activates people to show socially acceptable behavior. Our vision is registering the eyes, system one recognizes these eyes and automatically sends a response to the body to act.

3.3.2. Tactile cues

The effect that tactile priming cues have on the associative memory is demonstrated by a priming experiment conducted by Williams and Bargh (2008). Their experiments showed that participants who briefly held a cup of hot (versus iced) coffee judged a target person as having a "warmer" personality (generous, caring).

In their second study they discovered that participants “holding a hot (versus cold) therapeutic pad were more likely to choose a gift for a friend instead of for themselves”. The priming cue “warmth” had a positive effect on the affective state and behavioral intention of participants.

Consequent research by Ackerman et al. (2010) show that haptic sensations in the form of touch, can affect social judgments and decisions. During their research several experiments were conducted. One of them is a test with clipboards. Participants were asked to hold a clipboard and judge the resume of the subject in question by rating their level of competence. The clipboards however differed in weight and the participants holding the heavier clipboard, significantly judged the subject as higher competent and more interested in the job compared to participants that were holding the lighter weight clipboards.

The outcomes of this study confirm once more that our associative memory easily creates a conclusion based on previous perceptions and experiences that are stored in memory and impacts human bodily state and decision-making.

3.4 Priming and Motor response

As shown by the previous experiment and studies, we primarily use our associative brain that unconsciously affects our state of mind. However, unconsciously perceiving cues is one; taking actions accordingly is second. Later research by Bargh et al (1996) has shown that priming cues can have a direct effect on human behavior as well.

Their research showed those participants primed with elderly stereotypes were walking more slowly down the corridor after the experiment, compared to control participants. Furthermore, the research showed that activation of the elderly stereotype in the associative brain leads to slower walking, and walking slowly activates the elderly stereotype.

Over the past century many theorists have posed that our consciousness is not the sole source or initiator of our behavior (Gazzinga, 1989: Libet 1986; Wegner, 2002). Just as earlier referred Kahnemann (2011), they also theorize that the impulses to perform certain behavior are activated unconsciously and the conscious system is purely meant to act as controller and sense maker.

However, a well-known phrase of Norretranders (1998, p221) states, “it is not our unconscious that initiates, for only the conscious is conscious”. In other words, our unconscious thoughts are affecting our state of mind, but our body is taking actions and performs certain behavior. This phrase implies that we have or at least always should have control over our actual behavior.

This phrase is to a certain extent applicable to the purchase of a product. We are unconsciously triggered by verbal and visual cues that increase our purchase intention. “Free range eggs” for example can prime us unconsciously with the thought of chickens living in green fields enjoying complete freedom and the color red calls for immediate action. It is however our conscious decision to actually buy the particular product. The challenge for vendors therefore is to find cues that increase the purchase intention and ultimately lead to actual purchase behavior.

Following the previously discussed studies, researchers found out that by unconsciously preparing the motor response system to react, participants were able to respond faster.

D’Ostilio and Garraux (2012) show that sensory information that has not been consciously perceived can nevertheless influence behavior. Their experiment found that priming cues unconsciously prepared the motor response system that made participants respond quicker to threatening situations compared to the control group that was not exposed to these cues. This outcome is built on Tucker and Ellis (1998) who showed that participants were quicker to judge the orientation of an object (upright or inverted) if the grip of an object and the responding hand were in alignment.

These studies show that our brain more easily recognizes situation and shows behavior accordingly, when it has experienced these situations before. It is easier to visualize an object in your hand when that object is in alignment with the hand that you always use to grasp an object.

Our unconsciousness evolved as a guidance system for our actual behavior in order to adapt and respond in an appropriate manner in reoccurring situations. This implies that the unconscious preferences stored in our associative brain are directly connected to our behavioral mechanism or motor response (Bargh and Morsella, 2008).

Jeannerod (2001) explains that what we perceive with our vision is utilized to prepare our motor response. We are using our knowledge of previous experiences and interactions with stimuli to simulate our present encounter with similar stimuli. As Elders and Krishna (2012, pp.989) state, "if the visual depiction affords interaction, our mind gets ready for that action through simulation of our prior experience".

This is where this research is criticizing the statement of Elders and Krishna that their outcomes are directly applicable for online shopping. Since navigating a website requires an action of the participant, the actual motion is already in place. This research theorizes that the mental simulation and therefore motor response is already activated because the cognition expects a feedback from the actual action. The unconscious behavior (navigating on the website) is receiving direct feedback (seeing the mouse hoover over the screen).

In order to investigate whether this research questioning the findings of Elders and Krishna is valid, this study replicated one of their key studies. Their third hypothesis is, "impeding mental simulation by occupying perceptual resources will attenuate the visual depiction effect on behavioral intention" (2012, pp.991). This research predicted the opposite. It investigates whether there is a different effect on mental simulation, ultimate purchase intention and attitude towards the product, between a match/mismatch with the navigating hand. It therefore proposes:

H2a: A congruent visual depiction with the navigating hand (perceptual resources) has a more positive effect on mental simulation than a non-congruent visual depiction.

H2b: A congruent visual depiction with the navigating hand (perceptual resources) has a more positive effect on purchase intention than a non-congruent visual depiction.

H2c: A congruent visual depiction with the navigating hand (perceptual resources) will affect the attitude towards the product more positively than a non-congruent visual depiction.

3.5 Motor response and online control

To stay in line with Elders and Krishna's example of the coffee mug (2012, pp. 990), if the handle is on the right side, your mind is simulating grasping the mug with the right hand.

Their groundbreaking outcomes showed that once, in this case, the right hand is occupied and therefore not able to grab or hold another object, the handle of the mug should be oriented to the left hand. This outcome is fascinating and deserves respect since its findings opens doors to a better understanding of the influences on consumer behavior. It helps increase online shopping experiences and the chance of increasing conversion ratios for online vendors.

The biggest differences however between off- and online vendors is the spatial and temporal separation between buyer and seller (Fang, 2012) and the fact that online vendors are offering their products through a mediated communication system such as an PC, Ipad or Mobile phone (Li et al. , 2001).

Similar to Fang (2012), Pavlou et al. (2007) note, "in the online marketplaces, the spatial and temporal separation of online seller and customers aggravates information asymmetry (hidden actions and hidden information), fear of opportunism, and uncertainty". Pavlou et al. further address the main concern of distorted information online customer's experience regarding the online product. According to research by Li et al.(2001), an increased amount of interactivity enhances the product experience and purchase intention because of an increased sense of control.

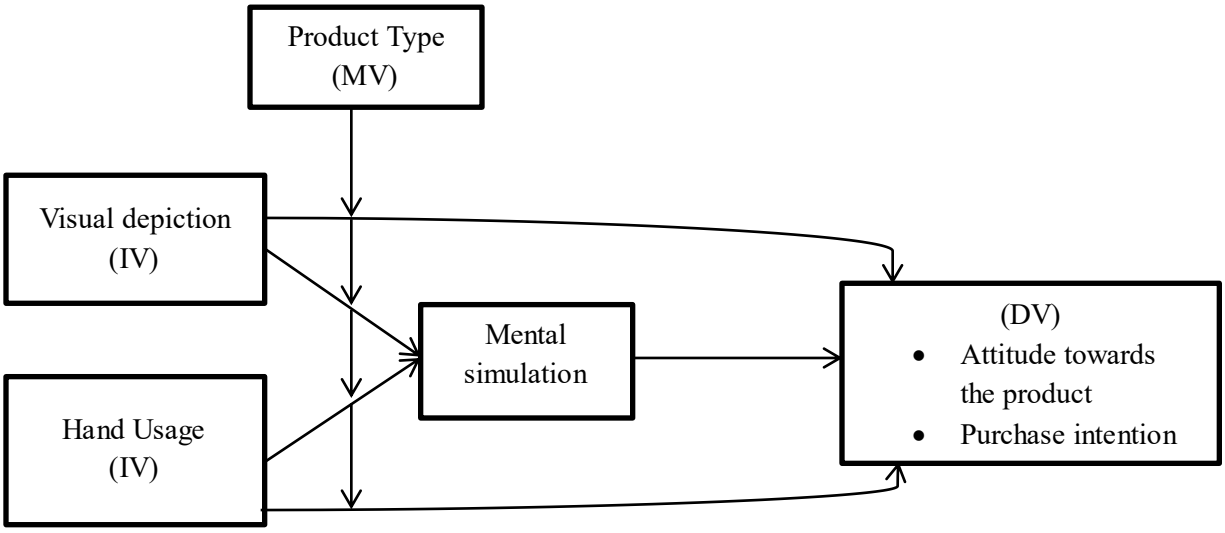
Research has shown an increase in online purchasers of 39,8% in the period of 2005 to 2013(CBS, 2013). Since this study wants to investigate to what extent the outcomes of this study are generalizable, this research examined four different products within two different product types. This research made a distinction between products which are mainly purchased in an off-line setting, such as FMCG goods (ice-cream) or office equipment (pen), and items which are widely sold on the internet, such as electronics, books and sporting equipment (CBS,2013).

The experiment is conducted in an online shopping setting. Participants were seated behind a computer and had to review the different product types. The setting of the experiment is in line with regular shopping behavior of online products but different for offline products. Literature has shown that experience increases the cognitive processing fluency and statistics of CBS (2013) have shown that FMCG goods and office equipment are less frequently sold online.

This research therefore predicted that the effect of the independent variables on the dependent variables would be higher for online products then offline products. Our third hypothesis therefore is:

H3: The effect the independent variables have on de dependent variables, attitude towards the product, purchase intention and mental simulation is significantly higher in the online product condition than the offline product condition.

Fig.1 Conceptual Framework



4. Research methods and design

4.1 Experiment and Participants

The experimental group consisted of 115 participants of which 63 work for an e-commerce company in London and 52 are a convenient sample addressed through Facebook and email. 85% of the respondents is aged between 20 and 50 years. In terms of origins 41.7% is Dutch, 52.2% is originated from other European countries and 6.1% from outside Europe. Of these participants 50 were male and 65 female. 97.6% of the participants were aged between 21-60 years of which 74% of them were aged between 21 – 40 years. (M= 27, SD= 3.40).

90.6% Preferred the right hand to browse with and since participants were randomly assigned to either the left hand or right hand usage condition during the experiment, only 73% of the participants actually used the right hand during the experiment.

The experimental conditions differed regarding the visual depiction, hand usage and product type leading to a 2 (visual depiction: congruent vs. incongruent) * 2 (hand usage: preferred vs. non-preferred) *2 (product type offline vs. online) mixed factorial design in which visual depiction and hand usage are between subject factors and product type a within factor. Hand usage and depiction remained constant throughout the experiment and the individual products were randomly chosen.

4.2 Stimulus materials and procedures

4.2.1. Stimulus materials

The experiment is conducted to measure what effect holding a computer mouse and using it to navigate on the screen has on the unconscious product orientation preferences of the users. Therefore, participants completed the experiment sitting behind a computer and were presented a set of 4 pictures. Two images of commonly online sold products (book and computer mouse) and two images of uncommonly online sold product (ice-cream and pens).

We created the two versions of the products (left or right side orientated) by flipping the image over a vertical axis by using the software tool Photoshop. In order to simulate an actual web shop experience this research embedded the product images in the Amazon web shop environment. Figures two to five show the images created for, respectively, ice-cream and the computer mouse. The remaining stimulus materials can be found in appendix 2.

Fig.2 Ice-cream left hand orientation

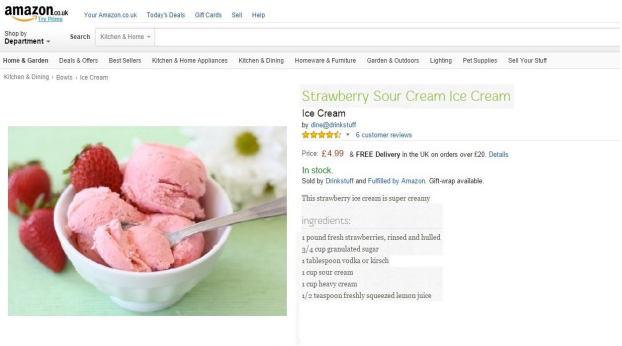


Fig.3 Ice-cream right hand orientation

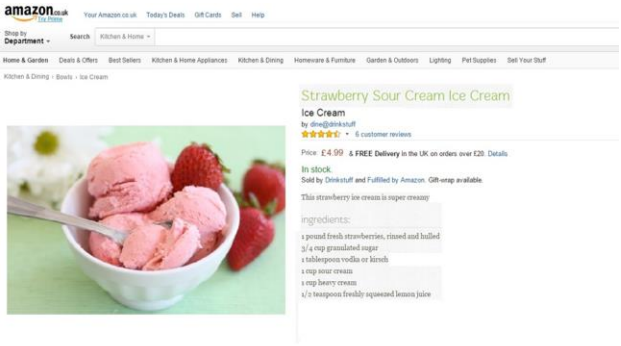


Fig.4 Computer mouse left hand orientation

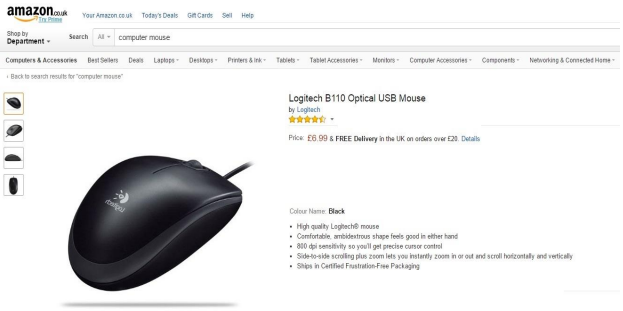
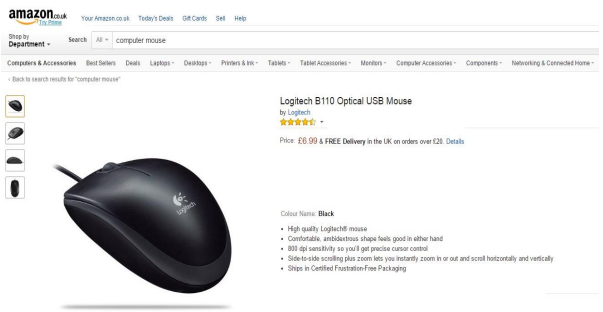


Fig.5 Computer mouse right hand orientation



4.2.2. Procedures

Each participant was provided with an URL that contained the stimulus materials (product images) and a questionnaire constructed with the online questionnaire software Qualtrics. The participants were randomly assigned to two of the eight stimulus conditions. The first image participants were exposed to was an off-line image, which was either an ice-cream or pen image. The second image that was shown was an on-line product image, which was either a computer mouse or book image.

Participants were randomly assigned to one of the hand usage conditions (left vs. right hand), and randomly assigned to the product orientation condition (congruent vs. incongruent). In order to control if participants used the hand they were assigned to, participants were, at the end of the experiment, asked to provide information regarding the hand usage during the experiment. The orientation of the second product was identical to the orientation of the first image that participants were exposed to. If the first image was congruent with the hand usage, the second image was congruent with the hand usage as well. The same goes for the incongruent condition. Participants were randomly assigned to the second image. Participants that, for example, started with the ice-cream image were randomly assigned to the second image. The software automatically guided them through the research tasks. In this way participants were able to complete the questionnaire completely autonomous.

After greeting participants and explaining the research's set-up, participants were asked to use either their right or left hand to complete the questionnaire. The questionnaire started easily with a question regarding the amount of online purchases in the past 12 years.

In this way right-handed participants that were assigned to the left-hand navigation condition had the opportunity to get slightly adjusted to this condition and vice versa. A note here is that the share of left hand participants was so low (<10%) that this study decided to exclude this data for the analysis and outcomes. Meaning, the results are based on participants that have a right hand preference. Tables 1 and 2 show how the participants were divided over the experimental conditions.

Table 1 Hand usage during experiment

	N
Right hand	84
Left hand	31
Total	115

Table 2 Congruent vs Incongruent conditions

	N
Preferred hand congruent	43
Preferred hand incongruent	41
Non-preferred hand congruent	22
Non-preferred hand incongruent	9
	115

Within this experiment participants were seated behind a computer and exposed to two of the eight on screen product displays. The images were shown one at a time and after every image participant had to answer questions regarding that image.

73% of the participants used their preferred hand. Furthermore, 56% of the participants of the 'hand usage' conditions were in the had an actual match with the visual depiction (congruent condition). The other 44% had an incongruent condition. Participants were allowed to use the mouse to navigate/hoover over the image without any time limitations. Further, participants clicked on the arrow next to the picture in order to go to the next screen.
On this next screen participants had to answer several questions regarding mental simulation, attitude towards the product and ultimately purchase intention.

Mental simulation

In order to measure to what extent participants were able to mentally simulate using the displayed products this research used the scale of Elders & Krishna (2012, pp.998, α=.88). The scale showed the same reliability during the present study (α=.88) and consists of the following items:

"As you viewed the product, to what extent did images of using the product came to mind?" (1 = not at all; 7 = to a great extent); "while viewing the ad I experienced": (1= few or no images of using the product; 7 = a lot of images using the product); "To what extent while viewing the image could you imagine using the product?" (1= not at all; 7 = to a great extent).

Attitude toward the product

This research also wanted to investigate whether the different conditions of the independent variables had a direct effect on the affective state. In order to measure to what extent, this research used the scale of Mitchell and Olson (1981, α=.93) to evaluate the attitude towards the product. Also this scale showed the same reliability during the present study (α=.93) and consists of the following items:

"This product makes me feel": (1= bad; 7 = good): "I really (1= dislike; 7 = like) this product": " I find this product": (1 = unpleasant; 7 = pleasant).

Purchase intention

This research further investigated the effect the different conditions had on purchase intention. In order to do so this research used the following 7-point Likert scale question:

"How likely would you be to purchase this product?" (1 = not at all likely; 7 = very likely)

Following the explanation of the variables this experiment will test, and the stimulus materials that will be included, this research uses a 2x2x2 mixed subjects design, with visual depiction and hand usage as between subject factors and product type as within factor.

All participants will rate two of the eight images: one off-line product and one online product. Participants are randomly assigned to these images.

Table 3. Experimental Design

	Offline product		**Online product**	
	Congruent	Incongruent	Congruent	Incongruent
Right hand blocked	43	41	43	41
Left hand blocked	22	9	22	9

5. Results

To access differences in scores between the experimental groups a 2*2*2 univariate analysis of variance (ANOVA) was conducted, in which hand usage and product depiction were addressed as independent variables and attitude as dependent variable and product type (online/offline) as moderator. Mean scores and standard deviations are shown in Table 4. Table 5 provides an overview of the ANOVA outcomes of all the dependents variables this research have tested.

Table 4. Average rating of Attitude as function of handusage, depiction and product type

Hand usage*Depicition*Product type										
	Offline product				Online product					
	Congruent (depiction)		Incongruent		Congruent		Incongruent		Total	
	M	*S*	*M*	*S*	*M*	*S*	*M*	*S*	*M*	*S*
Right hand blocked	4.45	1.29	4.52	1.42	4.34	1.37	4.67	1.21	4,49	1,32
Left hand blocked	4.68	1.25	4.44	1.34	4.55	1.13	4.00	1.05	4,50	1,29
Total	4.53	1.28	4.51	1.41	4.41	1.29	4.55	1,18	4,49	1,31

Table 5. ANOVA results for the dependent variables

	Mental Simulation	Attitude	Purchase Intention
	F (p)	**F** (p)	**F** (p)
Hand blocked	1.44 (0.23)	0.20 (0.65)	1.28 (0.26)
Product depiction	0.94 (0.34)	1.90 (0.17)	0.83 (0.36)
Product type	**3.88 (0.01)**	1.60 (0.19)	**13.27 (<0.01)**
Hand blocked*Product depiction	**6.04 (0.02)**	0.08 (0.78)	1.09 (0.30)
Hand blocked*Product type	1.15 (0.33)	0.32 (0.81)	0.80 (0.50)
Product depiction*Product type	1.14 (0.33)	**2.17 (0.09)**	**2.65 (0.05)**
Hand blocked*Product depiction* Product Type	1.02 (0.39)	0.34 (0.80)	0.20 (0.90)

5.1 Effect on attitude

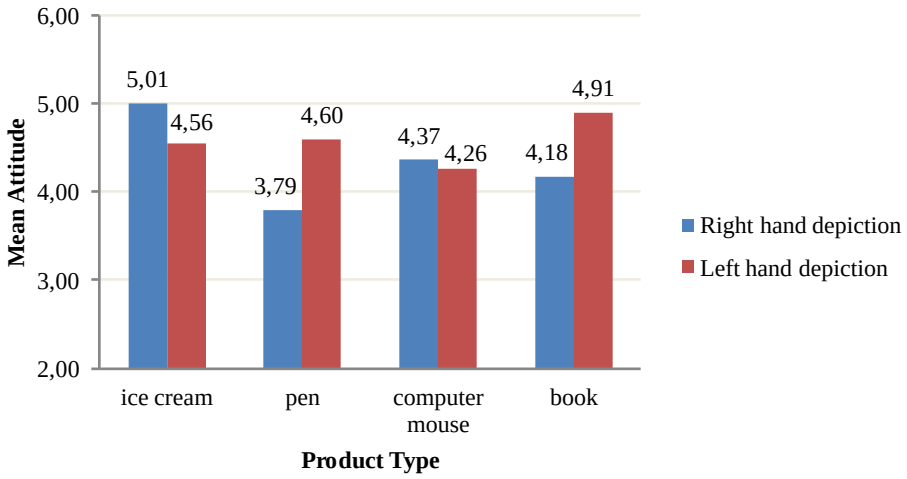
A factorial between groups analysis of variance (anova) was conducted to compare the average attitude score of the different groups, with hand usage and depiction as independent variables, and attitude as the dependent variable. The product type was used as a moderator.

Neither the main effect of depiction ($F(1,229)=1.9$, $p=0.17$. *ns*) nor the main effect of hand usage ($F(1,229)=0.2$, $p=0.65$. *ns*) were significant.

There was no significant interaction between depiction and hand usage (F(1,229)=0.08, p=0.78.*ns*) This research did not discover a significant interaction between depiction and offline vs online product types (F(1,229)=0.48, p=0.49*ns*) but did discover a marginally significant interaction between depiction and the individual product types ($F(1,229)=2.17$, $p=0.09$).

This indicates that for the products pen and book an image with a left hand depiction has a greater effect on attitude than a right hand depiction. The opposite applies to the products computer mouse and ice cream. For these products the effect on attitude seems higher when the image has a right hand depiction. Means are shown in figure 7.

Fig.7 Mean attitude by product type

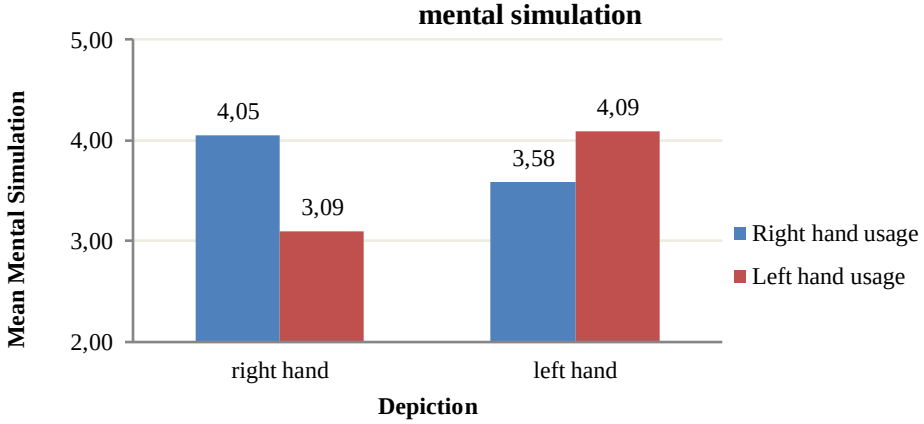


5.2 Effect on mental simulation

A factorial between groups analysis of variance (anova) was conducted to compare the average mental simulation score of the different groups, with hand usage and depiction as independent variables and mental simulation as the dependent variable. The product type, both offline vs online as the different product types, were used as a moderator. Neither the main effect of depiction ($F(1,229)=0.94$, $p=0.34$. *ns*) nor the main effect of hand usage ($F(1,229)=1.44$, $p=0.23$. *ns*) were significant.

There does exist an interaction between hand usage and depiction ($F(1,229)=7.53$, $p=0.007$) for the offline vs. online products as shown in figure 8. This also exist for the seperate product types ($F(1,229)=6.04$, $p=0.02$).

Fig. 8 Interaction effect between depiction and hand usage on mental simulation

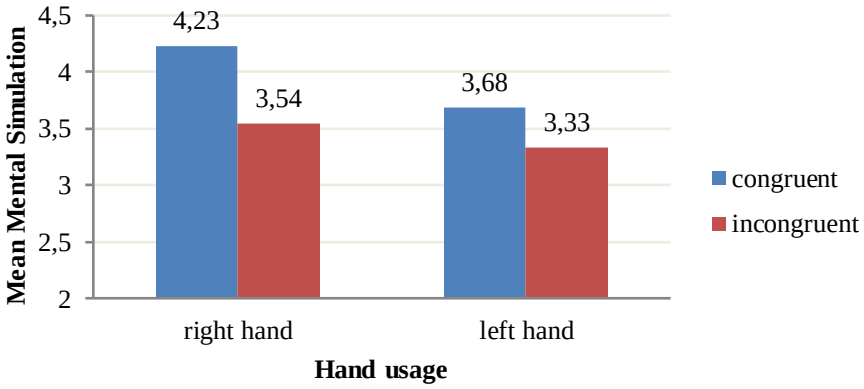


Since this research excluded participants with a left hand preference this outcome indicates that the depiction effect was greater in the congruent condition than the incongruent condition.

In order to further investigate the interaction effect this research recoded the variables in order to create a congruent or incongruent variable. A factorial between groups analysis of variances (anova) was conducted to compare the average mental simulation score of the different groups with congruent/incongruent and hand usage as independent variables and mental simulation as dependent variable and product type as moderator. Shapiro-Wilk and Levene's tests were used to evaluate the assumptions of normality and homogeneity of variance respectively. Neither was violated.

The results in fig. 10 show a main effect of congruent/incongruent depiction on mental simulation ($F(1,229)=3.92$, $p=0.049$). According to the independent sample T-test participants in the congruent condition experienced significantly higher mental simulation (M=4.01, SD=1.65) compared to participants in the incongruent condition (M=3.56, SD=1.74); t(229)= 2.00, p=0,046.

Fig.10 Mental simulation by hand usage

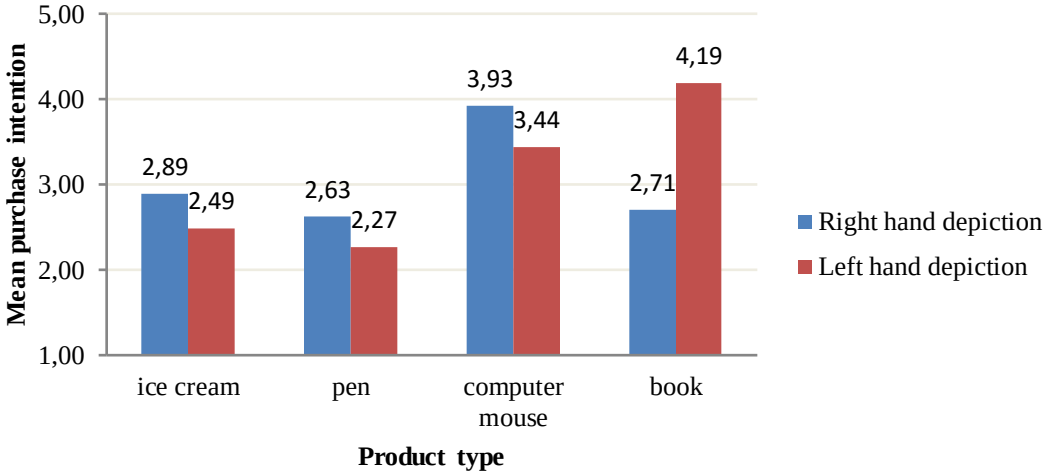


5.3 Effect on purchase intention

A factorial between groups analysis of variance (anova) was conducted to compare the average purchase intention score of the different groups, with hand preferences and depiction as independent variables and purchase intention as the dependent variable. The product type, both offline vs. online as the individual product types, were used as a moderator. Neither the main effect of depiction ($F(1,229)=0.83$, $p=0.36$. *ns*) nor the main effect of hand preference ($F(1,229)=1.28$, $p=0.26$. *ns*) was significant.

There does exist an interaction effect between depiction and the individual product types ($F(1,229)=2.65$, $p=0.05$). Fig.11 shows that there exist a significant difference in purchase intention for the product book between right and left hand depiction. This research did not discover any interaction between offline vs online product types and depiction ($F(1,229)=0.90$, $p=0.34$. *ns*).

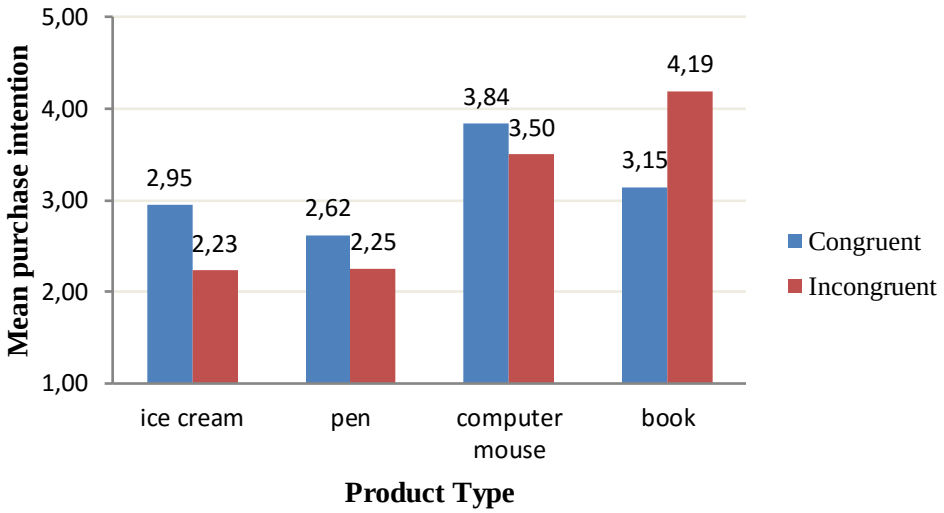
Fig. 11 Interaction effect between depiction and product type



In order to further investigate the interaction effect this research used the same recoded variables that lead to the congruent and incongruent condition for the mental simulation analysis. A factorial between groups analysis of variances (anova) was conducted to compare the average purchase intention score of the different groups with congruent/incongruent and hand usage as independent variables and purchase intention as dependent variable and product type as moderator. Shapiro-Wilk and Levene's tests were used to evaluate the assumptions of normality and homogeneity of variance respectively. Neither was violated.

As shown in fig.12, the congruent condition leads to higher purchase intention for all product types except the book. This main effect however is only marginally significant ($F(1,229)=3.49$, $p=0.063$).

Fig. 12 Purchase intention by product type



6. Discussion

The aim of this study is to argue the statement of Elder and Krishna (2012) that the outcomes of their study are directly applicable for online vendors. Their study has shown that a visual depiction of one's dominant hand has a direct effect on mental simulation and purchase intention, in which participants with a product depiction towards the dominant hand showed significant higher amounts of mental simulation and purchase intention. The research further showed in the case the dominant hand is blocked/occupied, the product depiction to the available hand showed a significant higher amount of mental simulation and purchase intention.

In contrast with the experiment of Elders and Krishna, this research conducted the experiment in an online environment in which the respondents were placed behind a computer and were asked to answer questions regarding the images that were shown to them on the computer. In this study two images for every condition were used; congruent depiction off-line products, incongruent depiction off-line products, congruent depiction online products and incongruent depiction online products. Participants were randomly assigned to a congruent (match) or incongruent (mismatch) condition and were then randomly assigned to two of the corresponding product images.

They started with one offline product image followed by one online product image. The depiction condition (congruent/incongruent) stayed the same throughout the experiment.

The images were shown one at the time and after every image the participant had to answer questions regarding the amount of images using the product came to mind, attitude towards the product and purchase intention. The experimental group consisted of 115 participants of which 63 work for an e-commerce company in London and 52 are a convenient sample addressed through Facebook and email. 85% Of the respondents is aged between 20 and 50 years. In terms of origins 44.1% is Dutch, 50.4% is originated from other European countries and 5% from outside Europe. The results are therefore generalizable for European people aged between 20 and 50 years old.

Tucker and Ellis (1998) showed that participants were quicker to judge the orientation of an object (upright or inverted) if the grip of an object and the responding hand were in alignment. Similar results were shown by Elders and Krishna (2012).

This research did not show any main effects of depiction on attitude, mental simulation or purchase intention, nor a main effect of hand usage on either of the dependent variables. This research did show a main effect of the congruent condition on mental simulation. Participants in the congruent condition group (a match between hand usage and image depiction) experienced significantly higher mental simulation compared to the incongruent condition group. This research therefore concludes that a congruent condition between hand usage and depiction has a significant higher effect on mental simulation than an incongruent condition. This research shows that researchers should be careful with generalizing the results of their study. As Elders and Krishna suggest displaying the product towards the non-occupied hand, the outcomes of this research suggest the opposite. A match between the navigating hand and product depiction increases the purchase intention significantly. This is because our brain more easily recognizes situations and shows behavior accordingly, when it has experienced these situations before. It is easier to visualize an object in your hand when that object is in alignment with the hand that you always use to grasp an object. While browsing a website the mouse is functioning as an offline tool to mimic the actual grasping and feeling of holding the online displayed product.

This research also showed that there exist an interaction effect between hand usage and depiction for the offline vs. online products as a function of mental simulation. This also exist

for the seperate product types. Since this study has investigated four non-related products from four different product categories (ice-cream, pen, book and computer mouse) we want to state that these outcomes are applicable to all products that have a graspable shape or require a graspable action by the consumer in order to utilize the product.

This research further showed that there exist a marginally significant interaction between product type and depiction regarding the attitude towards the product. This study showed that for the products book and pen, the attitude mean towards the product was high for a left hand depiction while a right hand depiction for the ice cream and computer mouse had a higher attitude mean. This could be explained by the following factors. The pen, at $230, was very expensive and most of the participants could have taken the questions regarding the pen less seriously. As shown in the appendix, the book was presented as a gift in which the incongruent condition (mismatch between the navigating hand and the product depiction) is actually matching the real life condition more than the actual congruent condition (match between hand usage and product depiction) as presented in this research. Right handed people hold a book with the right hand and browse the book with the left hand. looking at the images used for the book condition, this research noticed that the incongruent condition is actually a better representation of a book usage with the right hand compared to the congruent condition. These irregularities skew the results, which results in a marginally interaction between product type and depiction regarding the attitude towards the product.

Besides this interaction effect, another interaction effect occured. This research found there exist an interaction effect between depiction and product type. The purchase intention shows that there exists a significant difference in purchase intention for the product book between right and left hand depiction. Also with this interaction effect, this research follows the same reasoning as mentioned before, meaning that the congruent/incongruent condition of the book is less accurate in this research compared to real life.

Although the results are not conclusive due to irregularities in outcomes, the main outcomes do point in the following direction; a congruent condition has a more positive effect on mental simulation and purchase intention compared to a incongruent condition.

7. Managerial implication

The outcomes of this study are interesting for managers looking to improve the online shopping experience and increase the online conversion ratio of customers. This research has shown that to a great extent, a match condition between hand usage and depiction has a greater effect on mental simulation and purchase intention. It is therefore advisable to make sure that for graspable products, such as phones and computer accessories, the depiction of the product is towards the navigating hand.

Online vendors are able to use software tools and CMS systems such as Episerver to create different versions of the same website in order to reach out to customers with the appropriate depiction and address the customer more effectively. In order to do so, online vendors need data regarding the hand usage during browsing.

In order for online vendors to retrieve data regarding the navigating hand, hardware providers such as HP and Apple should enable users during the setup of the hardware to choose the hand usage during browsing.

8. Limitations and future research

The outcomes of this study need further testing in order to have a conclusive outcome. This research is limited in terms of participants and product types and the outcomes are therefore only generalizable to a small extent. This research has focused on graspable products and is therefore limited to these products only. Further research needs to be done to examine to which extent these outcomes are applicable and which product categories can further benefit from these outcomes.

This research has focused on graspable products but since online shopping is booming it would be interesting to see if these outcomes would be applicable to non graspable objects with a higher decision making level, such as furniture.

As Pavlou et al. addressed, the main concern in online shopping is the distorted information customer's experience regarding the online product. Within product types such as electronics, consumers want to know the difference in product features and compare the products according to these features. Further, looks are important and therefore images can be used to display all the angles of the products and even display the product in a real life setting in order for customers to imagine the product in their own real life. Within the furniture branch this distorted information mainly beholds the lack of tactile experience. Since buying a sofa or chair involves for most of the consumers, sitting on the furniture and testing the comfort of the seating, this type of distorted information is hard to address online. Since the furniture branch experience this difficulty it would be interesting to see if these alterations in product display are able to partially make up for the lack of a tactile experience.
In terms of experiment, this research was limited to an online experiment only and therefore had limited control over the deviation of participants. 73% of the participants used their right hand during the study although the Qualtrics tool should automatically assign an equal amount of participants to each condition. This study inserted a control question at the end of the experiment in which participants had to indicate the hand usage during the experiment. In this way the study was able to monitor if participants were using the hand they were assigned to. A next study should focus on creating a controlled setting in which it is possible to assigns participants equally to the conditions and control participants in working with the assigned hand.

A further limitation of this research is the maturation bias. All participants were assigned to two images and a corresponding set of questions. After the first image, participants were asked several questions about this image. The questions regarding the second image were exactly the same, meaning that participants could have unconsiously been preparing themselves for the questions to come while viewing the second image.

Altough the results are not showing any significant differences between online and offline product types, this research suggests we should only show one image to a participant or randozomize the order of the online and offline display in order to avoid this bias.

To summarize, the outcomes can be used as a starting point to test new hypothesis regarding different product types. This research can be used for scholars to investigate a broader variety of products.

Furthermore these outcomes can be used by online vendors in collaboration with hardware providers and software tools as VWO or Episerver to test new hypotheses regarding their online products in an actual e-commerce setting. Companies are able to gather data much quicker and the online tools are already in place to perform the appropriate A/B test. One of the limitations here could be that hardware providers need to be prepared to retrieve the data of hand usage in order for customers to be presented with the appropriate website.

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10. Appendix

10.1 Descriptive statistics and reliability per construct

Reliability Statistics Mental Simulation

Cronbach's Alpha	N of Items
.877	3

Reliability Statistics Attitude

Cronbach's Alpha	N of Items
.932	3

Which hand did you use during the experiment?

	Frequency	Percent
Right hand	168	73.0
Left hand	62	27.0
Total	230	100.0

What is your gender?

	Frequency	Percent
Male	100	43.5
Female	130	56.5
Total	230	100.0

Which country are you coming from?

	Frequency	Percent
Netherlands	96	41.7
Germany	2	0.9
Denmark	12	5.2
France	14	6.1
Belgium	4	1.7
Norway	2	0.9
Italy	18	7.8
Great Brittain	42	18.3
Sweden	8	3.5
Poland	6	2.6
Finland	6	2.6
Other European country	6	2.6
Other outside Europe	14	6.1
Total	230	100

10.2 Stimulus materials and survey questions

Fig 1. Book left hand orientation

Fig 2. Book right hand orientation

Fig.3 Ice Cream Left hand orientation

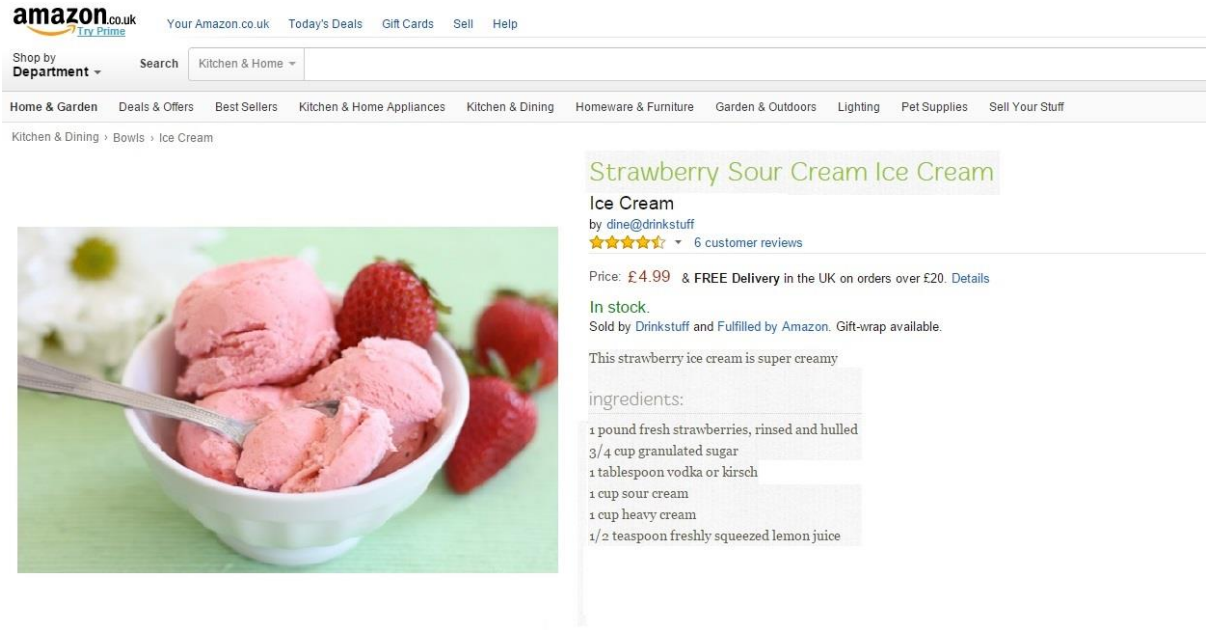


Fig 4. Ice Cream right hand orientation

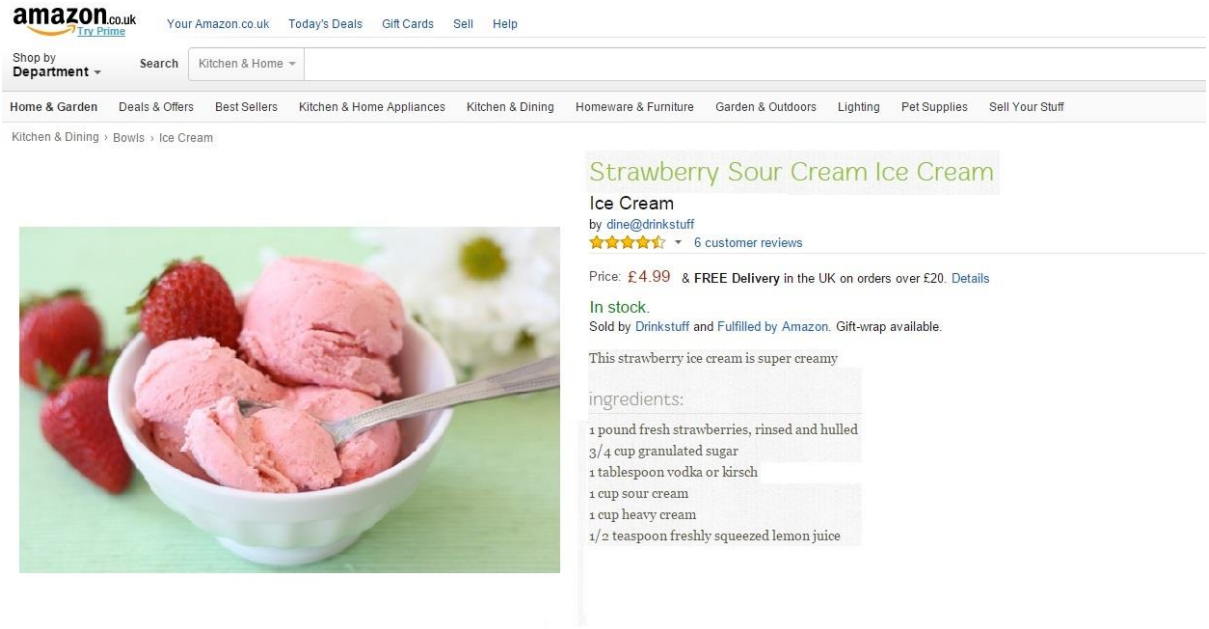


Fig 5. Pen left hand orientation

Fig 6. Pen right hand orientation

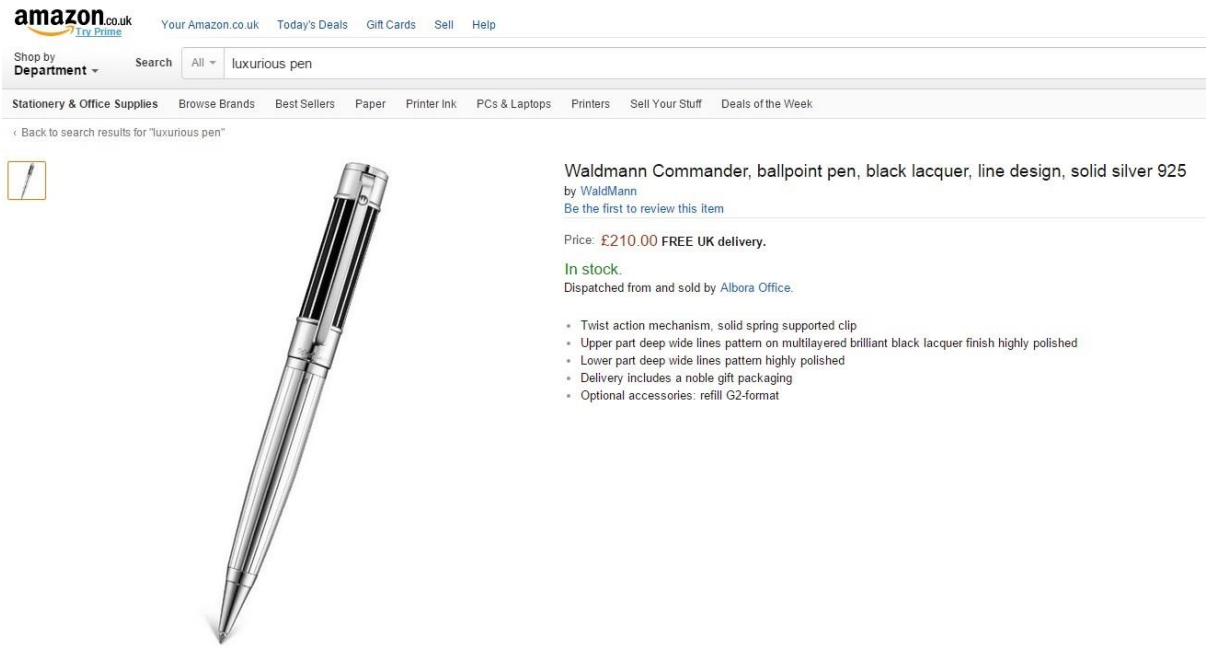


Fig. 9 Computer Mouse left hand orientation

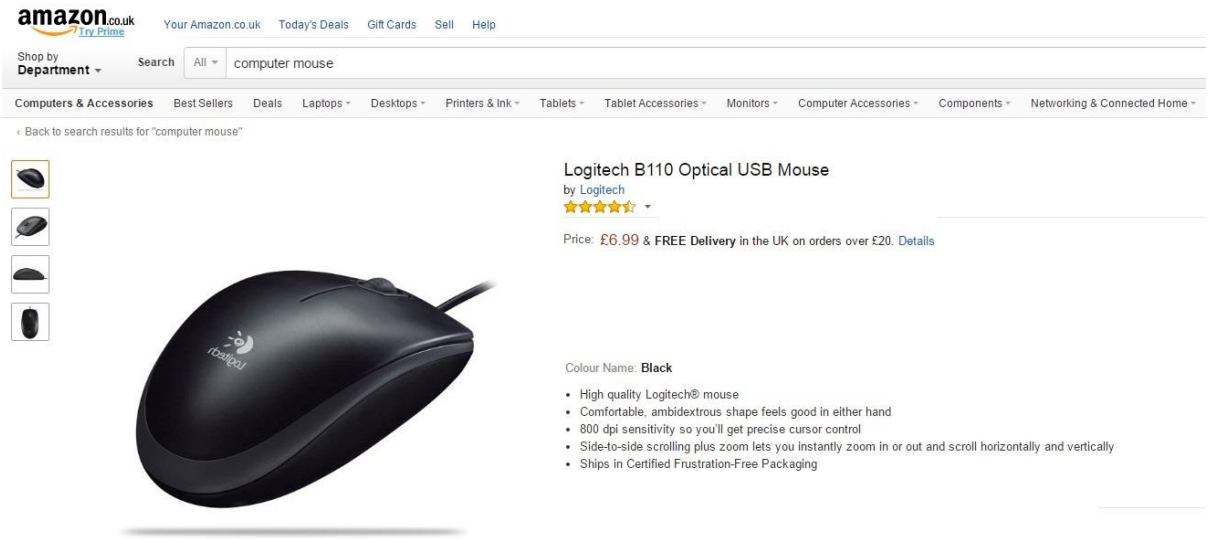
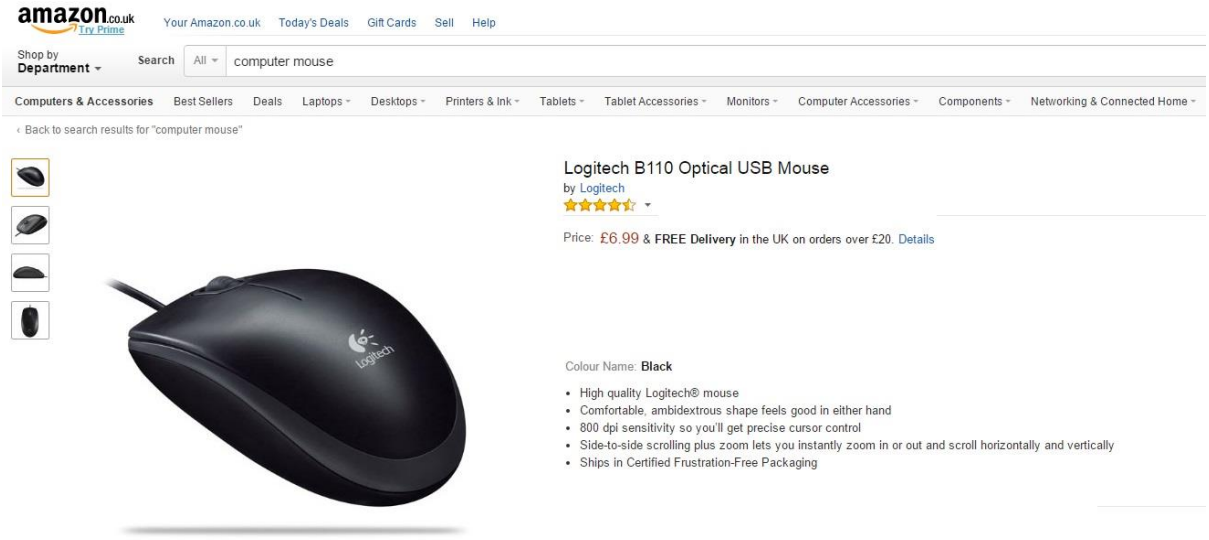


Fig. 9 Computer Mouse right hand orientation



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Dear participant,

Welcome to this experiment about online environment optimization. During this survey you will be asked to answer questions regarding two product displays. You can take as much time as you want to look at the pictures and to answer the questions afterwards.

IMPORTANT: On the first page of the actual experiment you will be asked to **use** either your **LEFT** of **RIGHT** hand to navigate through the experiment. This is regardless your preferred hand usage and for the validation of this experiment it is important that you will stick to the assigned hand usage.

Depending on the time you will take to look at the pictures the survey takes about 5-7 min.

Thank you for your time,

Joeri van der Heijden

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How many online purchases did you make in the past 12 months?

- none
- 1 or 2
- 3 or 4
- 5 or 6
- >6

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In the next screen you will see a product that is sold on amazon. Look as long at the product display as you want. After you have viewed the product at your own convenient duration, proceed to the next screen and answer the questions regarding the product.

IMPORTANT NOTE: Use your **LEFT** hand for navigation.

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As you viewed the product, to what extent did images of using the product come to mind?

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You are almost there. Just the final 5 questions and you are done.

NOTE: For the last 5 questions you can use the hand you normally use to navigate.

Which hand did you use during the experiment?

- Right hand
- Left hand

Which hand do you prefer to browse with?

- Right hand
- Left hand
- No preferrences

What is your gender?

- Male
- Female

Which age group are you in?

- 15-20
- 21-30
- 31-40
- 41-50
- 51-60
- >60

Which country are you coming from?

- Netherlands
- Germany
- Denmark
- France
- Belgium
- Norway
- Spain
- Italy
- Great Brittain
- Sweden
- Poland
- Austria
- Finland
- Other European country
- Other outside Europe