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The influence of information orientation in product packaging

Analysis of consumer behavior through an eye-tracking system

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Some food companies choose for their products to organize information (brand, description, product image, etc.) in a vertical packaging, others in a horizontal one. This thesis aims to understand which format is more effective for a consumer, to explain in which packaging orientation the product is perceived to be more attractive, complex, varied and fluid. In order to answer this question, an experiment was designed and carried out on a sample of 77 participants with an eye-tracking system in the laboratories of the University of Rennes 1, Rennes, France.
The eye-tracker provided detailed information on the visual attention to the *stimuli*, whose elaboration has allowed to obtain significant results from the point of view of information orientation in the packaging.

Summary

"I don't ask why patients lie. I just assume they all do."
Gregory House, MD (fictional character)

1. Theoretical bases

Before starting to illustrate the work done at University of Rennes, it is of fundamental importance to clarify the theoretical aspects that have affected my work.
Since neuromarketing is an interdisciplinary topic, it is necessary to illustrate concepts that refer to physiology, cognitive psychology, as well as economic and behavioral science.

1.1 Neuromarketing

1.1.1 Definition

Neuromarketing is the application of neuroscience to marketing. But what exactly does this mean? In order to answer this question it is necessary to explain what we mean by neuroscience, which is the set of scientific disciplines that study the nervous system, with the aim of approaching the understanding of the mechanisms that regulate the control of nervous reactions and brain behavior. Neuroanatomy, neurophysiology, neuropharmacology, neurochemistry, neurology must in fact be studied in an integrated and complementary way to understand the complexity of the brain.
According to Martinez [1], Neuromarketing is the result of the integration of three different disciplines:

- Neurology: focuses on the study of the human brain;
- Cognitive psychology: studies the relationship between mind and human behaviour;
- Marketing: the discipline responsible for developing new, profitable products and services to meet the needs of consumers.

So we can say that in general Neuromarketing includes the direct use of brain imaging, scanning, or other brain activity measurement technology to measure a subject's response to specific products, packaging, advertising, or other marketing elements. In some cases, the brain responses measured by these techniques may not be consciously perceived by the subject; hence, this data may be more revealing than self-reporting on surveys, in focus groups, etc.

In neuromarketing we can distinguish two main components:

- a strictly scientific derivation, connected to neurophysiology
- one of psychological derivation, in particular cognitive behavioral.

As already anticipated, since the disciplines involved in neuromarketing studies are very numerous, the following are summarized below:

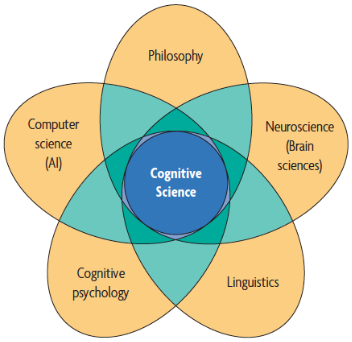


Figure 1 - The domain of Cognitive Science. The domain of cognitive science occupies tthe intersection of philosphy, neuroscience, linguistics, cognitive psychology and compter science (artificial intellingence) [2]

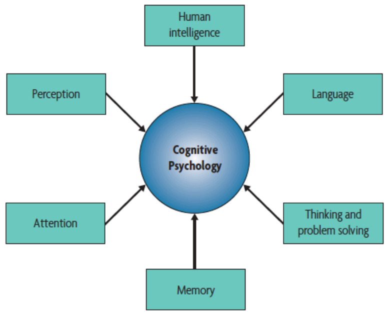


Figure 2 - The Domain of Cognitive Psychology. Cognitive psychologists study higher mental functions, with particular emphasis on the ways in which people acquire knowledge and use it to shape and understand their experiences in the world [3].

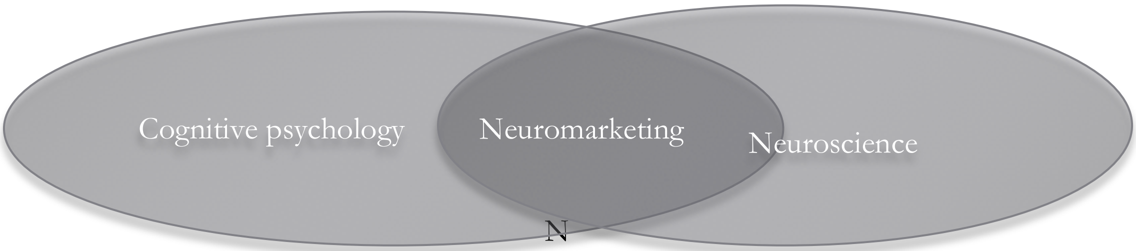


Figure 3 - Neuromarketing definition

Further details will be illustrated in the following chapters.

1.1.2 History

We can distinguish two important moments in the history of neuromarketing: the first one is when the Marketing Harvard Professor Gerry Zaltman, began to use the fMRI since 1999, in order to reveal aspects of consumers in relation to marketing stimuli. Another important moment in the history of neuromarketing, although it was foreshadowed some time ago, was the moment when Professor Ale Smidts used for the first time the term of Neuromarketing in 2002 [4] .
Zaltaman's method, called Zaltman metaphor elicitation technique (ZMET), was immediately appreciated and used by large multinational companies like Coca-Cola, General Motors, Nestle, P&G, etc. and a consultancy starts from 100 thousand euros.

Probably the most famous neuromarketing study in the world is that concerning Pepsi and Coca Cola. This study that revealed the role of brand in the decision making process was the famous study coordinated by Professor Read Montaque (2004) from Baylor College of Medicine. Research participants drank, while their brains were scanned at fMRI, two of the most popular beverages, namely, Pepsi and Coke. It was interesting that they preferred Pepsi when they did not know the brand and so it was activated the limbic system. Strong brand effect, which manifested then by decision, occurred when they all knew what they were consuming, therefore it was activated the frontal cortex [5].

Another study reported by Belden [4], which may have practical utility in understanding the decisional mechanism, was the one in which the people at Chrysler wanted to see through fMRI how consumers perceive their own cars. One of the results revealed that regarding sport cars, it is activated the ventromedial prefrontal cortex, known as the reward centre [6].

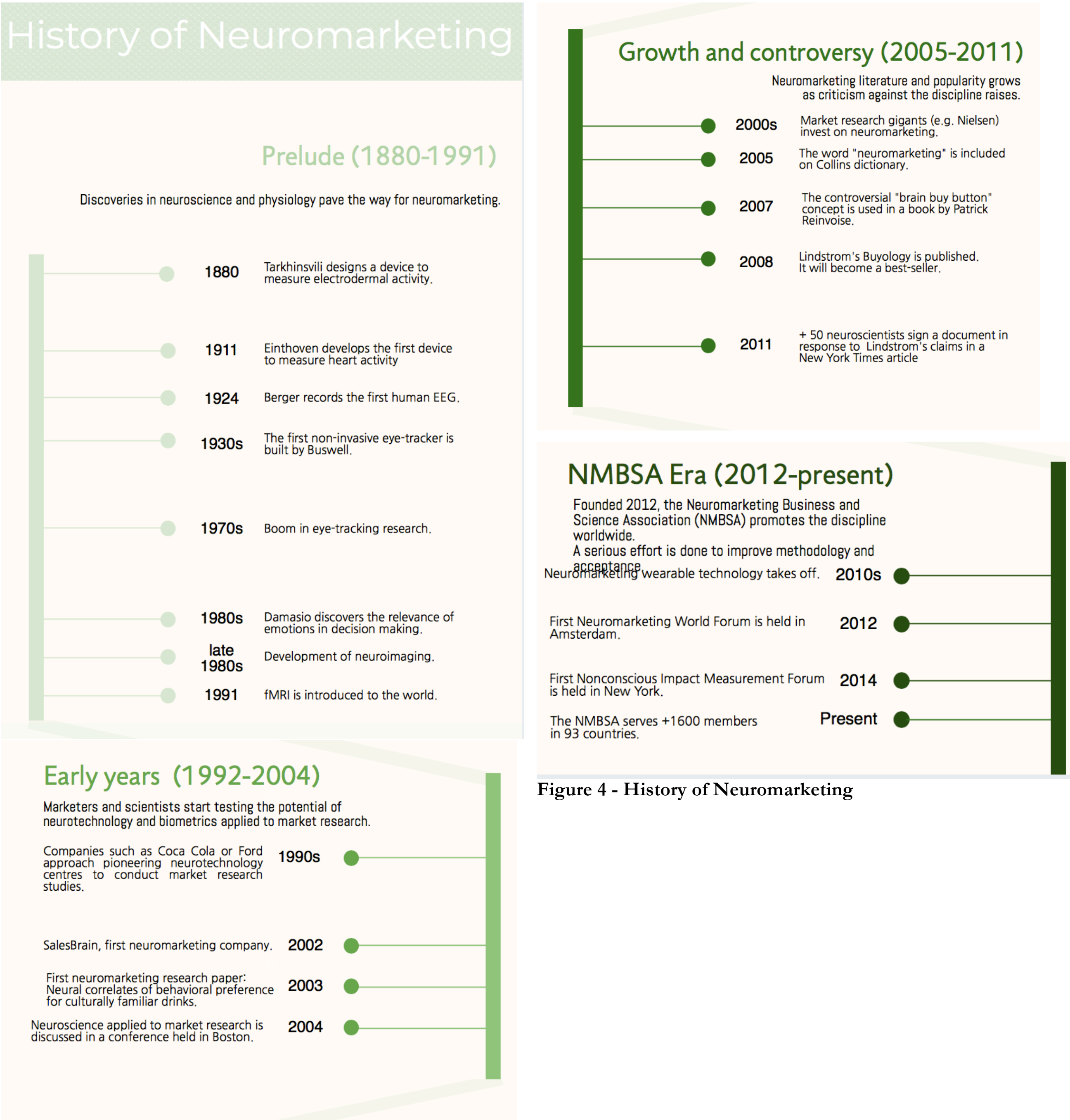


Figure 4 - History of Neuromarketing

1.2 Hints of neurophysiology and anatomy

1.2.1 Brain

Dr. Paul Maclean, a leading neuroscientist, developed the famous Triune Brain theory [7] for understanding the brain in terms of its evolutionary history. According to this theory, three distinct brains emerged successively in the course of evolution and now co-inhabit the human skull. These three parts of the brain do not operate independently. They have established numerous neuro pathways through which they influence one another. This interplay of memory and emotion, thought and action is the foundation of a person's individuality. The Triune Brain theory leads to a better understanding of the survival instinct such as the fight or flight response and its ability to override the more rational neocortex.

Reptilian Brain

The oldest of the three, controls the body's vital functions such as heart rate, breathing, body temperature and balance. Our reptilian brain includes the main structures found in a reptile's brain: the brainstem and the cerebellum. The reptilian brain is reliable but tends to be somewhat rigid and compulsive.

Limbic System

Emerged in the first mammals. It can record memories of behaviours that produced agreeable and disagreeable experiences, so it is responsible for what are called emotions in human beings. The main structures of the limbic brain are the hippocampus, the amygdala, and the hypothalamus. The limbic brain is the seat of the value judgments that we make, often unconsciously, that exert such a strong influence on our behaviour.

Neocortex

First assumed importance in primates and culminated in the human brain with its two large cerebral hemispheres that play such a dominant role. These hemispheres have been responsible for the development of human language, abstract thought, imagination, and consciousness. The neocortex is flexible and has almost infinite learning capabilities.

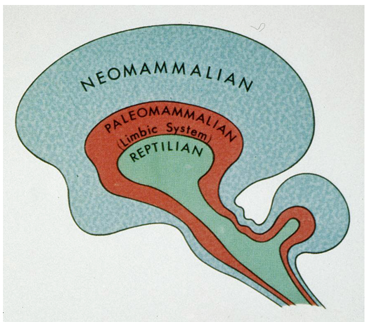


Figure 5 – Level brain classification

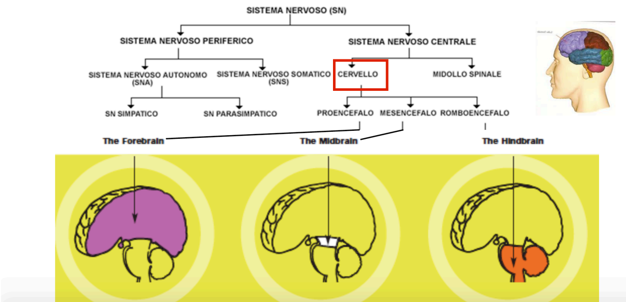


Figure 6 - Neurobiological level: the central nervous system (Boccignone ©)

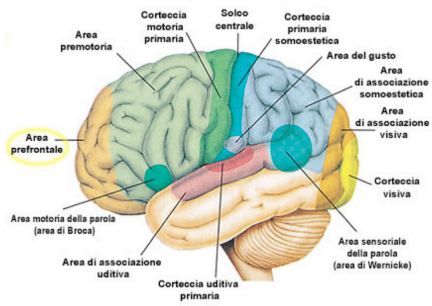


Figure 7 - Neurofunctional representation of the brain (Boccignone ©)

1.2.2. Eye

1.2.2.1 How eye works

In order to understand how visual information processing works and the tools that can do it, it is necessary to summerise the structure of the eye and how eye works.

Regarding the external structure, the components of the eye are:

- Iris: this is the colored portion of the eye. The iris is a muscle that controls the size of the pupil and, therefore, the amount of light reaching the retina.
- Cornea: this is a clear, dome-like layer that covers the pupil, iris, and anterior chamber or fluid-filled area between the cornea and the iris. It is responsible for the majority of the eye's focusing power. However, it has a fixed focus so cannot adjust to different distances.

The cornea is densely populated with nerve endings and incredibly sensitive. It is the eye's first defense against foreign objects and injury. Because the cornea must remain clear to refract light, it has no blood vessels.

- Sclera: this is commonly referred to as the white of the eye. It is fibrous and provides support for the eyeball, helping it keep its shape.
- Eyelid and eyelashes: they fulfill a protective function of the eyes and the tears keep them moist and clean.

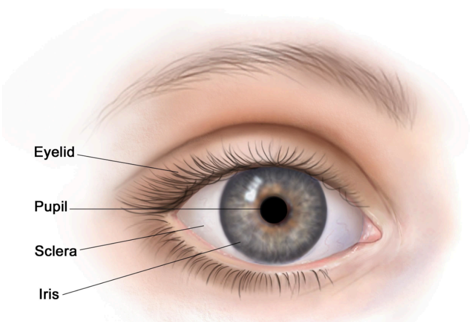


Figure 8 - External components of the eye

The cornea is a transparent structure found in the very front of the eye that helps to focus incoming light. Situated behind the pupil is a colorless, transparent structure called the crystalline lens. A clear fluid called the aqueous humor fills the space between the cornea and the iris.

In more detail, the internal structure of the eye is illustrated in the following figures (Figure 9 and Figure 10).

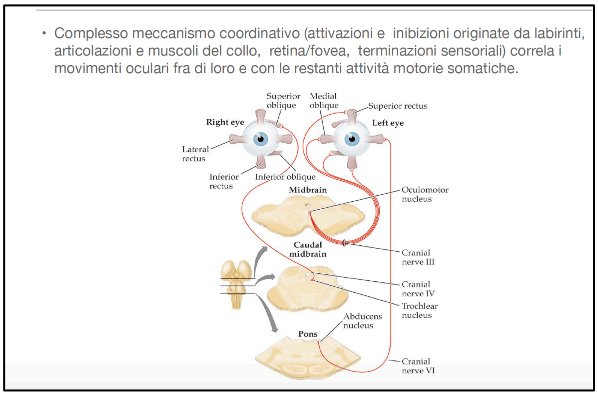


Figure 9 - Physiology of the eye (Boccignone ©)

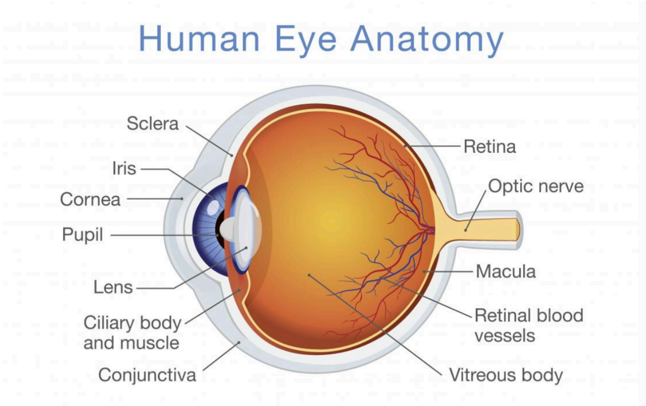


Figure 10 - Human eye anatomomy

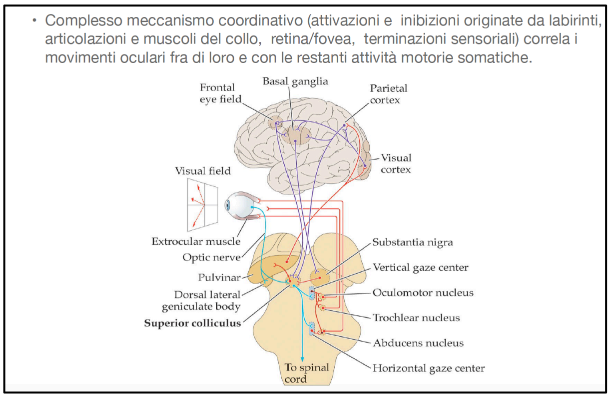


Figure 11 - Eye movments (Boccignone ©)

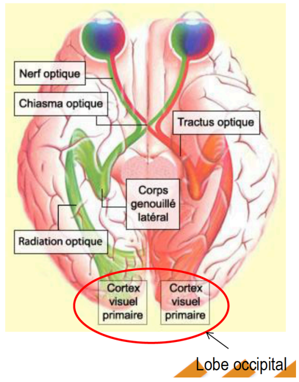


Figure 12 - Visual system

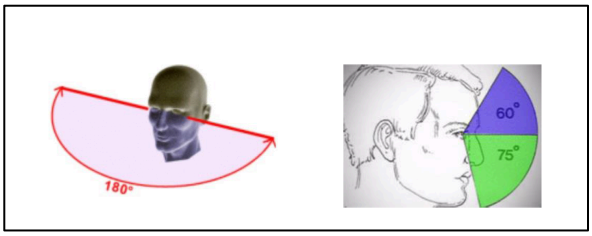
Light passes through the front of the eye (cornea) to the lens. The cornea and the lens help to focus the light rays onto the back of the eye (retina). The retina, a thin membrane that covers the inner face of the eye, is the key organ of vision since it includes more than 100 million photoreceptor cells that convert light signals into nerve signals. It is a neurosensory tissue derived from neuroblasts, that is to say from embryonic nerve cells; however, all the organs of the eye play a critical role for the photosensitive abilities of the eye. Thus, the iris and the pupil, by dilating the pupil when the luminosity is weak or by contracting it when it is strong, regulate the amount of luminosity - and thus the number of photons - which will come to strike the retina. The cornea and lens, for their part, will focus on the retina the light that has entered the eye (Figure 11).
The eye works much the same as a camera. The shutter of a camera can close or open depending upon the amount of light needed to expose the film in the back of the camera. The eye, like the camera shutter, operates in the same way. The iris and the pupil control how much light to let into the back of the eye. When it is very dark, our pupils are very large, letting in more light. The lens of a camera is able to focus on objects far away and up close with the help of mirrors and other mechanical devices. The lens of the eye helps us to focus but sometimes needs some additional help in order to focus clearly. Glasses, contact lenses, and artificial lenses all help us to see more clearly.

The information acquired by the photoreceptor cells is transmitted to the primary visual cortex located in the occipital cerebral lobe (at the back of the head). This information is then sent to multiple other visual areas located in the posterior temporal cortex and parietal cortex. In order for vision to work properly (and extract correct information from the environment), the eye must gather and record the information provided by the light and the brain must then process it to make it usable for the body [9].
So, from a physiological point of view, vision is the result of a coordinated action of a large number of nerves, tissues and organs that are localized in our eyes but also in many areas of our brain. The faculty

of seeing is therefore a physiologically imposing process. From a more psychological point of view (although it is illusory and even absurd to clearly distinguish the physiological attention from the psychological treatment since one can not exist without the other), the visual attention and the visual processing of the environment also involve many resources. The next step is to define visual attention and present theoretical elements that highlight the selective nature of attention.
According to Russo [10], eye movements can be considered good behavioural candidates for measuring visual attention and information acquisition because they are closely related to higher-order cognitive processes. Therefore, understanding and monitoring pupil dilation and other patterns in eye movement is an important part of neuroscience for Neuromarketing.

Figure 13 - Foveal vision. It is a mechanism for filtering information in order to avoid a brain overload (Lacoste-Badie ©)

The eyes cover a visual field of 180 ° horizontally and 135 ° vertically .



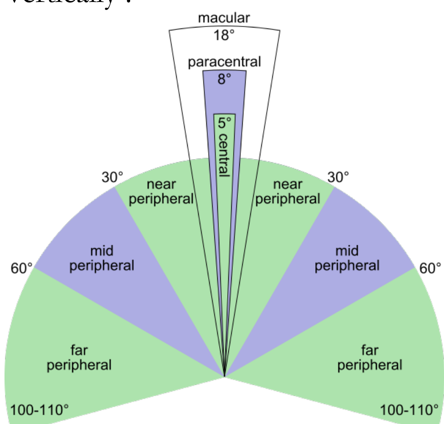


Figure 14 - Human eyes visual field (Lacoste-Badie ©)

Contrary to what one might think, the part of our visual field that we are able to deal with in detail is very small. Indeed, individuals have maximum visual acuity only in a specific area, which is called fovea *, because this area has a high concentration of photoreceptor cells. The viewing angle of the foveal area is limited to 1.5°-2° , which is extremely low. In addition to the foveal region, our field of vision also includes the parafoveal region (around the fovea) whose corresponding angle of vision is greater (10°) but has a lower visual acuity, and finally the peripheral region whose capacities visual discernment are extremely reduced.

1.2.2.2 Eye movements

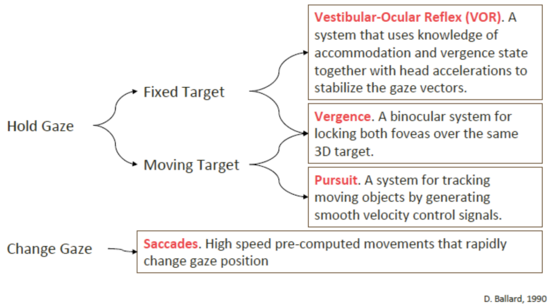


Figure 15 - Visual attention. Eye moviments (Boccignone ©)

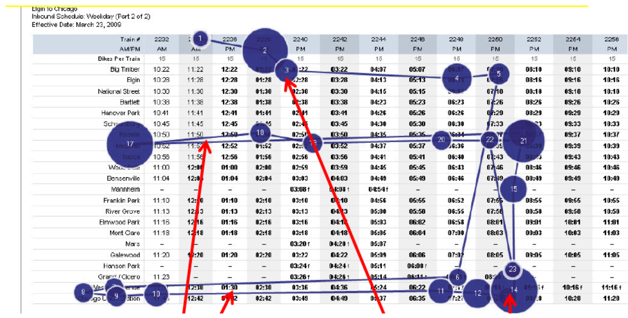


Figure 16 - Eyes can path. How eyes move (Lacoste-Badie ©)

Eyes move several times in a second (from 3 to 5)
These muscular movements called **saccades** are the most rapid movements produced by the organism. In my experiment, visual information is not extracted during saccades, but during fixations ie when the eyes do not move.

Eye movements are characterized by two major types of "event":

1. Fixations, which are brief periods of relative eye stability that last from a few tens of milliseconds to several seconds [11]; the most common times are between 200 and 400 milliseconds [12]. The term fixation is commonly accepted in marketing although semantically somewhat incorrect because the eye is not quite stable during this period;
2. Saccades, which are the extremely fast movements of the eye used to bring the foveal region from one point of fixation to another point of fixation. Jerking is the fastest movement the body can perform and usually lasts less than 50 milliseconds [11].

1.2.2.3 Fixations

- Fixations appear when the look is motionless
- They can last between 200 and 400 ms
- Visual information is extracted only during the bindings, ie is when the eyes are still and centered on something
- The visual information is stored during the bindings

1.2.2.4 Saccades

- The saccades are brief movements and very rapid
- They can last between 20 and 200 ms next the amplitude of saccades
- They allow to explore the visual field and direct the fovea on the object or region of interest in order to be able to perform a more detailed analysis at this location
- A saccade takes place between two bindings
- During saccades, visual information does not are not memorized

1.3 Psychology

1.3.1 Marr model

Cognitive processes are how you manipulate the mental contents—in ways that enable you to interpret the world around you and to find creative solutions to your life's dilemmas.
According to Robert Marr [13], man is a computer of information, and cognition (henceforth understood in a broad sense) is a collection of processes that lead to the construction of representations.
The complexity of perceptive-cognitive processes makes it necessary to address them through more than one descriptive level. Only in this way can we have a not excessively partial and not excessively simplified view of the phenomena. Even if this is a view of vision, this part of Marr's theory must be understood as valid for every computational phenomenon.
The author identifies three levels, called respectively computational, algorithm level and implementation level.

1) At the computational level it is a matter of specifying only in terms of input-output streams and black boxes what a cognitive system as a whole is, and what are the subsystems that constitute it. In other words, everything that has to be established at this level but it is the most important and difficult task consists in specifying the different functions computed by a system. So to refer to his case study, the vision is defined as a black box that receives in input a pair of retinal images and produces in output a description of the objects contained in that image. Examples of subsystems could be color perception, or depth detection; for each of these it is essential to specify exactly what information it receives in input and what it produces in output.
   Who provides a theory of the computational level is placed at the border between psychology and philosophy. In fact, questions pertinent to this level are philosophical, such as: Does perception require conceptual skills? "

2) At the algorithmic level it is a matter of entering into the merit of each black box identified at the level of computational theory and giving a description of the body of the function it computes, that is, of specifying its algorithm. How it works, for example, the Marr system, which as we will see is characterized by the hypothesis of several representational levels (retinal image, primary sketch, sketch 2 d, 3d representation) linked to each other by complicated processes and subprocesses. Note: at the algorithmic level there is not only a greater detail, but a real explanation of the algorithms.
   Providing an algorithmic level theory is the psychologist's own task. Moreover, since the algorithms are implemented to the computer to prove its likelihood, artificial intelligence is also involved at this level.

3) Implementation level, and finally answers the question: "how are representations and algorithms physically realized?". Here it is a matter of correlating the abstract computational descriptions provided to the previous levels with the data we have available on the biology of the brain, that is to specify which brain areas are responsible for which functions and, at least approximately, by virtue of which neurophysiological mechanisms.

The three levels occupy at least the philosopher, the psychologist, the computer scientist and the neuroscientist. For the study of cognitive processes different from vision, it is not difficult to imagine the advice of linguists, anthropologists and so on.
It is in this sense, therefore, that Marr's theory is a sort of programmatic manifesto of cognitive science.

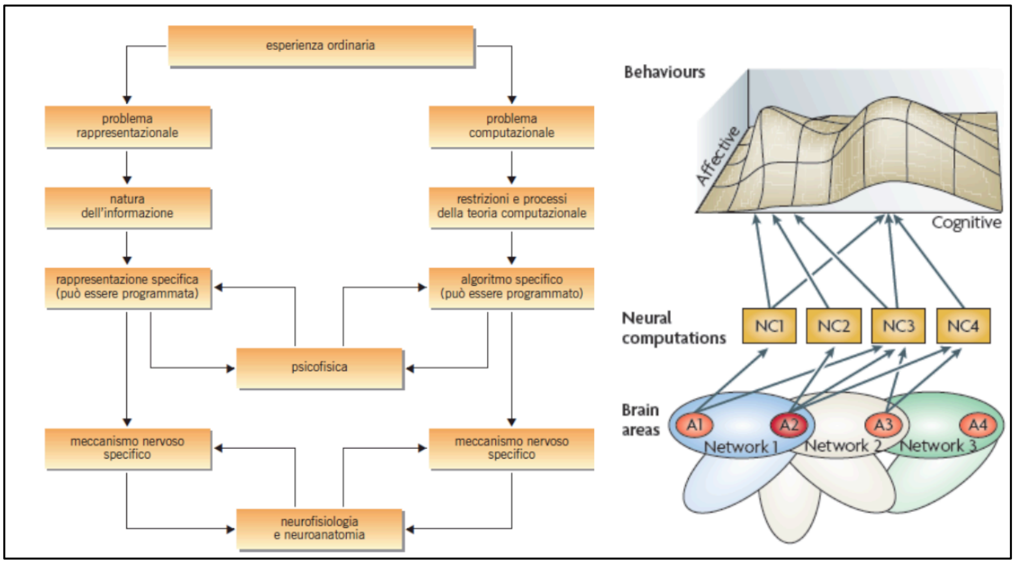


Figure 17 - Levels of explanation in cognitive sciences (Boccignone ©)

1.3.2 Cognitive Process

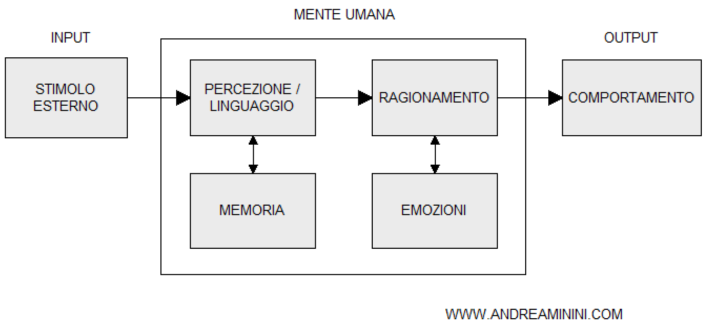


Figure 18 - Cognitive Process (Aminini ©)

1.3.3 Attention

1.3.3.1 Definition

"Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others..." (James, 1890, Principles of Psychology)

The concept of attention is a subject of interest by many researchers and is still a topic of debate. In general we can define attention as " the process by which we select or control the access of information in the consciousness field for perception". It is typically a **passive** process or an instinctive or neurophysiological reaction of the brain to external or internal sensory stimuli and is theoretically distinct from **mental concentration** which is instead an act of the mind in which will is involved.

Scientists have not yet reached a shared definition on the subject, except that it does not make sense to talk about a single type of attention, but rather of development processes that operate at different levels.

The attention has been studied both for psychology before and for neurophysiology later. Attention and level of activation are not the same concept. Precisely as a process of selection of information, attention can be defined as a cognitive process. They are two different states, even if connected: the degree of attention depends on the level of activation of the organism which in turn depends on both internal conditions and external stimuli: intense stimuli arouse attention, which then selects incoming information based on their biological or psychological relevance.

On the side of the subject, the factors that influence the attentional capacity are:
1. sensory capacity
2. the expectations of the subject.

On the side of the object:
1. the intensity: a bright color or a strong sound attract the attention of an opaque color and a weak sound;
2. the size of the stimulus: a large object is more likely to attract than a small object;
3. the duration of the stimulus: a stimulus that repeats itself or which persists over time draws attention more than a short-term stimulus;
4. emotional content: a known stimulus linked to a positive or negative emotional value is more attractive than a neutral stimulus;
5. the novelty: an unexpected or new stimulus can attract our attention in a repetitive or family situation.

As we can see, some of these characteristics appear to be conflicting with each other (for example, the force of a stimulus known for emotional value and that of an unexpected stimulus in family situations are potentially opposed), since it is the context that determines the strength of a stimulus.

First of all it is necessary to distinguish two types of processing:
- top down (from top to bottom) where processing is guided by sensory data (data driven processing)
- bottom up (from bottom to top) where processing is guided by concepts and theories, ie traces contained in the memory of the observer.

There are several explanatory models on how attention works.
Therefore, there are several types of attention.
The most important differentation is between[14]:
1. Involuntary attention*:* it implies a state of alert (involuntary appearance) or activation - vigilance → arousal. It comes into play in the presence of novelty, surprise, incongruity, complexity, intensity. It refers to those phenomena in which something, for example a sensory event, catches the attention.
2. Voluntary attention
   a) Selection process: process through which part of the information is processed in a conscious way and part is filtered or processed unconsciously → selective attention - it is the ability to select one or more external or internal stimulation sources, in the presence of information competing with each other. There is the intention to pay attention
   b) Allocation process: process through which the attentive resources are voluntarily allocated to a particular task at the expense of other tasks → attention supported (keeping watch over time) o warning divided - distributed (on more stimuli at the same time) or alternate (on more stimuli alternately).

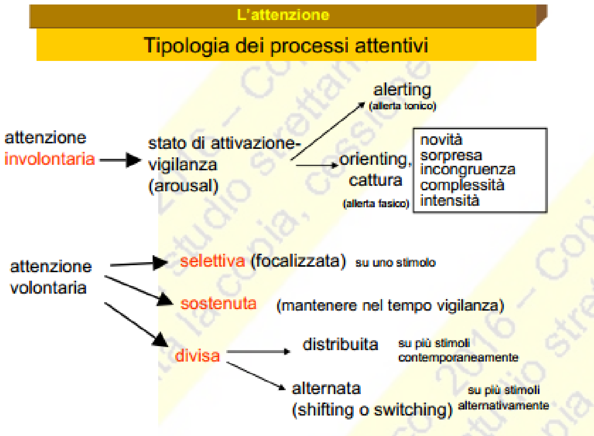


Figure 19 – Voluntary and Involuntary attention

One of the main definitions of attention is "the function that regulates this cognitive activity and that, through the filtering and organization of the information received, allows the subject to issue appropriate answers".
The characteristics of the stimulus able to capture our attention, that is to activate the selection mechanism are numerous, and they vary according to the contexts and also to the aims that the subject places.

Attention may arise on stimuli presented in each of the sensory modalities, but it is mainly distinguished in visual and auditory attention.

1.3.3.2 Theoretical models of attention

At the present state of research, we can distinguish three macro categories of attention, all three of voluntary origin:

1. selective
2. distributed
3. maintained

1. Selective attention

Selective Attention refers to the ability to select one or more sources of external stimulation in the presence of competing information to devote more effectively to the processing of relevant information for our current purposes and to ignore the non-relevant information.

Why does a selection of stimuli become necessary? Since our cognitive system has a limited number of resources, to avoid an "overload" situation it is necessary that only a part of such incoming information be processed in depth and then become conscious.

In the studies on selective attention, two classes of experimental paradigms (a reference model) were mainly used: selection paradigms and filtering paradigms.

- SELECTION PARADIGMS: we basically have two types:

1. Visual research tasks: first a target stimulus is presented and then a set of stimuli among which the target can be; the subject must say whether this target stimulus is present as quickly as possible. This experimental paradigm was used by Treisman.
2. Posner paradigm: The reaction times are measured against expected, unintended and neutral stimuli. In other words, the subject is pre-warned of the position in the visual field of a target stimulus, by a signal stimulus (cue) - e.g. an arrow that in the field of view indicates the position in which the target stimulus may appear -; the most consistent result is a reduction in reaction

times (improvement) when the signal stimulus is true and an increase in timing when the cue stimulus is not true.

- FILTRATION PARADIGMS: they are essentially based on the rapid and continuous presentation of relevant and irrelevant (to be ignored) stimuli, which generally differ for some physical attribute, such as spatial position, color, intensity, etc. the best known and that of the dichotic listening proposed by Cherry (1953), and used by many other researchers as Broadbent (filter theory) in which two messages are presented simultaneously to the two ears of the subject, which must pay attention to only one of the two messages (attention channel) and ignore the other (non-attentive channel).

These theories are called "structural", since they hypothesize that the selective capacity of man is based on a mechanism, a **filter**, which allows the passage of some information only. If the selection occurs before the semantic coding it is the case of early selection, whereas if we speak about late selection. the attentional filter can be placed just before the threshold of awareness;

1.3.3.3 Cherry

In detail, the study of selective attention was initiated by Colin Cherry [15] in 1953, who tried to understand why, among multiple stimuli coming from the outside world, the subject selects some (attended messages) leaving others to decay (unattended messages). In his experiments, the author has ensured that at the same time individuals were provided with different auditory messages. Cherry used, therefore, the dichotic listening: two different messages were made to listen simultaneously through two audio channels, right ear and left ear. Subjects must be careful of only one of the two messages (a only attentive channel = one ear). This technique is called shadowing technique and later it became very common in this kind of investigation.
Cherry was the first to perform selective attention studies focusing on the "cocktail party" phenomenon. This effect refers to the ability to tune our attention to just one voice from a multitude.

In the first set of experiments he played back two different messages voiced by the same person through both ears of a pair of headphones (dichoting listening technique) and asked participants to '*overshadow*' (repeat aloud) one of the two messages they were hearing by speaking it out loud, and later by writing it down. With the two voice presented together, as though the same person were standing in front of you saying two completely different things at the same time, this task appears to be very hard for the particpants.
Regarding the message in the ear that was asked to pay attention, the participant was able to report the meaning, while as regards the message in the ear that was asked not to pay attention, the participant was not able to extrapolate the content, but only the physical characteristics and the message was overlooked.

In other following experiments, Cherry discovered that difference in sex, intensity of voice or location of the speaker this ability uses the **physical differences** of the various auditory messages and allows us to isolate what interests us. For example, it can be explained why we can hear and distinguish our name during a party on the other side of the room.

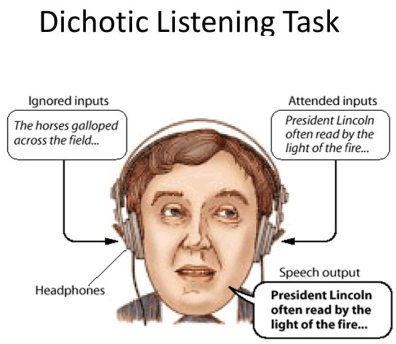


Figure 20 - Cherry Experiment on dicothic listening task

It is crucial to understand at what point in the cognitive process the selection of information takes place. There are two orientations:

1. the theory of **early** selection, according to which the selection is made on the sensorial input; attention is like a filter that blocks information meaning acquisition of the message. Only physical characteristics of non-selected message passed;
2. the theory of **late** selection, which instead places the selection after the process of recognition of the stimulus. Identical perceptual processing for all the characteristics of the stimuli; the intervention of the selective filter is at the moment of selection of the answer.

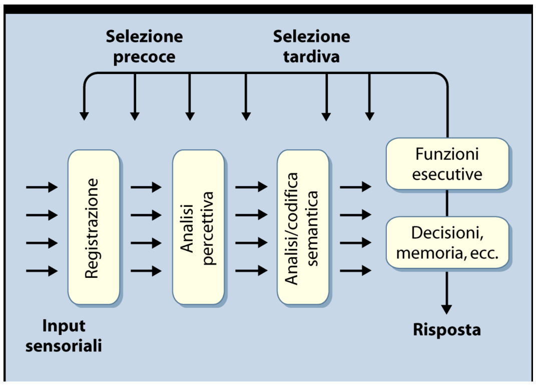


Figure 21 - Types of selection

Starting from Cherry, attention theories are arranged along a continuum that goes from theories that propose an early selection of information to those that propose instead a late selection.

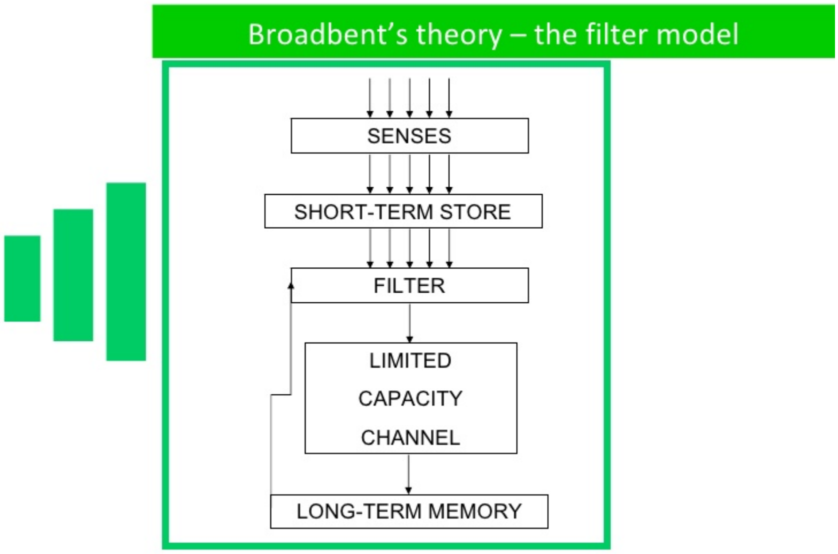


Figure 22 - Broadbent's theory filter

1.3.3.4 Broadbent Filter Theory

An example of a model that proposes an early selection of the information to be processed is the Broadbent Filter Theory, according to which there would be an initial phase of information processing during which all the stimuli are analyzed simultaneously on the basis of their characteristics. elementary physics and stored for a short time.

The air traffic controller finds he can deal effectively with only one message at a time and so has to decide which is the most important. Broadbent designed an experiment (dichotic listening technique) to investigate the processes involved in switching attention which are presumed to be going on internal in our heads.

Broadbent [16] argued that information from all of the stimuli presented at any given time enters a sensory buffer. One of the inputs is then selected on the basis of its physical characteristics for further processing by being allowed to pass through a filter. Because we have only a limited capacity to process information, this filter is designed to prevent the information-processing system from becoming overloaded.

The inputs not initially selected by the filter remain briefly in the sensory buffer, and if they are not processed they decay rapidly. Broadbent assumed that the filter rejected the non-shadowed or unattended message at an early stage of processing.

Broadbent wanted to see how people were able to focus their attention (selectively attend), and to do this he deliberately overloaded them with stimuli - they had too many signals, too much information to process at the same time. One of the ways Broadbent achieved this was by simultaneously sending one message (a 3-digit number) to a person's right ear and a different message (a different 3-digit number) to their left ear. Participants were asked to listen to both messages at the same time and repeat what they heard. This is known as a 'dichotic listening task'.

Broadbent was interested in how these would be repeated back. Would the participant repeat the digits back in the order that they were heard (order of presentation), or repeat back what was heard in one ear followed by the other ear (ear-by-ear). He actually found that people made fewer mistakes repeating back ear by ear and would usually repeat back this way.

Resultsfrom this research led Broadbent to produce his 'filter' model of how selective attention operates. Broadbent concluded that we can pay attention to only one channel at a time - so his is a single channel model.

In the dichotic listening task each ear is a channel. We can listen either to the right ear (that's one channel) or the left ear (that's another channel). Broadbent also discovered that it is difficult to switch channels more than twice a second.
So you can only pay attention to the message in one ear at a time - the message in the other ear is lost, though you may be able to repeat back a few items from the unattended ear. This could be explained by the short-term memory store which holds onto information in the unattended ear for a short time.

Broadbent thought that the filter, which selects one channel for attention, does this only on the basis of PHYSICAL CHARACTERISTICS of the information coming in: for example, which particular ear the information was coming to, or the type of voice.

According to Broadbent the meaning of any of the messages is not taken into account at all by the filter. All SEMANTIC PROCESSING (processing the information to decode the meaning, in other words understand what is said) is carried out after the filter has selected the channel to pay attention to. So whatever message is sent to the unattended ear is not understood.
Because we have only a limited capacity to process information, this filter is designed to prevent the information-processing system from becoming overloaded.

The inputs not initially selected by the filter remain briefly in the sensory buffer store, and if they are not processed they decay rapidly. Broadbent assumed that the filter rejected the non-shadowed or unattended message at an early stage of processing.

1.3.3.5 Treisman's Attenuation Model

Treisman's model [17] retains this early filter which works on physical features of the message only. The crucial difference is that Treisman's filter attenuates rather than eliminates the unattended material. Attenuation is like turning down the volume so that if you have 4 sources of sound in one room (TV, radio, people talking, baby crying) you can turn down or attenuate 3 in order to attend to the fourth.

The result is almost the same as turning them off, the unattended material appears lost. But, if a non-attended channel includes your name, for example, there is a chance you will hear it because the material is still there.

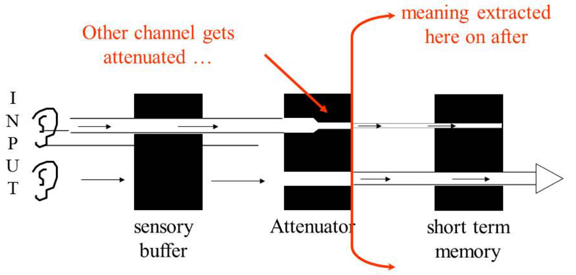


Figure 23 - Treisman's Attenuation Model

Treisman agreed with Broadbent that there was a bottleneck, but disagreed with the location. Treisman carried out experiments using the speech shadowing method.
Participants were presented with two auditory messages, one to each ear via a set of headphones. They were required to attend to one message while ignoring the other message. To be sure that participants were attending to the message they were asked to repeat aloud the message they hear (shadowing). Typically, the messages presented were spoken words or sentences. Treisman was interested to know how much and what type of information the participant can hear from the non-attended message (the 'unshadowed' message). Findings suggested that some information, such as one's own name, the gender of the speaker and other features could be detected in the unshadowed message.
In one of her experiments, identical messages were played into both ears but with a slight delay between them. If the delay was too long, the participants were unable to realize that the same material

was played into both ears. When the unattended message was ahead of the shadowed message by up to 2 seconds, participants noticed the similarity.
In an experiment with bilingual participants, Treisman presented the attended message in English and the unattended message in French. When the French translation lagged only slightly behind the English translation, participants could report that both messages had the same meaning. Clearly then, the unattended message was being processed for meaning.
This led Treisman to develop her attenuation theory of attention. She stated that stimulus processing proceeds systematically. It starts with analysis based on physical characteristics (location, pitch, gender etc.) syllabic pattern, and individual words. After that, grammatical structure and meaning are processed. When the unattended messages yield no useful or important information, those messages are attenuated; they are weakened in their importance to ongoing processing.

1.3.3.6 Deutsch e Deutsch

A proposal that is more radical than the Broadbent model is that of Deutsch and Deutsch [18] . These authors rejected the Broadbent model, because they considered that the information processing capabilities that the filter described by Broadbent should have to operate information selection should be as complicated as those of the perceptive system (P). If this is true, then the filter becomes totally useless.
They then postulated that there was no filter and that the entire processing of the stimulus is automatic and independent of selective attention. Selective attention would intervene only to control access of the stimulus to consciousness, memory and response systems. The effects of the attention would therefore be only the product of the interaction between coefficients of importance and related information. In other words, the filter would no longer be at the level of receiving information, but at the level of the answer.

1.3.3.7 Jonhnston and Heinz

Jonhnston and Heinz [19] placing the filter in such a way that the selection is possible at various stages of the process. According to these authors, therefore, selection is not rigidly placed at a certain level of the process, but takes place as soon as possible taking into account the circumstances and demands of the task itself. In this way the process is more flexible and economically more valid. An example of a characteristic that influences selection is the discriminability of stimuli, according to Johnston's hypothesis if the two stimuli are not very discriminable, the selection of the relevant item occurs after both have been processed at a fairly deep level.

Figure 24 - Theory of Attention summary

If in the Broadbent model (and following) the attention was a system of filtering of the incoming information, in the modern models it is considered a system of control of cognitive operations (attentional system supervisor): attention intervenes in the selection between a cognitive process and the other when these are in conflict with each other (competitive selection).

- SEMANTIC PRIMING PARADIGM (OR SEMANTIC PREACTIVATION): refers to the homonymous effect for which the subject responds more quickly to a target word semantically related to a word that precedes it (called "prime"), for example: doctor .... . It has been hypothesized that there are 2 types of mechanisms at the base of this phenomenon:
  - automatic mechanisms, quick and independent of the subject's expectations / will and that facilitate the response;
  - attentive mechanisms that are slower and depend on the subject's expectations and facilitate or inhibit the response.

More generally, we say that selective attention is considered here as a mechanism for selecting messages that come from different channels.

1.3.4 Visual Attention

In particular the visual attention can be defined as “the selective use of information from one region of the visual field at the expense of other regions of the visual field [20]”

1.3.4.1 Yarbus

The behavior of visual exploration is composed of a succession of fixations, interspersed with saccadic movements that orient the fovea towards different parts of the image. The sequence of saccades and fixations performed during the observation of a visual scene is not accidental but is influenced by mental states and cognitive objectives of the observer. The first experiments on the study of visual attention date back to 1965 and were conducted by the Russian psychologist Yarbus.Tra the '50s and' 60s Yarbus used an innovative method for recording eye movements, based on tiny suction cups fixed on the surface of the eye, which allowed him to study eye movements with great precision. Yarbus observed that the gaze movements are not random but are functional to the perceptive and cognitive objectives of the observer: during the observation of a scene, the gaze stops (both voluntarily and involuntarily) more often and for a longer time on the elements that are susceptible to make more information.

In a classic 1967 experiment, he studied the paths of the gaze on the painting “*An unexpected visitor*”, by I.E.Repin. The experiment showed clearly that the observer examined the picture with completely different visual paths according to the request made by the experiment operator. The scanpaths shown in Figure X correspond to the following requests from the conductor:

1) examine the picture freely;
2) examine the material environment;
3) indicate the age of the people;
4) indicate what the characters were doing before the unexpected visitor arrived;
5) memorize which clothes people wear;
6) memorize the position of persons and objects in the room;
7) indicate how long the unexpected visitor has been away from the family.

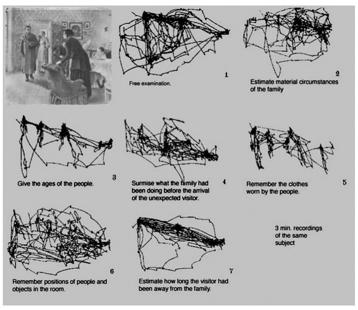


Figure 25 - Yarbus experiment

There is therefore a mechanism able to filter the information coming from the peripheral parts of the visual field and to select the most salient or relevant elements as potential targets of the next saccadic movements. This mechanism is the visual-spatial attention: we look at what attracts our attention. In this case the ocular movement is guided by the search for the elements that can identify the unconcert. It is a type of top-down research.

1.3.5 Perception

Perception (from the Latin perceptio) is the organization, identification, and interpretation of sensory information in order to represent and understand the presented information, or the environment[21]
Perception can be split into two processes, processing the sensory input, which transforms these low-level information to higher-level information (e.g., extracts shapes for object recognition), (2) processing which is connected with a person's concepts and expectations (or knowledge), restorative and selective mechanisms (such as attention) that influence perception.

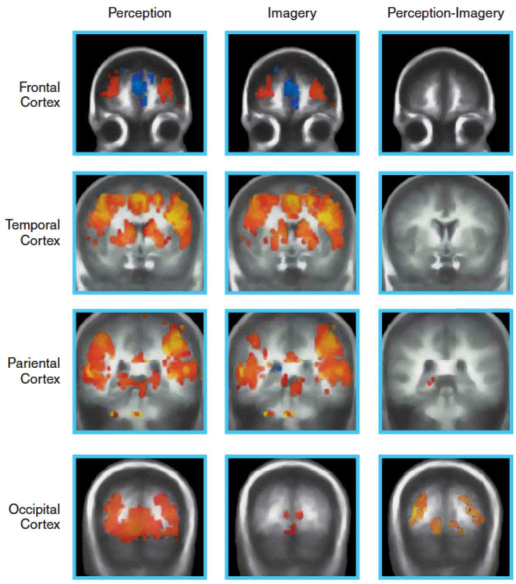


Figure 26 - The Brain Bases of Visual Imagery. The figure shows the results of fMRI scans when participants were engaged in either a perception task or an imagery task. The left and middle columns show brain activity for each task: Regions marked with red, orange, and yellow were more active with respect to a no-task baseline; regions marked in shades of blue were less active. The right column shows the brain regions that were affected by the perception task but not the imagery task. These fMRI scans demonstrate that much the same brain regions are used for perception and imagery.Reprinted from Cognitive Brain Research, 20, G. Ganis et al., "Brain areas underlying visual menta imagery and visual perception: An fMRI study," pp. 226–241, copyright © 2004, with permission from Elsevier.

1.3.6 Emotion

Tu summerize, in dealing with emotions, there are two types of approach[22]:
1. dimensional
2. categorical

In the dimensional level, the emotion is defined by:

1. level of pleasure
2. level of arousal

For example, speaking in front of an audience can give a lot of arousal and little pleasure

In the categorical approach there are two types of feelings:

1. positive feelings
2. negative feelings

It must be underlined that attention and emotion are two different capacities.

After summarizing the main theoretical aspects underlying neuromarketing, we analyze the tools through which the data are collected.

2. Eye movement detection techniques

Before describing in detail the operation of eye tracking, it is good to remember that this is the result of technological innovation and that previously very different visual investigation techniques were used.

2.1 Before eye-tracker

Below is a summary

1. Magnéto-oculographie
2. Electro-oculographie (EOG)
3. Vidéo-oculographie (VOG)

1. Magneto oculography

The first technique of visual investigation was magneto-oculography. A contact lens containing a conducting coil was used. The movement is deduced from the variations of the magnetic field created by the loop. As can be seen from the image, it is a very invasive technique. It generates a magnetic field and records only if there are movements

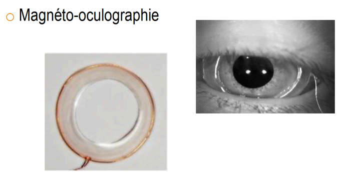


Figure 27 - Magneto oculography (Lacoste-Badie ©)

2. EOG

With the electro-oculography technique the electrodes are fixed on the external and internal orbital margin in order to calculate potential difference between the electrodes positioned to obtain the position of the eye.

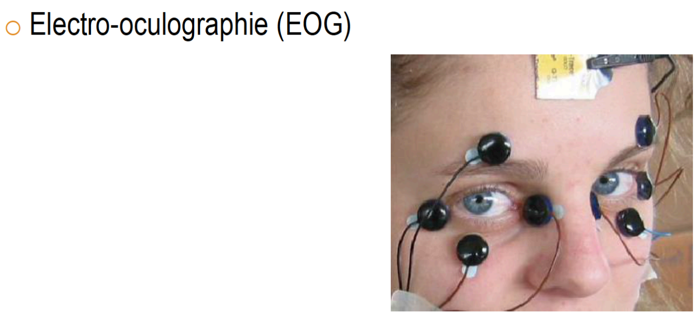


Figure 28 - Electro-oculography (Lacoste-Badie ©)

3. Vidéo-oculographie (VOG)

Video-opulography (VOG) is the most modern and non-invasive visual survey technique. The eye-tracker belongs to this group.
The position and movement of the eye are recorded via a camera.

Initially there was only an analog camera (16 mm), replaced by a digital camera.
The most modern technology, that of the ee-ytracker. it is a VOG combination and infrared reflections.

2.2 Eye tracker

2.2.1 How eye-tracker works

Eye tracking refers to the process of measuring where we look, also known as our point of gaze.
Eye Tracking (E.T.) is an eye tracking methodology, to determine with reasonable accuracy where a user is looking.
ET measures where the person is looking (gaze or fixation point), the time that this person looked at this certain point, the movement of his eyes in relation to his head, pupil dilation, and the number of blinks [23].
In addition to the fixation, the sequence in which his or her eyes shift from one location to another (saccade) can also be evaluated.
Eye tracking records our point of gaze and our eye movements in relation to the environment and is typically based on the optical tracking of corneal reflections, known as pupil center corneal reflection (PCCR).
Near-infrared light is directed towards the center of the eyes (pupil), causing visible reflections in the cornea (outer-most optical element of the eye). These reflections – the vector between the cornea and the pupil – are tracked by an infrared camera.
An infrared light source (and thus detection method) is necessary as the accuracy of gaze direction measurement is dependent on a clear demarcation of the pupil and the detection of corneal reflection. Normal light sources (with ordinary cameras) aren't able to provide as much contrast, meaning that an appropriate amount of accuracy is much harder to achieve without infrared light.

The visible spectrum is likely to generate uncontrolled specular reflection, while infrared light is allows for a precise differentiation between the pupil and the iris – while the light directly enters the pupil, it just "bounces off" the iris. Additionally, as infrared light is not visible to humans it doesn't cause any distraction while the eyes are being tracked.

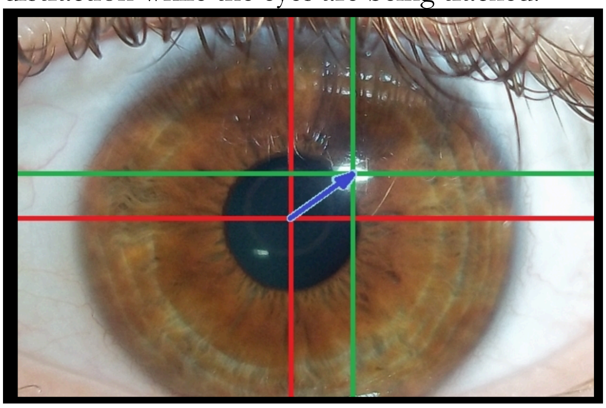


Figure 29 – How eye-tracker work – Pupil and Iris difference (Lacoste-Badie ©)

There are two techniques of operation of the eye-tracking:

1. BrightPupil: the camera and the light source are coaxial. As a result, the light is reflected from the retina creating an illumination similar to that one has with a flash
2. DarkPupil: the camera and lighting system are not coaxial: the pupil appears dark

Bright Pupil	**Dark Pupil**
• More stable	• Independent of the presence of other infrared

• Independent of eye color • Independent of the lighting conditions of the environment in which the test takes place	light sources

Table 1 - Eye-tracker techniques

For all the methods used, measurement can be influenced by the movements of the subject

There are two types of eye-trackers based on portability:

- fixed eye-tracker: participants do not have to move and stimuli are presented on a non-moving surface (screen or wall). It is usually used for research on packaging, websites, press ads, etc. Participants must be positioned in front of ET, with no obstacle between the eyes and the stimulus presentation screen.
    - Fixed eye-tracker with chin rest
    - Screen mounted devices
- mobile devices there are two types:
    - mounted on the face
    - glasses

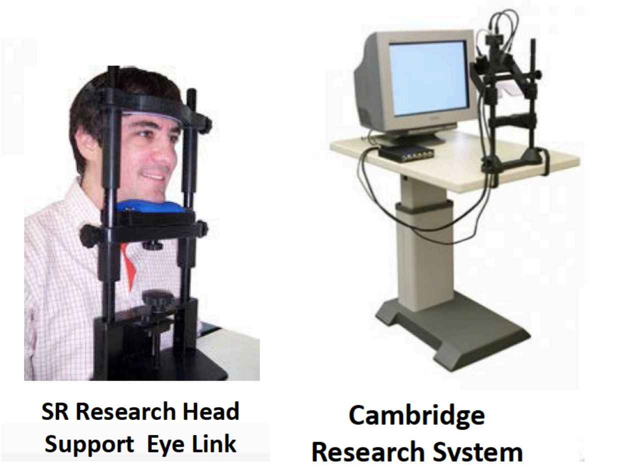


Figure 30 - Fixed eye-tracker with chin rest (Lacoste-Badie ©)

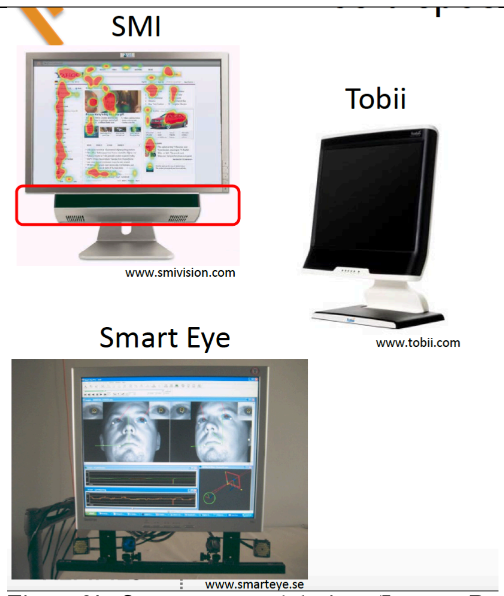


Figure 31 - Screen mounted devices (Lacoste-Badie ©)

Fixed eye-tracker	Portable eye-tracker (glasses)
• non-intrusive • participants sometimes forget the presence of ET	• offers great mobility • exhibition in real condition (street, shop ...)

• simple to set up	• Pretty intrusive
• Limited head movements	• more complex records to analyze

Table 2 - Fixed vs portable eye-tracker

Other elements to consider when choosing the eye tracking device are:

- sampling rate (usually 50 Hz to 500 Hz) which is an important parameter for data quality since it indicates the number of times, per second, where the eye tracker will record the position of the gaze.
- Monocular system (single-eye recording) vs. binocular (recording of both eye movements)

In the next chapters the material used for the realization of the experiment will be illustrated in detail.

2.2.2 Main Eye Tracking Applications

Eye tracking measures attention, interest, and arousal, making it a great tool for any kind of human behavior research applied in a variety of fields such as Psychology, Medicine, Marketing, Engineering, Education and Gaming as well as for enhancing human computer interaction by using the eyes for navigation and controls.

1. Academic and Scientific Research

Without a doubt, the academic and scientific research fields are currently making the most out of eye tracking for cognitive, developmental, experimental and media applications in psychology and neuroscience.

2. Market Research

During the past few years, eye tracking for market research has become increasingly important. Many leading brands use the tool to evaluate their products, designs, advertising or even the shopping behavior of their customers to optimize the overall customer experience.

With eye tracking, it is possible to measure attention to brands, products, and their key messages as well as the ease or difficulty of store navigation.

3. Psychology Research

Within this area, visual attention can be measured and correlated with other measures such as how the brain works. The visual attention research can be done for normal populations as well as for specific subpopulations that have conspicuous behavioral patterns or different kinds of mental health disorders.

4. Medical Research

Eye tracking in combination with conventional research methods or other biometric sensors can even be helpful for diagnosing diseases such as Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD), Obsessive Compulsive Disorder (OCD), Schizophrenia, Parkinson's and Alzheimer's disease.

For instance, it can be used to detect drowsiness or support various other fields for medical, quality assurance or monitoring use.

5. Usability Research

Eye tracking for usability and user experience is an emerging field using these methodologies. One classic example is website testing. Here, attention to real estate, communication, and call to action (CTA) can be measured.

If it is difficult to find a certain product on a website, the owner of that website is very likely losing out on revenue. So, if that website could be improved to increase the findability of a product, a fast and big return on investment can be seen. Similar applications can be applied to mobile apps on tablets and smartphones.

If it is difficult to find a certain product on a website, the owner of that website is very likely losing out on revenue. So, if that website could be improved to increase the findability of a product, a fast and big return on investment can be seen. Similar applications can be applied to mobile apps on tablets and smartphones.

6. Packaging Research
Generally, there is a lot of money invested into designing packages of a product before they go to market. This is the case especially for fast moving consumer goods because the competition is very fierce.
It is necessary to make sure that the package of a product gets enough visual attention on the shelves, meaning it has to stand out from the others. Eye tracking is basically used here for designing the packages and understanding the customers' preferences.

7. PC and Gaming Research
Eye tracking has also been introduced to the human-computer interaction and gaming industry which now enables for instance game designers to get a better understanding of the game experience so that it is somewhat possible to control the experience and create features that push the boundaries of reality even more.
In the time to come, it will most likely even be possible to personalize the game's development in regard to pupil dilation of the player and the gamer will be able to control the game with eye movements.

8. Human Factors and Simulation
Automotive research has embraced eye tracking glasses for a long time to gauge driver's visual attention – both with respect to navigation and layout of dashboards. In the near future automobiles might be able to be responsive towards their driver's eye gaze, eye movements or the dilation of the pupil.
The applications mentioned above are only the most commonly used within eye tracking research. Eye tracking is however not limited to these and can in combination with further biometric sensors be even more powerful.

What Can Eye Tracking Be Used For?
Eye tracking is used across a range of different research fields, and for various different applications within the commercial realm too.

Obtaining detailed information about where an individual or group of people look is useful in a range of contexts, from psychological research, to medical diagnosis, neuromarketing applications and beyond.
To resume:

Eye tracking in psychology
Understanding when and how people look is essential for understanding how attention is distributed. Eye tracking is widely used within psychological tests like the IAT (implicit association test), Stroop Test, and the Iowa Gambling Task, as well as within gaze contingency paradigms.

Eye tracking in healthcare
Tracking an individual's gaze can also be important in medical settings. Studies have shown the potential predictive power of eye tracking in diagnosing autism, as well as other neurological disorders. Future uses may see the application of eye tracking data in providing optimal patient care in healthcare settings.

Eye tracking in neuromarketing

Following gaze patterns while people shop has been a growing topic within neuromarketing for many years now. Being able to see what people attend to or ignore can be crucial for implementing optimal packaging design, store layout, and point-of-sale displays.

Eye tracking data can also deliver valuable insights into the gaze patterns of your website visitors – how long does it take them to find a specific product on your site, which kind of visual information do they ignore (but are supposed to respond to)? Where do your website visitors look? What do they look at and how much time do they spend looking at it?

In summary, eye tracking can reveal:

- What people look at on a screen or in the real world
- When attention is placed on certain visual elements
- How long each fixation lasts for
- The order in which visual elements are fixated upon
- If an individual's gaze returns to a visual element that was looked at before

Eye tracking however can't alone reveal:

- Why an individual looked at a certain visual element
- How they felt when looking at a visual scene
- With the evolution of computer technology, eye tracking has become a non-intrusive, affordable, and easy-to-use tool in human behavior research that allows the measurement of visual attention as it objectively monitors where, when, and what people look at.

Given the ease of application and measurement, it's no wonder that eye tracking technology finds increasing popularity among a rapidly growing variety of academic and commercial disciplines, well above and beyond the topics mentioned above.

2.2.3 Some experiments in some academic articles realized thanks to the eye-tracker

Participants preferred the packaging with widely recognised third-party brands compared to supermarket private label brands	**Hurley, Ouzts, Fischer, & Gomes, 2013**
Using celebrities as human brands on the quality of consumer decisions in an environment of online purchases through the analysis of visual attention using	**Chae & Lee, 2013**
Impact of branding activities through the audio-visual representation of brands	**Wedel and Pieters, 2012**
The viewer's attention is strongly limited to the centre of the screen when fast-forwarding. ET can help us to understand the new challenges created with technological changes and their effects on consumers' attention	**Brasel & Gips, 2008**
Analysed the attractiveness of packaging designs using functional magnetic resonance imaging (fMRI) and eye-tracker	**Stoll, Baecke and Kenning, 2008**
With the use of ET, it was possible to identify consumers with two different kinds of characteristics: analytical-rational thinking and intuitive-empirical thinking	**Ares 2013**
how consumers acquire information from food labels through eye tracking	**Ares, Mawad, Giméneza, & Maiche, 2013**
The participants read descriptions of the characteristics of three kinds of cookies. ET revealed	**Khushaba et al., 2013**
A study of women selecting ladies' handbags demonstrated the motivation to observe specific parts of the product and dentified a clear order of priorities and fixations on different parts of the product	**Ho, 2014**
One research project examined numeric digits and eye movements in order to identify patterns in	**Coulter, 2007**

selective visual attention related to the rounding of prices. The project investigated whether individuals are conscious or not of left-right orientation (front/rear) when reading numeric digits. It	
ET to investigate the role of various stimuli on the shelves	**Chandon, Hutchinson, Bradlow, & Young, 2009**
ET technology assesses exactly what consumers see and what they miss when they are looking at different categories	**Grewal et al., 2011**
One particular study tested the relationship between the colours used on websites and the trust and satisfaction engendered in customers	**Cyr, Head, & Larios, 2010**
The impact of contrasting colours in the fruit and vegetable market on the attention behaviour of customers. They used ET to determine the perceived quality, visual appeal, and purchase intent of customers. Results	**Bix, Seo, & Sundar, 2013**
Effectiveness of marketing emails	**Rowe & Burridge 2012**
Attention of consumers on internet banners to determine the effectiveness of these banners	**Lee & Ahn, 2012**
Effect of stimuli on consumers' attention to print ads	**Hutton & Nolte, 2011**
Difference between the visual attention of smokers and that of non-smokers	**Baschnagel, 2013**
Visual attention of adolescents (aged 14-19) on the health warnings displayed on cigarette packages	**Maynard, Munafò, & Leonards, 2013**
Irresponsible consumption of alcoholic beverages. A study conducted using adolescents investigated whether they pay attention to messages about responsibility and moderation that appear in magazine advertisements for alcoholic beverages	**Thomsen & Fulton, 2007**

This is just a brief excerpt of the academic articles where the eye-tracking was used. As you can easily guess is a technology that has taken hold, especially since the 00s.

3. Experimental Design

3.1 Research process

This chapter identifies factorial designs as particularly popular in eye-tracking research.
As already mentioned, neuromarketing is given by the fusion of multiple disciplines such as psychology and neuroscience. Psychology is considered a science that follows the rules established by the scientific method. Neuromarketing is also subjected to scientific validation.
The research process in psychology can be divided into several steps that usually occur in sequence (see Figure 32).

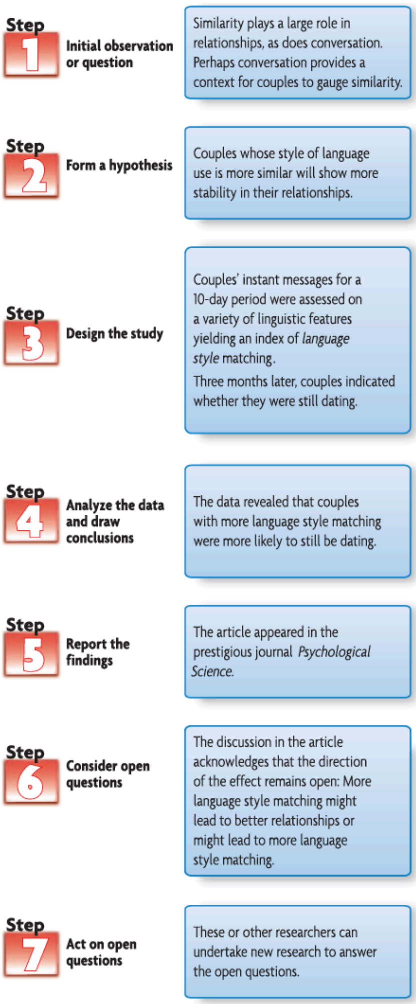


Figure 32 Steps in the Process of Conducting and Reporting Research. To illustrate the steps in the scientific process, consider a study that examined the relationship between couples' language styles and the stability of their relationships (Ireland et al., 2011).

“The process typically begins with Step 1[2] , in which observations, beliefs, information, and general knowledge lead someone to come up with a new idea or a different way of thinking about a phenomenon.
The researchers’ questions originate from:
- direct observations of events, humans, and nonhumans in
the environment;
- some issues are considered to be “great unanswered questions” that have been passed down from earlier scholars.
Researchers often combine old ideas in unique ways that offer an original perspective.

The **formulation of research hypotheses** is one of the most important steps to design a good experiment. For example, starting out with a statement such as, “I wonder what would happen if...,” is what could be considered a naive approach because it is not necessarily based on any assumptions or theories and does not identify any particular direction for testing. On the other hand, stating, “I bet this result would happen if...,” already suggests an underlying assumption as well as potential candidate measures, e.g., some quantity that can be measured during experimental outcomes. The point is that a hypothesis is required when designing a formal experiment. Given a hypothesis, the experiment almost “designs itself” because it is then mainly concerned with accepting or rejecting the preliminary hypothesis, if it is stated with sufficient precision”.

More formally, an experimental design is often drawn from the formulation of a null hypothesis (H_0), i.e., a statement predicting no difference in measured results collected between two (or more) sets of data obtained under different conditions.Hence, no effect is expected. The point of the experiment then is to reject the null hypothesis,
showing that results are highly unlikely if the null hypothesis is true, thereby providing support for the alternative hypothesis. A classic example that is familiar to most people is that of a new drug being tested. The null hypothesis states that the drug has no effect, or more specifically, its effect is no different from a placebo (a sugar pill that is known not to have any effect). Establishing the hypothesis immediately suggests a logical course of action: how to administer the drug, and what to measure.

A theory is an organized set of concepts that explains a phenomenon or set of phenomena providing support for the alternative hypothesis. For Step 3, researchers rely on the scientific method toput their hypotheses to the test. The scientific method is a general set of procedures for gathering and interpreting evidence in ways that limit sources of errors and yield dependable conclusions.
More formally, the treatment being manipulated or changed in value is referred to as the Independent Variable, or IV. All other variables are held constant (or attempted to be held constant; variables outside the experiment’s control affecting the measured outcome may confound the outcome and are known as confounding variables). Whatever is being measured (e.g., reaction time) is usually whatever is expected to be affected by the IV, and is known as the Dependent Variable, or DV. That is, the DV depends on the manipulation of the IV [23].

“More specifically, the experimental approach to test the influence of one (or more) independent variable (s) manipulated on one or more dependent variable (s) measured, all by better controlling other factors that may affect the dependent variable (s), has been adopted. We chose this method because "the essential aim of the experiment is to measure cause-and-effect relationships"

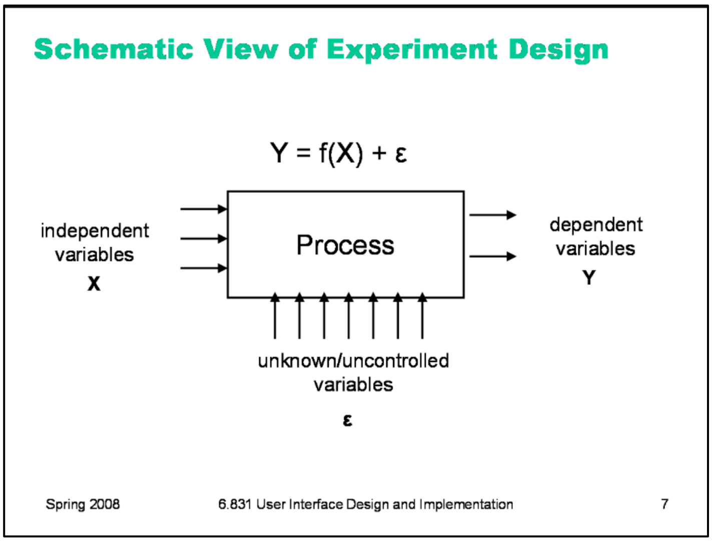


Figure 33 - Schematic view of experiment design

An experiment is a particular form of study where, in general, all possible causes of variation in the effect being measured are eliminated except the one influence under investigation. The general rule of thumb is to vary one thing while keeping everything else constant. Ensuring that all other conditions are equal except the main effect suggests gaining control of the experiment. This is the key concern of experimental designs: how to ensure that only one condition is varied and all else is held constant.

The degree to which conditions are controllable will determine the type of experiment (or nonexperiment) being conducted. There are a few different dimensions that specify different forms of experimental designs, including:

- Experiments versus observational studies
- Laboratory versus field research
- Idiographic versus nomothetic research
- Sample population versus single-case experiment versus the case study

3.1.1 Experiments versus observational studies

"The distinction between experiments and nonexperimental observational studies revolves about the manipulation of an independent variable. Observational studies are generally made by observation without manipulation of an IV (e.g., consider gender as an IV; it cannot be manipulated). Being able to manipulate an IV is generally a prerequisite for the design of an experiment. Furthermore, in the interest of replicability, experiments often follow a standardized procedure. Variables, independent and dependent, need to be strictly defined, procedures undertaken during experimental trials need to be detailed, and results from analysis must be effectively reported.

Most research papers follow a fairly similar format, partially so that other researchers can reproduce their experiments and (it is hoped) replicate their results. This format often includes [24]:

1. Hypothesis: the null or alternative hypothesis, with theoretical justification for any given assumptions.
2. Design: which experimental design is ultimately chosen, is it a nonexperimental observational study, or if an experiment, what are the IVs and DVs, and how are participants grouped, if at all (e.g., within-subjects or between-subjects; see below).
3. Participants: the number of participants in the study, with demographic data such as age ranges and gender distribution (all reported anonymously).
4. Apparatus: the devices used; in eye tracking studies, one generally reports the operating characteristics of the eye tracker including its underlying mechanism (e.g., video-based,

combined pupil–corneal reflection), accuracy (e.g., 0. 5◦), sampling rate (e.g., 50 Hz), operating range (e.g., 50 cm), and whether any other auxiliary devices such as chin rests are needed.

5. Procedures: essentially what is told to participants prior to and following their experimental trials; is there any training or instructions (usually read from a script), what type of calibration is used, etc.
6. Tasks: what do the participants actually do? Task definition is particularly important, more so for eye tracking studies because eye movements are known to be task-dependent (gaze is simultaneously bottom-up, stimulus-driven as well as top-down, goal-oriented).

3.1.2 Laboratory Versus Field Research

Conducting an experiment in the laboratory can often allow greater control over experimental conditions than what can normally be achieved in the field. Control is probably the chief reason for holding experiments in the laboratory.

For eye tracking research, equipment often dictates pragmatic constraints such as whether the experiment needs to remain in the lab or whether the eye tracker can be used out "in the field". With increasingly smaller and more portable equipment, eye tracking experiments need not be confined to the lab. For example, table-mounted eye tracking equipment can be fairly easily transported and with a laptop experiments can be conducted "on-site".

3.1.3 Idiographic Versus Nomothetic Research

This distinction pertains to the study of an individual (idiographic) versus the study of larger populations. Generally speaking, beyond clinical evaluations of individuals, or evaluation of custom-built solutions, eye tracking studies seek to uncover similarities of viewing patterns of large groups of viewers (e.g., over art, or computer-generated scenes), even though variability and task-dependence of eye movements are widely acknowledged.

3.1.4 Within-Subjects Versus Between-Subjects

Of the many experimental approaches available, the two most likely methods of collecting data from groups is either via a within-subjects (repeated measures) or via a between-subjects design. A within-subjects design uses one group of participants and tests them under all treatment conditions. A between-subjects design uses different groups of participants, where different treatments are assigned to different groups.

Care has to be taken to avoid accidental homogeneity of groups, e.g., testing two groups where one group is entirely male, the other entirely female, introduces gender bias into the results. Random assignment may not attenuate participant variability fully, however. Other strategies for group assignment involve prescreening of participants, and/or targeted assignment by representation. The former involves some form of participant assessment, e.g., questionnaire or pretest."

	Between	Within
Pro	Data can be analised for linear regression	Easier Less time to execute
Contra	Need time to executr	No advanced data analysis

Table 3 - Within vs Between

3.2 Research question

As already explained in the previous chapter, the applications of the eye-tracker are manifold.
This research tool has a lot of potential, but for effective use it must be used with a certain goal in mind, in order to find a correct methodology for data interpretation.
At the same time scientific research requires focusing on a specific issue.
After several comparisons between me and the prof. Droulers, after having had an overview on the issues already dealt with in the scientific literature, Prof, Droulers has allowed me to analyze a topic so far not specifically addressed in the literature.
The subject concerns packaging. One wonders if and how a horizontal or vertical packaging can influence the consumer's perception of the product and how.

3.2.1 Why

Several firms have chosen to have, on their food products packaging, the main information (brand, product image, promise ...) not on a single "face" (facing) as is usually done, but on two faces. The information is then presented concomitantly on one side of the packaging vertically and on the other side horizontally. The aim of this experiment study is to measure the influence of a horizontal *versus* vertical arrangement of information on packaging, on the one hand, on visual attention and, on the other hand, on the perception of the qualities of the display through measures of visual complexity, perceptual fluency and perceived variety.

3.2.1.1 Vertical packaging vs horizontal packaging

- **Horizontal packaging arrangement** means a package of a product where the width is larger than the height.
- **Vertical packaging arrangement** means a package of a product where the width is smaller than the height.

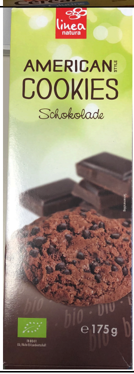
Horizontal			
Vertical			

Table 4 - Horizontal vs vertical arrangment

In addition there are products that have both a horizontal and vertical facing. In the GDO, an example is represented by some types of biscuits. Following are some examples

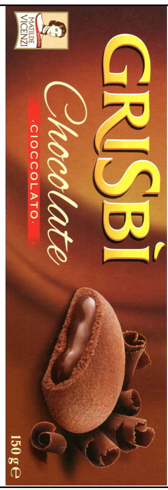
Grisbi biscuits		
Biocoop biscuits		
		

Table 5 - Real packagings woth both H and V arrangment

As already mentioned, the experimental protocol provides for the formulation of research hypotheses. In this thesis the horizontal orientation of the packaging, horizontal packaging layout and horizontal (packaging) arrangement are used as synonyms. The same applies to vertical orientation of the packaging layout and vertical packaging and vetical (packaging) arrangement.

3.2.2 Literature review

Although no one has previously conducted an experiment comparing these horizontal sets with vertical sets so explicitly, in the scientific literature it is possible to find examples of nearby studies, which investigate shared themes, such as verticality, the disposition in space, the relationship between verticality and brand, etc.
A brief summary is presented below, while for further details, see the appendices.

Chandon et al[30] tested four horizontal position conditions (far left - left center - right center - far right) and four vertical position conditions (top of the shelf - two intermediate levels - bottom of the shelf) for current consumption on visual attention, brand evaluation and choice. In the case of the horizontal orientation, they show that there is no significant difference in attention or assessment of the marks for the products at the ends of the shelves (on the left or right side of the shelf). On the other hand, the products were more watched and more re-examined when they were positioned in the center of the shelf. These were also the most chosen products. The results of the work of Atalay et al. [31] go in the same direction. These authors tested a layout of three products on a horizontal shelf on attention and choice. They showed that the middle product was both the most watched and the most chosen and described this result as a "horizontal centrality" effect. The attention being the mediator of the effect of the position of the product on the choice. These observations are consistent with psychology that shows that central fixation on a stimulus is the best way to extract the maximum amount of information from the stimulus. This effect is termed "central fixation bias" [32]. However Valenzuela et al. [33] relativize the effect of horizontal centrality by showing that the product of the center is not systematically the most observed if one manipulates the information given to the consumers concerning the organization of the ray. According to their study, in the case of an organization of the radius "according to the expectations of the consumers", the effect of horizontal centrality is confirmed. On the other hand, in the case of an organization of products "by region" (wine case), whatever the place of the products, they are as likely to be chosen by the consumers. Finally, Deng et al. [34] have shown that a horizontal arrangement of products on a shelf favors ocular saccades (rapid movements of the eyes between two fixings) horizontally, and a greater number of fixed options per second, thus a better treatment of the linear than vertical layout.

The vertical schema effect

In the study by Chandon et al. [30] on the vertical layout of products, the best positions in terms of attention are located at the middle shelf and the high shelf. However, greater attention to certain products on a vertical axis does not systematically lead to a better evaluation of these products. These authors show that only products on the high shelf are better evaluated. In the case of a vertical arrangement of the products, the evaluations are therefore directly influenced by the level of the shelf on which the product is placed. Valenzuela et al. [33] suggest that consumers share diagrams of how retailers place brands on shelves: in the middle, popular brands and brands of retailers; in height, premium brands; and at the bottom of the shelves, the cheapest brands. These presuppositions, which are not always verified in the field according to the Valenzuela et al. [33], strongly influence how consumers view, evaluate and choose products.

In the end, the two types of orientation of the products on the shelves (horizontal versus vertical) influence the visual behaviors, the evaluations and the choices of the products in a differentiated way. It is however, in these studies to compare the same products but arranged differently on the shelves. By extension, the research question that we propose is the following: does the horizontal versus vertical orientation of information on packaging facings influence visual attention, evaluation and choice?

Below is a summary of the main publications whose themes related to the experiment.

3.3 Research hypotheses

The aim of this exploratory study is to measure the influence of a horizontal versus vertical arrangement of information on packaging, on the one hand, on visual attention and, on the other hand, on the perception of the qualities of the display through measures of visual complexity, perceptual fluency and perceived variety.

The orientation of the packaging layout influences:

- perception of complexity
- perception of variety
- attractiveness
- processing fluency
- choice satisfatction
- difficulty choice

So at this point the research hypotheses can be formulated:

Hypothesis 1: the attention to horizontal and mixed is higher than the attention paid to vertical sets

Hypothesis 2: in mixed sets, the attention paid to horizontal packs is higher than the attention paid to vertical packs

Hypothesis 3: according to the composition of the set, the attention is greater in the vertical sets than the mixed ones.

Hypothesis 4: In the vertical sets, the attention, measured in number of fixations, revisists and fixation time is greater for the packaging on the right.

Hypothesis 5: for horizontal sets, the attention, measured in terms of fixation court, revisits and fixation time, is greater for the sets that are in the upper part of the screen compared to those found in the lower part.

The first 6 hypotheses will be confirmed or denied using eye-tracing. For the remaining ones the data of the questionnaire are used.

3.3.1 Formalizing concepts

How to formalize the concepts of complexity, attention, attractiveness?

- **Attention**: the attention is formalized and measured, thanks to the tracking, as the number of total fixations (FC = fixation count) and the duration of fixations (FT = fixation time). If the number and time of fixation is greater, then the focus is greater.
- **Processing fluency:** If the number of revisists is greater, then processing fluency is lower
- The **detectability** of a packaging is determined by the time of entry into the zone in milliseconds (ET).
- The **interest in the packaging** is indicated by the number of ocular fixations in the area (FC), the duration of fixations in the area in milliseconds (FT) and the number of revisits in the area after the first pass (R).

Indipendent variables (IV)	**Dependent variables (VD)**
Orientation: • Horizontal (H) • Vertical (V) • Mix (M)	Complexity Attractiveness Processing fluency Choice satisfaction Choice difficulty

Table 6 - Indipendent and dipendent variable of the experiment

In the next chapter the implementation of the experiment is described

4. Experiment design

4.1 Method

To answer the research question, the experiment conducted was of type **within**. This means that all the participants were subjected to the same experimental stimuli.

It has been decided to use a within-type experiment for two main reasons:
- execution of the experiment takes less time
- data are easier to handle.

A type experiment would have provided more detailed answers, but required more resources. This type of choice (which is actually the most used in experiments of this type) can not be compatible with a master degree thesis, but requires greater concentration with a PhD thesis.

For reasons of simplicity, it is important to underline that the study is not performed on the single packaging, but on the overall presentation set (horizontal, vertical, mixed). Sets with different facing and ocnforntati are compared.
A survey on individual packaging would have required too much time.

4.2 Partecipants

A review of the literature found that the number of participants employed in experiments mobilizing an eye-tracking system was variable, ranging from about ten subjects to about 70.
It is necessary to have more than 70 participants for the experiment as some data of a participant could be illegible or unusable, both on the right eye and on the left eye.
So the sample consisted of 73 participants (54 women) aged 21 to 47 years (mean = 26.25 and standard deviation = 5.62). Forty-three participants were employed and 30 were students. All participants had normal vision (possibly corrected) and voluntarily participated in the study without receiving compensation.
Each participant was asked not to discuss the experiment with those who had already taken part. These to try to get more pure data.
For the same reason, the research question of the experiment (in my case effects of the horizontal arrangement with respect to the vertical provision) should not be communicated in any way to the participants and should not be easily understood by the experiment.

In order to participate in the experiment there are no particular prerequisites: it is sufficient to have a good view and to know the French language to understand the instructions.
The girls are asked to come without mascara as this can interfere with the detection of eye movements.
Glasses are generally not a problem in data acquisition, unless you have very thick lenses.
Monocular visions are not a problem because data is recorded for both eyes and only those with eye (usually the right) are used to be processed.

4.3 Stimuli

Experiments of this type can be carried out on different categories of products, provided they are contained in packaging suitable for the experiment.

In my case it was decided to use cookies, as they are a product known and consumed by an etrogenic population (young people, adults, men and women). Moreover, in supermarkets, there are many brands and categories of this product, especially in France.
In the food outlets, products of this category have been found quite frequently in recent years, presenting information arranged horizontally or vertically. A selection of 24 packagings was made, 12 horizontal and 12 vertical for 24 different brands. The selected products had a standard format (a rectangular cardboard box) typical of the category. In order to control the effects due to the brand, only brands that are little known in France have been chosen (brands distributed in specialized stores or in other European countries).
Two assortments of four horizontal packagings, two assortments of four vertical packagings and two mixed assortments comprising two horizontal packagings and two vertical packagings were constituted by checking the surface of each packaging which should be identical)

In experiments we want to be as close as possible to reality.
As a consequence the proposed assortments are heterogeneous and the chosen pakaging are existing in reality.

In the choice of visual stimuli there are three solutions:
- visual stimuli from reality
- visual stimuli created for the experiment, not existing in reality
- elaboration of real visual stimuli and adaptation to the experiment.

In my case it we decided to take packaging of products present in reality and to modify them where necessary, to obtain homogeneous sets. It is preferable to work with truly existing products as they give greater reality and concreteness to the experiment.
The packaging used is part of a database of ordered and cataloged food products, accumulated during years of travel and research.
Each packaging was subsequently scanned in its 6 faces, cataloged according to the variables of interest (orientation, product category, subcategory).

Real packaging	**Modified packging for the experiment**
	

Table 7 - Real vs modified packaging

As you can see, the image has been replaced by two to a cookie to make it homogeneous with respect to the others in the set.

Why 4 packaging for each set?
Why 2 sets for each type?

4.3.1 Homogeneity of the set

To minimize any distortion of results, the packaging within the same set must be the most homogeneous from a structural point of view.

There are many types of biscuits. First of all, each set is heterogeneous by type of biscuits. In fact, the types used in the experiment are:

- petit beurre
- palet
- petit beurre au chocolat
- cookies with chocolate chips
- chocolate cookies with chocolate chips
- dolcetti

Structurally, the packaging is composed of the following elements:

- image
- brand (image, logo or both)
- where present, quality logo (biological and French provence).

For the logo, homogeneity is about size and position
For the image concerns the position, size and number of elements. in fact it has been shown that a number of elements represented may influence the choice of the product (add reference article)
For quality logos, they must all be of the same size, preferably in the same position and in the same shade of green.
Moreover, if an element of the set has particular characteristics (for example "product suitable for celiacs" or "without palm oil"), the same characteristic must be present and visible also on the packaging of the other elements of the same set.
In addition, there should not be too many differences in colors and style between the different packaging of the same set.

The choice of stimuli is of fundamental importance for the design of the perimeter. If the principle of homogeneity is not respected, the study loses its scientific importance because there is too much dispersion on the data.

4.3.1.1 Price

One of the variables that has not been introduced for each product is the price.
It has been chosen to proceed in this way as price is one of the main factors of choice in a product (add literary references).
The price would have increased the perception of heterogeneity within the set by introducing a bias on the study of data.

4.3.1.2 Brand

As products are really existing and distributed in department stores, one wonders if the brand can influence the perception and the choice of the product.
As is well known, in fact, in the purchasing processes the brand plays a very important role (add bibliography).
If the brand is removed, the reality of the experiment is reduced. If you use known brands, you introduce a distortion element.
What to do? The choice was to use lesser-known brands (in France), not present in the GDO, in order to mitigate the branding effect.
In the cases of packaging interesting for the purpose of the experiment, whose title was too well known, it was decided to substitute for a less known or fancy one.

4.3.2 Stimuli sets

Each set corresponds to a category of biscuits:

- Horizontal (H)
  - H1: petit beurre nature
  - H2: palets

- Vertical (V)
  - V1: chocolate cookies
  - V2: cookies

- Mixed (M)
  - M1: petit beurre au chocolat
  - M2: dolcetti

Assortiment Horizontal_H1

Assortiment Horizontal _H2

Assortiment Vertical_V1

Assortiment Vertical _V2

Assortiment Mixte_M1

Assortiment Mixte_M2

Table 8 - Stimuli

4.3.2.1 How many facing ?

Another aspect to decide was whether to put one or two faces for each product.

2 products X 2 facing	**4 product x 1 facing**

In the reality of supermarkets, for each product there are 2 facing.

Using 4 products per set, this would have meant 8 packaging in a Dell de 48 "screen (48.7 cm x 27.4 cm). To display all the elements on the screen, this would have to be very small, therefore difficult to view. The alternative could be to use only two products per set, with a facing of two packaging. As a result, 4 elements.
With Prof. Droulers we have long debated this aspect, analyzing the pros and cons of any eventuality. If it is true that a facing for each product is more distant from reality, it is equally true that choosing between only two products provides a poorer quality of data.

4.3.3 Experiment language

Being the participants of the experiment purely of French origin, it was decided to conduct the whole experiment in French.

4.3.4 The room laboratory

The experiment took place in the experimental room of the Institut de Gestion de Rennes. Each participant was individually welcomed by the experimenter and only the subject and the experimenter were present in the experimental room during the entire course of the protocol.
In order to ensure sufficient comfort for the participants and not to disturb the progress of the experiment, the experiment room had several characteristics:

1. It had reinforced soundproofing so that external noise was limited (a sign indicating that "an experiment is in progress" was also systematically displayed on the door),
2. It was of a neutral color and devoid of any decorative element likely to attract the eyes of the participants,
3. The data acquisition laptop and the experimenter were out of sight of the participants,
4. The seat used for the participants was comfortable and adjustable in height so that the participants could position themselves comfortably in front of the stimulus projection screen and that the experimenter could precisely place the participant according to the technical constraints of the eye-tracking device. .

Figure 34 - Eye tracking laboratory

Figure 35 - Eye-tracking laboratory door

4.4 Eye-tracking equipment

The experimental passes took place from January and Febraury 2018. The assignments always started with the installation of the eye-tracking device. The eye system tracking is composed:

- of the device itself (eye-tracker), model RED 250 of the manufacturer SMI (SensoMotoric Instruments, Teltow, Germany),
- a presentation screen of the stimuli Dell 22 inches (30 cm X 48 cm)
- a Dell laptop allowing both sending stimuli on the presentation screen ("extended Windows" configuration) and data acquisition.

The stimulus presentation screen was positioned in front of the participants' seats. The eye-tracker was positioned in front of the stimulus presentation screen ("stand-alone" installation) 22 cm away from the screen with an inclination angle of 20 °. Information about the dimensions of the stimulus presentation screen, the positioning of the presentation screen and the positioning and tilt angle of the eye-tracker were then entered into the iView X software so that the system can accurately position the eye movements of the participants (see Figure 36).

The eye-tracker and the stimulus presentation screen were then connected to the data acquisition laptop. The sampling frequency of the eye-tracking system was set at 250 Hz, that is, the participant's eye position was recorded 250 times per second, one measurement every four milliseconds.

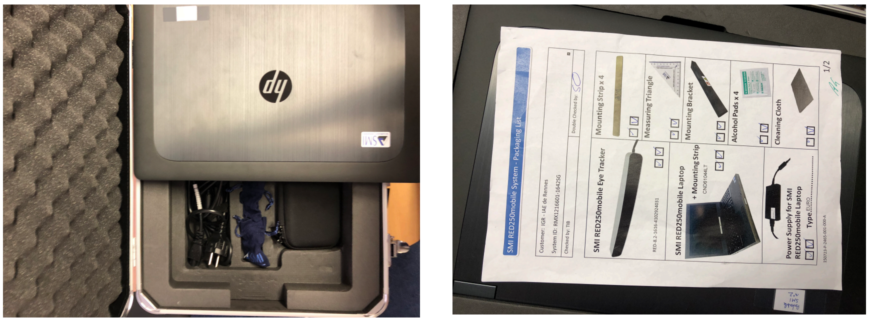


Figure 36 - Eye-tracker equipment used during the experiment

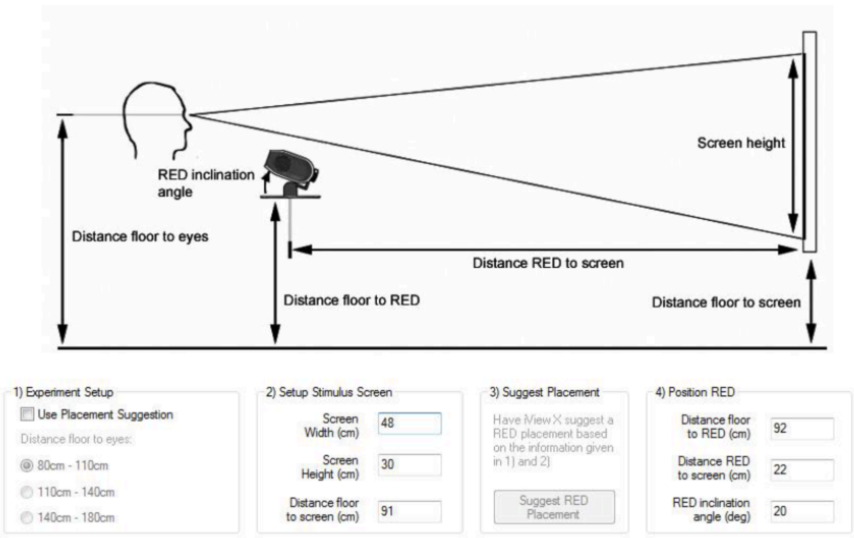


Figure 37 - Correct positioning in using eye-tracker system

4.5 Implementing and recording the experiment : Experiment Center

Experiment implementation software is called Experiment center. All stimuli are inserted in a well-defined order in the analysis software.

To show deliveries and stimuli to the participant, it is as if slides are projected: each slide consists of a pdf or jpg format file loaded in the overall experiment.
For each stimulus is indicated:

- the source: name and type of the document
- if the duration is pre-established or is manual (sending forward with the space bar)
- if the participant's response (his scan path and all related information) must be recorded.

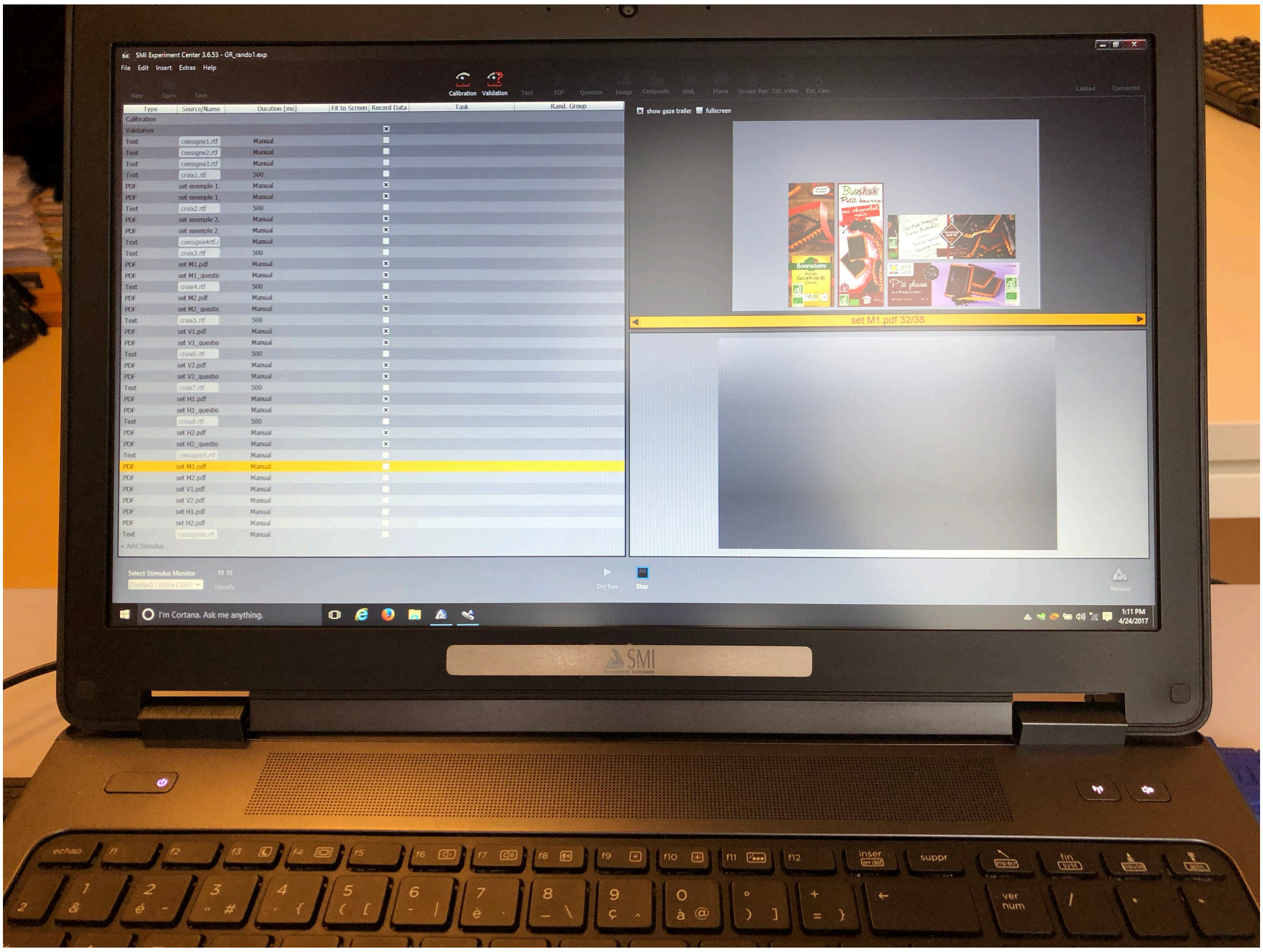


Figure 38 - experiment center software

4.6 Procedures and measures

1. welcome the participants
2. calibration of the eye-tracker
3. eye-tracking experiment
4. questionaire
5. conclusion

4.6.1 Welcome the partecipants

The procedure of reception and handover was identical for all subjects. Each participant was first welcomed individually by the experimenter and taken to the experimental room. The experimenter then introduced the eye-tracker and invited each subject to ask him any questions he / she wanted about the device. The general run of the experiment was then presented to the subject. In the calibration and test phase the participant and the examiner can integrate: if the participant has doubts, he can ask questions. The examiner asks if the participant is at ease and needs time.

Experiment information is recorded in a log: date, experiment location, experiment name, participant name and his / her contacts.

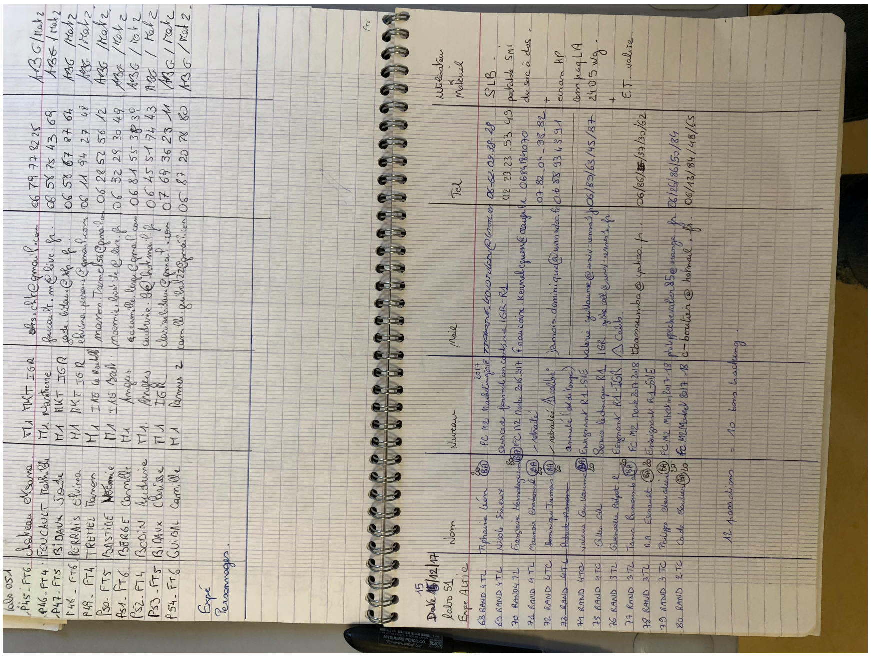


Figure 39 - Attendance register

Deliveries for the participant are shown on a monitor. In order to advance in the experiment, it is essential to press the space bar

4.6.1.1 Sitting in front of the eye-tracker and positioning

After this first step, the participant was installed in front of the eye-tracker, at a distance of about 70 cm from the camera (92 cm from the screen), which ensured a good recording of the eye data and comfort satisfactory visual vis-à-vis the screen for the subjects. A green band under the eyes of participants displayed on the data acquisition screen confirmed to the experimenter that the participant was well positioned vis-à-vis the eye-tracker.

Once the participant was well positioned, he was asked to limit his head movements so as not to disturb the recording of eye data (he was nevertheless informed that the system could withstand small movements of the head). The experiment was then launched via the Experiment Center stimuli presentation software.

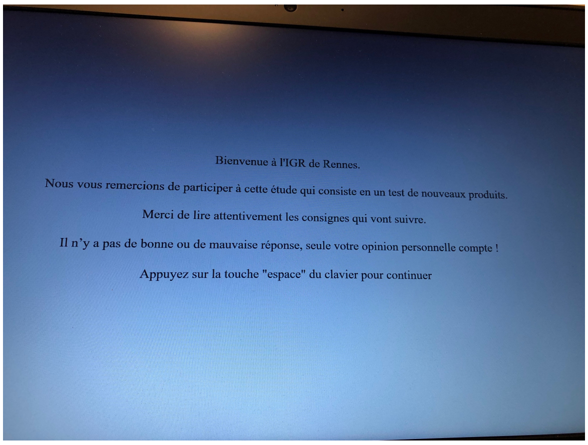


Figure 40 - Welcome screen 1

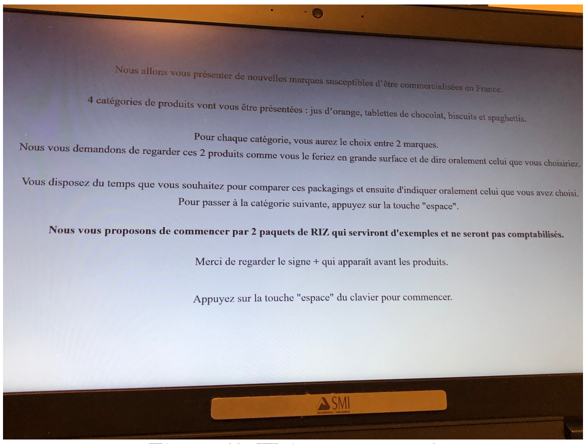


Figure 41- Welcome screen 2

4.6.2 Calibration

The calibration consisted, for the participant, in following and setting successively five reference points delimiting the plane within which the stimuli were to be presented. The purpose of this calibration procedure is to provide the eye-tracking system with examples of pupil center positions and corneal reflection of each participant; these two positions being the reference points used by this system to track eye movements.

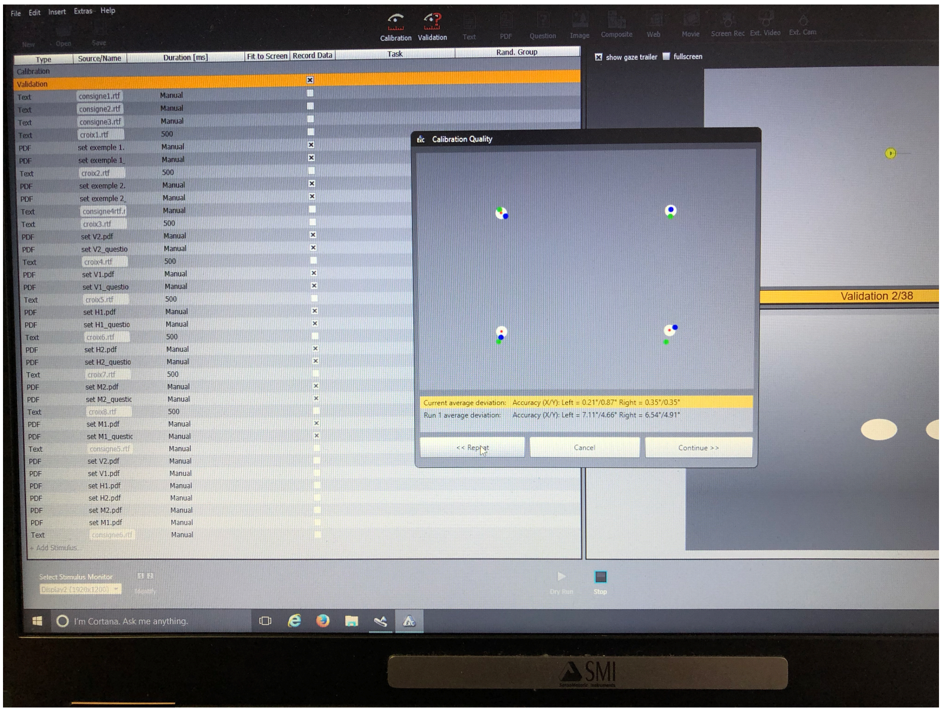


Figure 42 - Calibration

In order to obtain good quality eye data, it is recommended that this calibration deviation value be less than 1 °. If the average difference observed was less than 1 °, the calibration was accepted. If not, the participant was asked to repeat the calibration procedure until a satisfactory calibration was obtained.

4.7 The begin of the experimental phase

Once the calibration phase was accepted, the experimenter no longer interacted with the participant until the end of the experimental phase mobilizing the eye-tracking device. All protocol instructions were written. The reading time was controlled by the participant who had to press the "space" key on the keyboard to go to the following pages.

4.7.1 First fixation control

The experimental phase began with a welcome slide introducing the experimental scenario according to which this study consisted of a test of new products. The following instruction then indicated to the participant that he was going to see a set of 4 packages of chocolate and that he would be asked to indicate on the next page his level of appreciation.
Before the presentation of each packaging, a fixing cross - consisting of a + sign in the middle of the screen - was displayed and the participant had to fix this cross for 500 ms for each packaging to appear. The purpose of this procedure was to control the position of the first fixation so that it was identical for all participants. Indeed, although the influence of the position of the first fixation on the choice of the product has not been demonstrated [26], the fact that very little research has been conducted on this topic has led us to prefer to control this element which could be a source of possible uncontrolled variance.

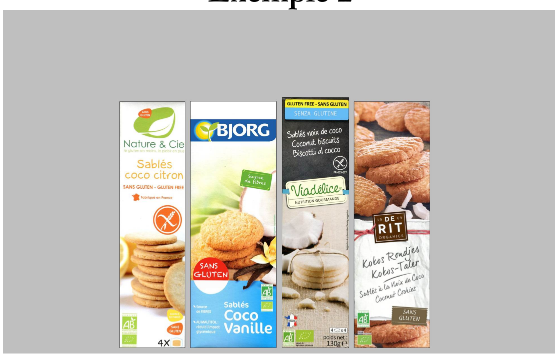
4.7.2 Test

In order to show the participant the procedure of carrying out the experiment and to familiarize them with the eye-tracking system, two examples of sets are shown where asked to participate in choosing the one they prefer.
Because most of the subjects are not familiar with the eye tracker, it was decided to mention two introductory examples, not one.
The products chosen for the test are biscuits from the "sablé au coco" and. It should be noted that the packaging of its sets does not respect the condition of homogeneity within the single set. In this phase it is important to understand the task for the participant, and not to have respected the condition does not compromise the veracity of the experiment in any way.
Below are the two examples used.

Exemple 1

Exemple 1

Exemple 2



Exemple 2

Figure 43 - Examples

Once the calibration and testing phase is complete, the participant and examiner can no longer interfere. The participant is required only to announce the number of the chosen packaging orally in order measure the attitude towards the product.
L'esaminatore annota nella prima pagina del questionario le risposte dell'esaminatore.

4.7.3 Randomization of the sets

The randomization of the display of the sets is not a necessary choice, but preferable to obtain the purest results. The same display order (eg horizontal, vertical and mixed) for each participant, could affect the purity of the data obtained. The presence of minimizes inaccuracies due to the repetition of patterns, but at the same time produces a larger amount of data to be analyzed.
The more radnomizations are performed, the more data there is to extrapolate, rearrange and aggregate for the next analysis.

The randomizations were carried out considering the 3 macro-groups:

- M = M1 + M2
- V = V1 + V2
- H = H1 + H2

Initially, six randomizations had been devised: MHV, MVH, VHM, VMH, HMV, HVM. Usually 20 participants are expected for randomization, so 6 are decidedly too much not only from the point of view of data complexity, but also in relation to the academic literature.
Finally, the 3 permutations were chosen:

- MHV
- HMV
- VHM

Then

- Random1 : M1 M2 H1 H2 V1 V2
- Random2: H1 H2 M1 M2 V1 V2
- Random3: V1 V2 H1 H2 M1 M2

The randomization of the two sample sets would not have brought any added value, so we chose not to realize it.

4.7.4 Max fixation time

Another important variable to be decided is the observation time: in some experiments with the eye-tracker you set a maximum time for the observation of the set and the answer is given in front of a subsequent slide, where the stimulus is not re-presented .
In other experiments, it is preferred not to fix a maximum ttime of observation of the stimulus and to let the subject free to choose according to his own time.
Since this implementation does not require testing the memory of packaging, it is beyond doubt that it would not make sense not to show it when choosing.
As regards the maximum time of fixation, we chose not to fix it because, in reality, if there is the desire to choose a product, the subject takes his own tmepo to observe and choose.

In the delivery it is emphasized that the subject who is facing the packaging set must push on the space bar only after making his choice.

On the following page the packaging associated with a number is re-proposed. This slide has the sole purpose of proposing a packaging-number association. It is not the page where the participant is making his choice.

It could then be natural to wonder why the user can not state his choice already in the first stimulus, but must press on the space bar and wait for the second stimulus.
This operation is first and foremost necessary in order to be able to measure all the information BEFORE the choice (fixation time, revisits, number of fixations).

Furthermore, it is necessary to wait for the second stimulus to obtain the packaging - number association.
It was decided to use a number to identify the packaging and not the brand because to maintain greater neutrality.

Stimuli choice slide

Slide after stimuli choice

Figure 44 -Stimuli choice and after stimuli choice

Here are the stimuli for the randomization number 1

M1

M1

M2

M2

V1

V1

V2

V2

H1

H1

H2

H2

4.8 The questionnaire

In the second part of the experiment participants are asked to fill in the questionnaire regarding the attitude towards the product.
Eye tracking is not used at this stage. The participants should express their perception for:

- variety
- complexity
- attractiveness
- simplicity of processing
- choice satisfaction
- choice difficulty

For each aspect to be investigated, more items are presented on a scale of 1 to 9 points.

The scales used for each item have a neutral element, they are interval scales, and obviously derive from the academic literature.
The scales have already been tested and have been translated from French into English with the opinion of a dual national teacher
It is of paramount importance that the scales retain the original meaning in the translated language. To overcome the linguistic problem, two ways can be followed:

- the first is to have the tradition certified by an academic committee and subsequently to impose the experiment
- the second consists in carrying out a translation from a competent person.

Since the first procedure requires a lot of time and resources, it was considered reasonable to proceed with the translation of the scales without recourse to the academic committee.
A bilingual lecturer (English-France) from the IGR was asked to be able to control the translation carried out.
In the meantime, you will be presented with an unico item, which will be presented to you as a single item, item number and variable number.
Below are the bibliographical references for the stairs used, in French and translated in English

Visual complexity (Cox et Cox, 2002) [27]	2 items, 9 points : • Cet assortiment est compliqué/ Cet assortiment est simple • Cet assortiment est complexe/ Cet assortiment est peu complexe Translation: • This assortment is complicated / This assortment is simple • This assortment is complex / This assortment is not very complex	r=0,95
Easy processing (Landwehr *et al.*, 2011) [28]	3 items, 9 points : • Selon vous, l'analyse / le traitement visuel de cet assortiment est difficile/facile • Si vous deviez vous représenter cet assortiment les yeux fermés, diriez-vous que cette tâche serait difficile/facile • Si vous deviez décrire cet assortiment plus tard, diriez-vous que cette tâche serait difficile/facile Translation • In your opinion, the analysis / visual processing of this assortment is difficult / easy • If you were to represent this assortment with your eyes closed, would you say that this task would be difficult / easy? • If you had to describe this assortment later, would you say this task would be difficult / easy	α=0,89
Perceived variety (Deng *et al.*, 2016) [29]	1 item, 9 points : • Cet assortiment offre une très faible variété de produits/ Cet assortiment offre une très grande variété de produits	

	Translation • This assortment offers a very small variety of products / This assortment offers a very wide variety of products	

On the last page, participants are asked to specify some biographical information.
The questionnaire is below.

On the last page, participants are asked to specify some biographical information.
Below is the questionnaire in English. The original the French language is present in the attachments.

5. Data analysis

5.1 Data axtraction

A lot of information can be obtained from the Eye-Tracker.
For each participant a registration is made, the registrations are divided by R1 R2 R3 randomizations. The data obtained are aggregated according to the type of randomization.

The data are imported into a software called BeGaze, which is part of the eye-tracking system.

Before analyzing data, the experimenter must first check the quality of the data and eliminate the poor quality data. Next, each stimulus must be "prepared" to allow the extraction of eye data.
The entire phase of data extraction (from quality verification to final extraction) is carried out via the BeGaze data analysis software (SMI).
There are two main sources of poor tracking quality:
1. The first is the loss of tracking. This occurs when the eye-tracker no longer detects the pupil center and / or corneal reflection of the participant and is therefore no longer able to follow the eye movements of the subject. These loses can be displayed in the scan path.
2. The second source of poor ocular data quality is tracking lag (see Figure 101). This can happen for two reasons: either an imprecise calibration at the beginning of the experiment (non-compliance with the average maximum deviation of 1 ° between the position of the calibration points and the position where the eye-tracking system located the eye-tracking system "lost" the two ocular reference points of the participant at the time of the handover and when he again detected the subject's gaze, he did not correctly reposition the participants' eye fixation, which resulted in erroneous eye tracking. BeGaze can correct offset eye trackings by applying a degree of correction to the ocular coordinates. However, in many cases, it is difficult to ensure the correct correction to be applied, which often leads to the elimination of participant data.

The extracted data are relative to both eyes. However, data from the right eye are usually used.
In the case where there are anomalies (missing data, obviously not incorrect: too high variance), data from the left eye are used.

5.1.1 Visual representation of data

BeGaze allows the visual representation of a part of the data.
The main representations are:

- heat map
- focus map
- scan path

5.1.1.1 Heat map

Heat map: a graphical representation, by a system of colors superimposed on the page, indicating the areas of the stimulus that have received attention. Areas that have received a lot of attention are shown in warm colors (ie, red and then yellow) and areas that have received less attention are shown in cool colors (ie, green then blue).

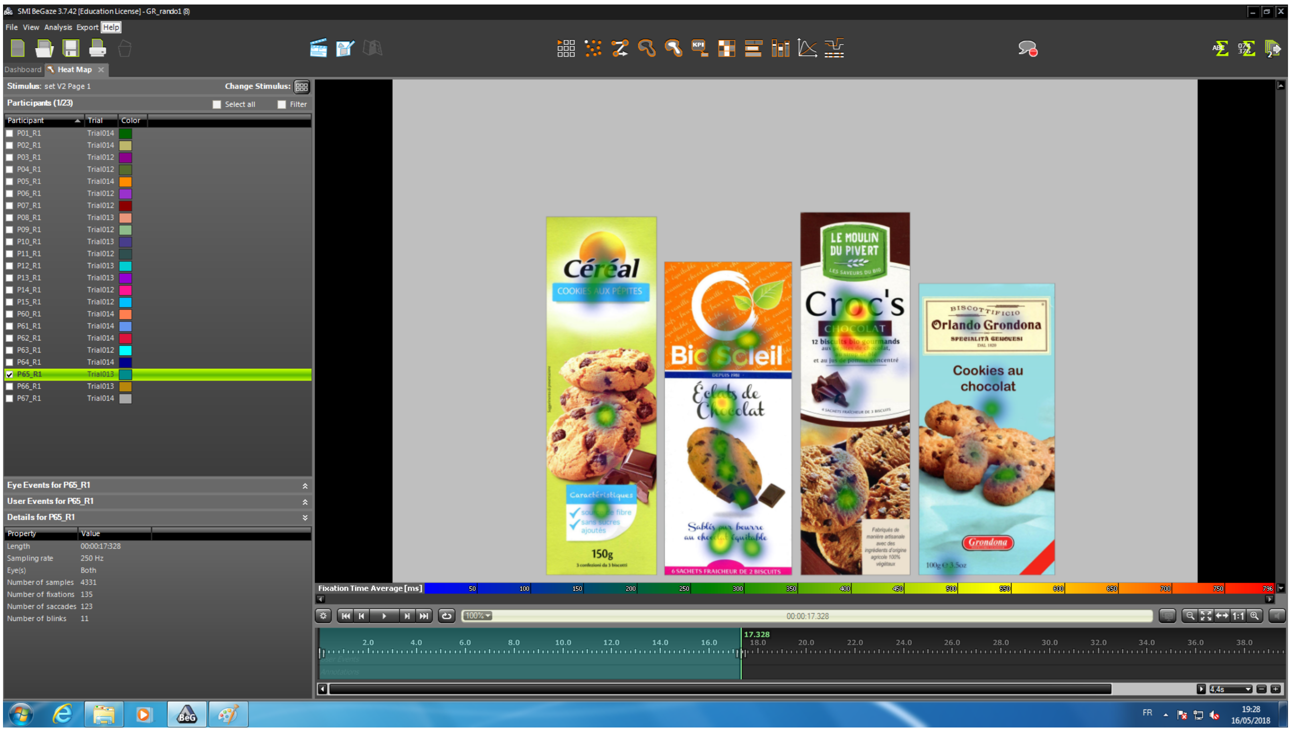
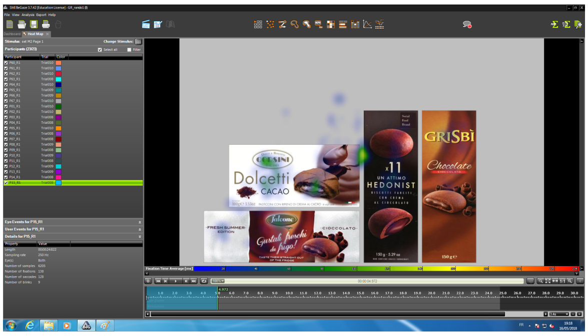
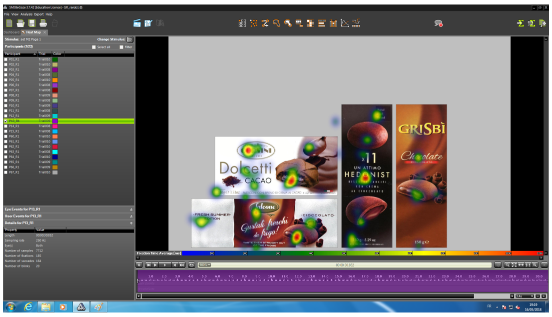


Figure 45 - Heat map

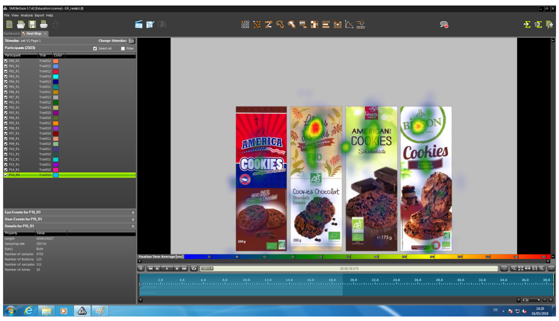
M1



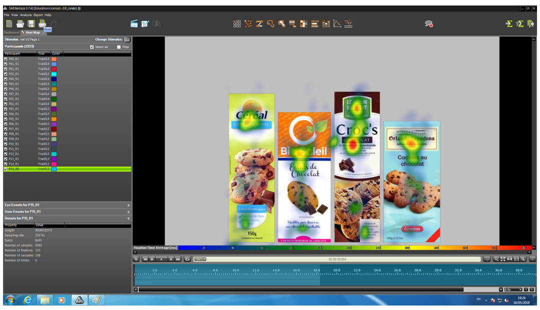
M2



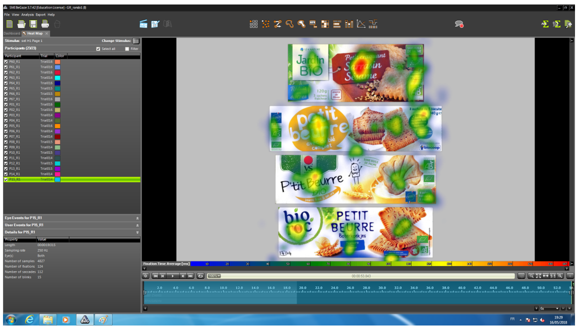
V1



V2



H1



H2

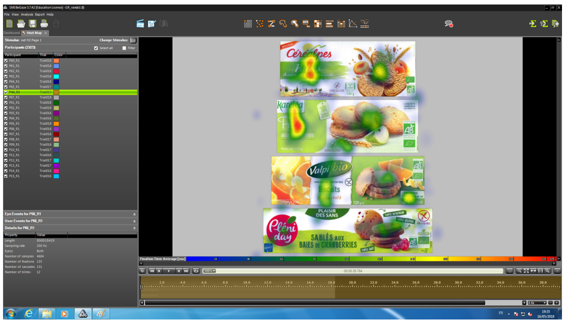


Figure 46 - Heat map of the sets

Since data is available for the duration of the recording, the heat maps can be obtained for every tenth of a second for each participant. The heat maps shown above for each set are the overall ones.
Each map is an average on the data of the participants (remember that maximum aggregation can be done at the randomization level).

The color represents the fixation time. It goes from a minimum time of 20ms in blue to a maximum of 240 ms in red. If the area does not have any color it means that the tmepo of fixation by the participant has been less than 20ms.

Analyzing the data from a qualitative point of view, it can be seen independently from the type of set, the fixation time is greater for the areas of the product name and for the pil brand. On the other hand, little attention is paid to the image, but this could be explained by the dimension: the big image does not need to be fixed for long to be received.

Attached are the heatmaps for each randomization for completeness.
For example, for the "petit beurre au chocolat" product set (mix set number 2), the following maps are obtained for the three randomizations.

R1

R2

R3

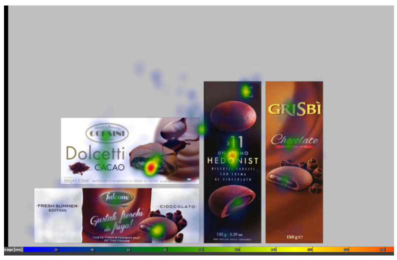
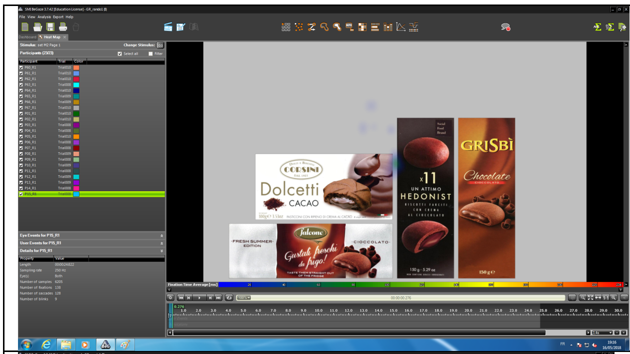
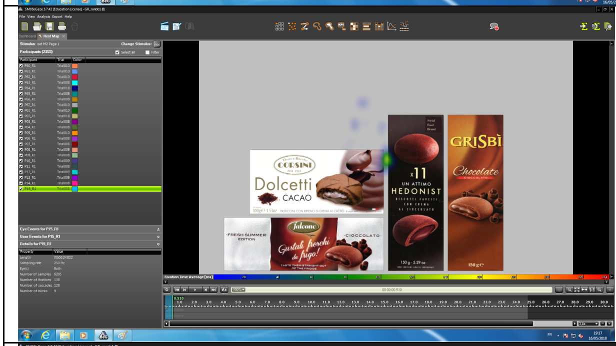
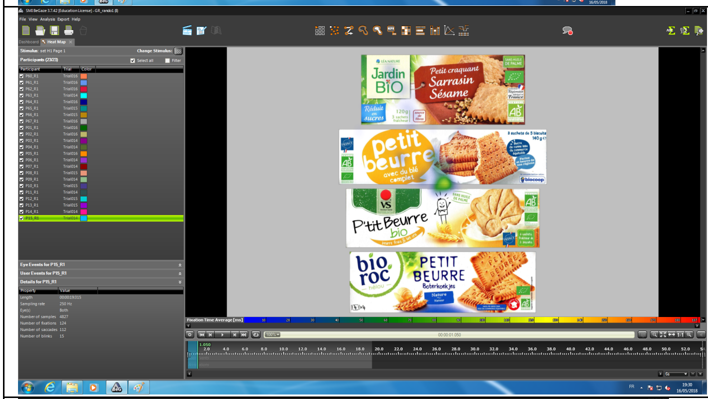
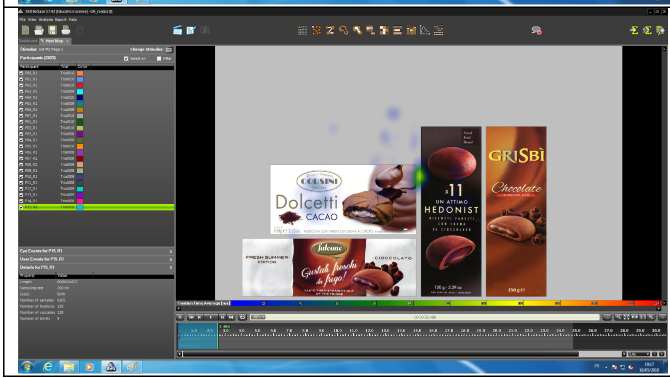


Figure 47 - Heat map o f the 3 random

It is easy to see that the three randomizations do not show great differences between them.

It is also possible to obtain hea tmaps for different moments: here is an example at 0.2 ms, 0.5, 1, 2.5, 5 et final

	**0,2 ms**
	**0,5 ms**
	**1 ms**
	**2,5 ms**

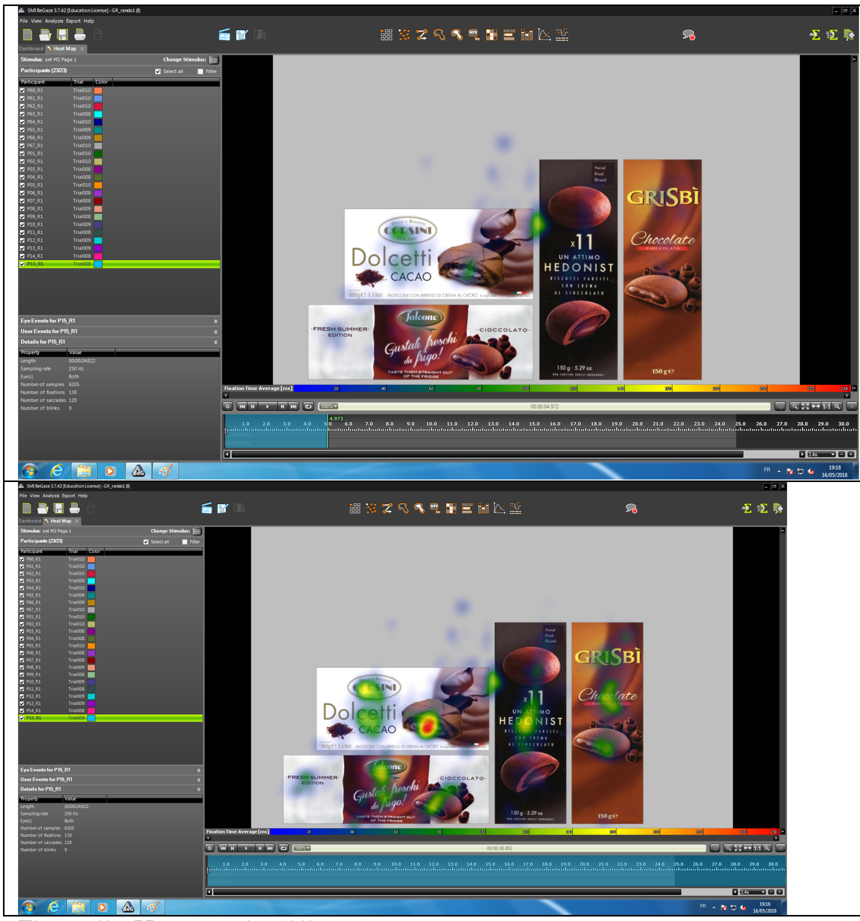


Figure 48 - Heat map for different moments

Initially, the fixed area is the central one, consistently with the insertion of the cross to uniform the initial fixation point.

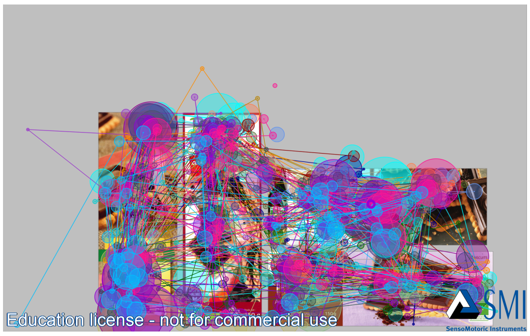
5.1.1.2 Scan path

Scanpath: the scanpath visualization generally represents this scanning path by symbolizing the ocular fixations by circles (whose diameter is greater or smaller depending on the duration of the ocular fixation) and the saccades by lines linking two successive fastenings between them. Crearly the number expresses the order of observation.

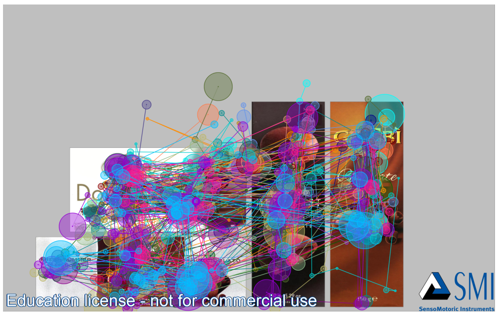
Similar to the heatmap, there are three, one for each randomization.

Figure 49- Example of Scan path

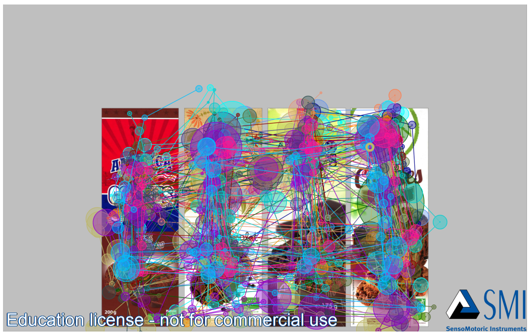
M1



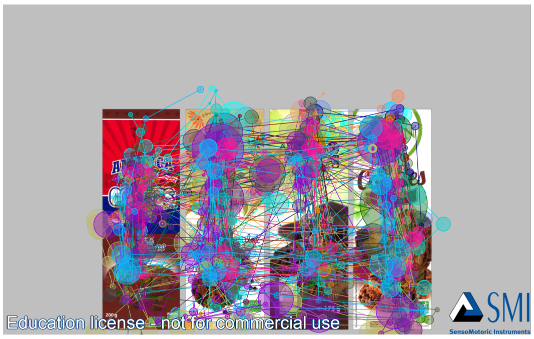
M2



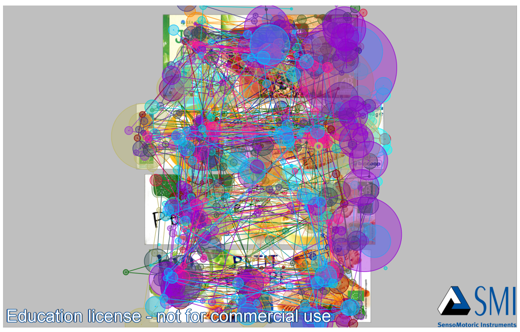
V1



V2



H1



H2

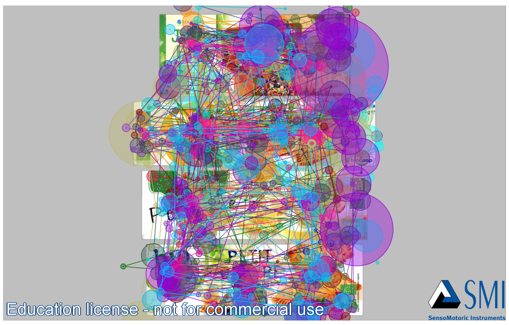


Figure 50 - Full scan path for each set, each participant

Creating a unique scam path for many participants does not lead to a clear reading of the information. Qualitatively, analyzing the individual scan path of the participants, it was suggested that there are some recurrent patterns, according to the literature.
After the central visualization, we have to shift our gaze to the left, because as a Western civilization we are accustomed to this sense of reading.
Heat map and scan path are the most used qualitative and visual tools.

5.1.1.3 Other visual data representation

There are also others less known and used for the analysis of date dell'eye-tracker.
these are:

Bee swarm: displays gaze fixation of respondents in the form of points that attract the most attention.
For R1

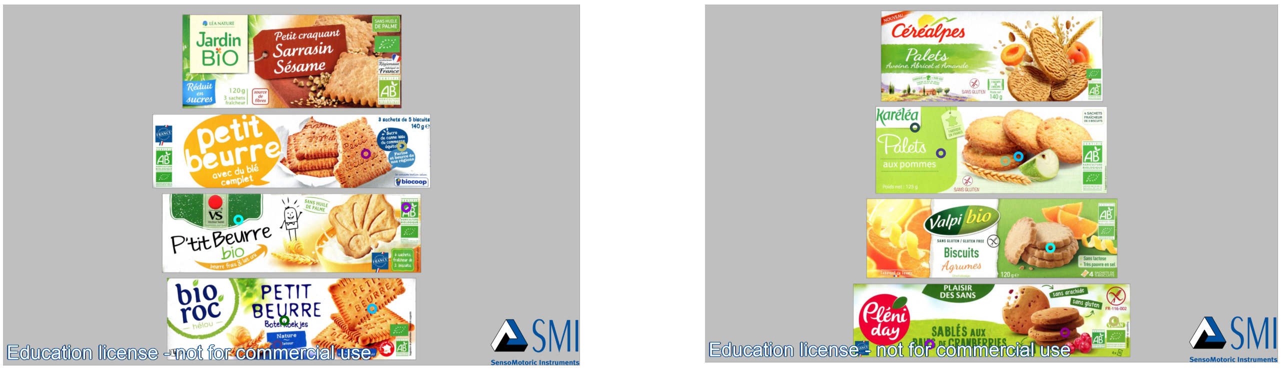
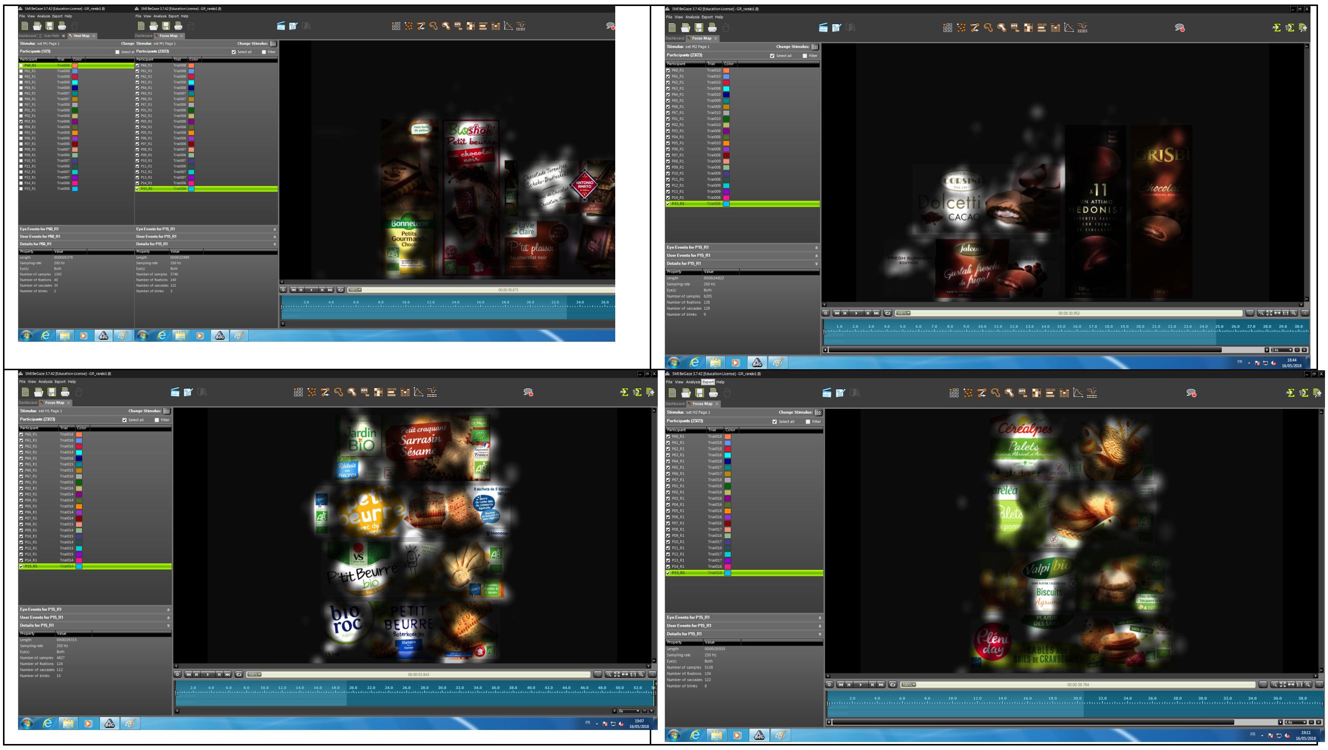


Figure 51 - Bee swarm for Horizontal sets, R1

Focus map: it's essentially the inverse of the heatmap. Only the zones of interest are shown, while the others are obscured.



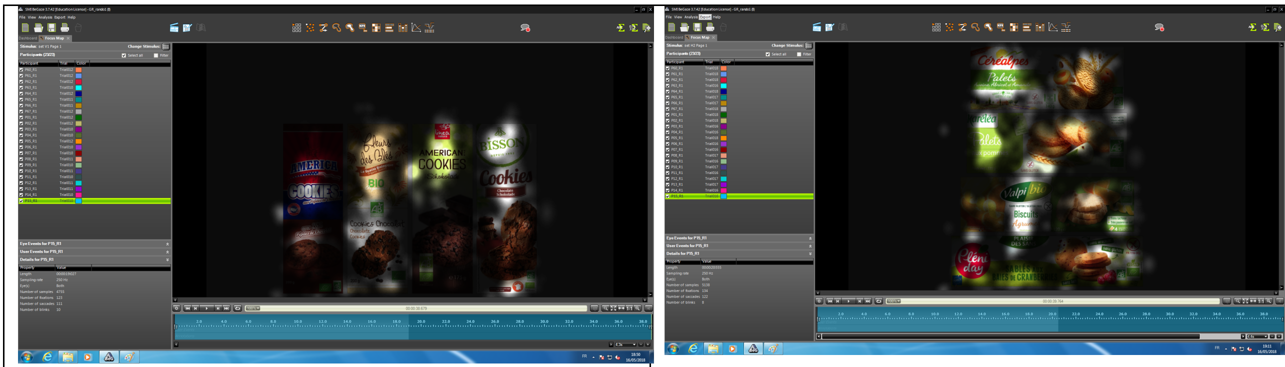


Figure 52 – Focus map for R1

For each set BeGaze also provides the main KPIs.

Figure 53 - Main KPIs

However, these representations, although clearly represented, are very general and do not allow to have much detailed information. For the purpose of my research question, significant answers can not be found. In this regard, the data must be processed using a statistical tool.

In the following chapter it is explained how.

6. Quantitative analysis result on ET

BeGaze is a good sotware for graphic representations and qualitative studies. However, the type of information that can be obtained from this software is not sufficient.
The data obtained from the eye-tracker must be exported and analyzed on a statistical analysis software (MatLaB, sSTAT, SPASS). In my case SPSS was used.
However, before the data can be imported into SPSS, the data must be prepared so that the photosoft can read the database.

6.1 Preparing the data before extraction

The first step to proceed with data extraction is the creation of Areas of Interest (AOI). AOIs are areas of interest for analyzing data that are drawn by hand. This means delimiting the regions for the analysis of each stimulus.
The software makes it possible to draw all the forms (rectangle, oval and free form consisting of a succession of points created by the experimenter) and thus makes it possible to marry all the forms (and in particular those of the logos).
Once all areas of interest have been drawn, the BeGaze software automatically calculates all the eye data for each area of interest.

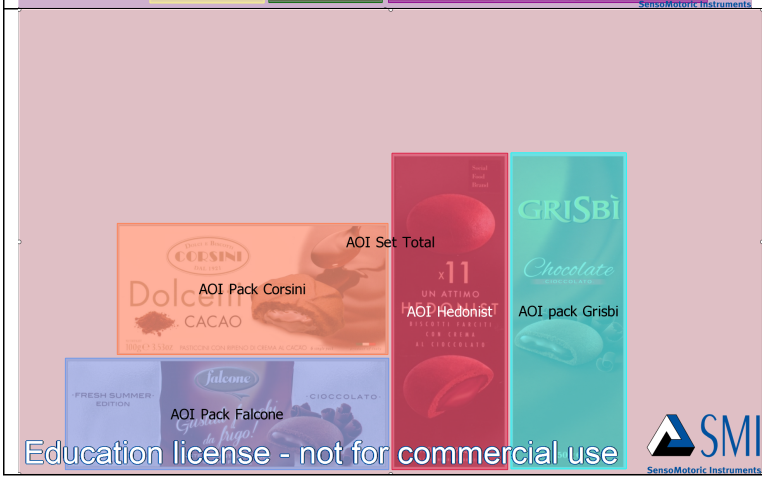
The most studied areas of interest are: the logo, the brand, the product description, the quality certification (organic product, without palm oil, without hydrogenated fats), the image, the weight of the product and the price.
Clearly, the questions that can be answered using this methodology are many.
In my case, if we want to analyze if there is a difference in perception between a horizontal and vertical (and mixed) arrangement, we have chosen to draw the AOI in the following way:
- one AOI for each packaging
- one AOI for each set, ie for the whole area visible on the screen for each set.

For example, for the H1 set, the AOI are:

- AOI Pack JardinBio
- Aoi Pack Biocoop
- AOI Pack VS
- AOI Pack Bioroc
- AOI Set Total (is the whole region in pink, including packaging)

Figure 54 - AOI designed for H1

For regions of simplicity, it has been chosen as the name of the AOI in the name of the brand, but the name is ineffective for the purposes of the study.

SET	AOI
	AOI Pack Bonneterre AOI Pack Bioshock AOI Pack Amato AOI Pack LA Vie Claire AOI Set Total M1
	AOI Pack Corsini AOI Pack Falcone AOI Pack Hedonist AOI Pack Grisbi AOI Set Total M2

<table>
<tr>
<td>
</td>
<td>AOI Pack JardiBio
AOI Pack Biocoop
AOI Pack VS
AOI Pack Bioroc
AOI Set Total H1</td>
</tr>
<tr>
<td>
</td>
<td>AOI Pack Cereaples
AOI Pack Keralea
AOI Pack Valpibio
AOI Pack Pleniday
AOI Set Total H2</td>
</tr>
<tr>
<td>
</td>
<td>AOI Pack America
AOI Pack FDB
AOI Pack Linea
AOI Pack Bisson
AOI Set Total V1</td>
</tr>
<tr>
<td>
</td>
<td>AOI Pack Cereal
AOI Pack Biosoleil
AOI Pack lINEA
AOI Pack Orlando
AOI Set Total V2</td>
</tr>
</table>

Once the areas of interest are drawn, the sotware is able to provide the data, which can be exported to be prepared to be analyzed in SPSS.

6.2 Data export

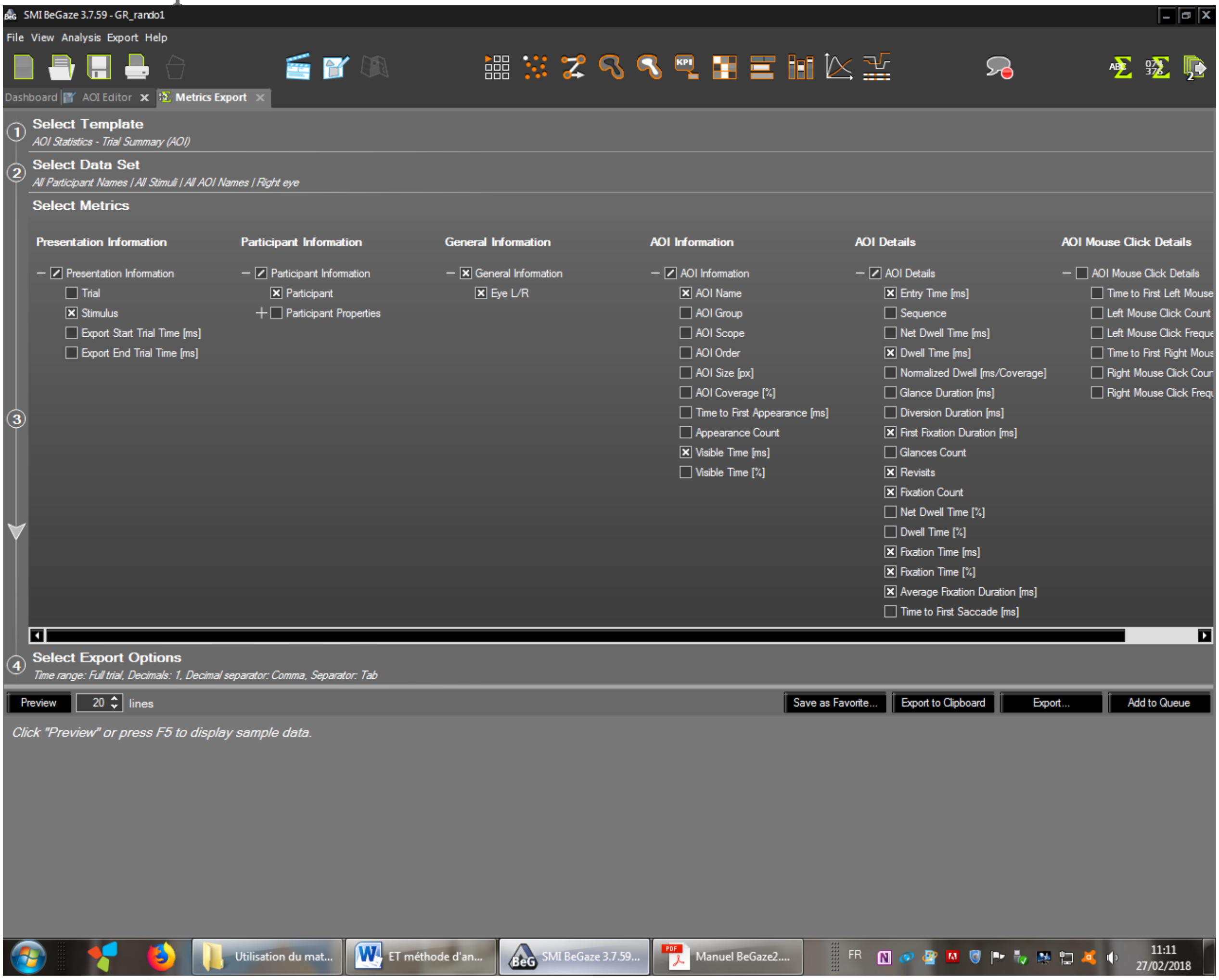


Figure 55 - BeGaze screen for data export

The next step consists in importing the database into Excel.
The data obtained are subdivided by set (H1 H2 M1 M2 V1 V2) and by randomization.
For example, for set H1 there are:

- H1 R1 right eye
- H1 R1 left eye

- H1 R2 right eye
- H1 R2 left eye

- H1 R3 right eye
- H1 R3 left eye

For each of these sheets the data include:

- Visible Time [ms]
- Entry Time [ms]
- Dwell Time [ms]
- First Fixation Duration [ms]
- Revisits
- Fixation Count

- Fixation Time [ms]
- Fixation Time [%]
- Average Fixation Duration [ms]

related to the AOI

Entry time: Time before first fixation: measurement calculated by the eye-tracking system indicating the time, in milliseconds, before the first ocular fixation performed in the area of interest. This measurement is called entry time by the SMI eye-tracking analysis software and time before the first fixation (time to first fixation; TTFF) by the Tobii eye-tracking analysis software.

Quality control on eyes is performed as a ratio between:

$$Quality = \frac{dwell\ time}{visible\ time}$$

The result is a percentage value that must be greater than 70%.
For the H1 set the only participant who reported a lower quality is the number 49 of R3 randomization.

$$Quality\_RE\ (P49) = \frac{dwell\ time}{visible\ time} = \frac{3319{,}5}{7607} = 44\%$$

In this case we analyze what happens to the left eye.

$$Quality\_LE\ (P49) = \frac{dwell\ time}{visible\ time} = \frac{3508}{7607} = 46\%$$

Since the data quality is also not significant for the left eye, data relative to participant 49 are discarded from all sets. In fact, even if the quality is good for other sets, the statistical tests must always be performed on the same sample.
For the other participants, however, the quality for H1 set is above 70% (94% on average).

$$Quality\_RE\ (P63) = \frac{dwell\ time}{visible\ time} = \frac{39674}{25286} = 64\%$$

Even for the left eye the result must be discarded

$$Quality\_RE\ (P63) = \frac{dwell\ time}{visible\ time} = \frac{39554}{25289} = 64\%$$

With the same procedure the data relating to the participant 63 for the M2 set have been discarded, the participant 49 for the set V1 and the participant 36 for the sets V1 and V2.
As a consequence, the final sample consists of 73 elements.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Stimulus	Participant	Eye L/R	AOI Name	Visible Time [ms]	Entry Time [ms]	Dwell Time [ms]	First Fixation Duration [ms]	Revisits	Fixation Count	Fixation Time [ms]	Fixation Time [%]	Average Fixation Duration [ms]
2	set H1 Page 1	P60_R1	Right	AOI set total	4954,3	2,3	4819,7	439,9	0	16	4127,7	83,3	258
3	set H1 Page 1	P61_R1	Right	AOI set total	14741,6	2,2	13603,1	579,8	0	46	11695,1	79,3	254,2
4	set H1 Page 1	P62_R1	Right	AOI set total	11782,9	0,2	10235,7	144	0	40	7915,6	67,2	197,9
5	set H1 Page 1	P63_R1	Right	AOI set total	33835,9	479,8	24398,3	120,2	1	68	19411,4	57,4	285,5
6	set H1 Page 1	P64_R1	Right	AOI set total	11967,7	49,2	11471,4	316	0	47	9103,8	76,1	193,7
7	set H1 Page 1	P65_R1	Right	AOI set total	12903,5	74,4	11999,3	264	0	49	10363,3	80,3	211,5
8	set H1 Page 1	P66_R1	Right	AOI set total	14985,3	2,4	13919,1	591,9	0	60	10907,3	72,8	181,8
9	set H1 Page 1	P67_R1	Right	AOI set total	5093,9	1,3	5003,5	487,8	0	18	4147,6	81,4	230,4
10	set H1 Page 1	P01_R1	Right	AOI set total	25964,1	14,8	22578,5	116	3	80	12387,4	47,7	154,8
11	set H1 Page 1	P02_R1	Right	AOI set total	53843,6	56,9	50460,9	516,1	2	132	45096,9	83,8	341,6
12	set H1 Page 1	P03_R1	Right	AOI set total	20241,7	3,4	19555,1	672,2	0	65	16883,4	83,4	259,7
13	set H1 Page 1	P04_R1	Right	AOI set total	14963,1	1,9	14499,3	320,2	0	59	12071,5	80,7	204,6
14	set H1 Page 1	P05_R1	Right	AOI set total	11208,7	2,5	10783,4	720,1	0	44	8727,3	77,9	198,3
15	set H1 Page 1	P06_R1	Right	AOI set total	11354,4	3,5	10575,3	976,1	2	46	8791,4	77,4	191,1
16	set H1 Page 1	P07_R1	Right	AOI set total	11416,1	1,2	9075,2	443,9	0	38	6423,3	56,3	169
17	set H1 Page 1	P08_R1	Right	AOI set total	9058,7	44,4	8635,5	492,1	0	27	7483,7	82,6	277,2
18	set H1 Page 1	P09_R1	Right	AOI set total	15206,9	0,8	15150,9	263,9	0	58	12030,7	79,1	207,4
19	set H1 Page 1	P10_R1	Right	AOI set total	25012,1	37,3	23190,3	196,1	1	74	19210,6	76,8	259,6
20	set H1 Page 1	P11_R1	Right	AOI set total	12480,8	2,2	10183,3	495,9	1	42	8515,5	68,2	202,7
21	set H1 Page 1	P12_R1	Right	AOI set total	11454,2	3,7	9171,5	604	1	44	6643,9	58	151
22	set H1 Page 1	P13_R1	Right	AOI set total	40171,8	2,8	37501,4	308,2	1	100	33669,6	83,8	336,7
23	set H1 Page 1	P14_R1	Right	AOI set total	14167,3	413,2	13267,1	308	0	53	10143,1	71,6	191,4
24	set H1 Page 1	P15_R1	Right	AOI set total	19315,3	114,9	17934,8	467,9	0	62	15551	80,5	250,8
25	set H1 Page 1	P60_R1	Right	AOI pack Jardinbio	4954,3	714,1	1456,1	280	1	5	1300	26,2	260
26	set H1 Page 1	P61_R1	Right	AOI pack Jardinbio	14741,6	774,1	2579,7	176,1	1	9	2351,8	16	261,3
27	set H1 Page 1	P62_R1	Right	AOI pack Jardinbio	11782,9	708,3	2131,8	100	1	8	1855,8	15,8	232
28	set H1 Page 1	P63_R1	Right	AOI pack Jardinbio	33835,9	479,8	8687,7	120,2	3	28	6775,7	20	242
29	set H1 Page 1	P64_R1	Right	AOI pack Jardinbio	11967,7	657,1	5095,6	92	3	22	4367,8	36,5	198,5
30	set H1 Page 1	P65_R1	Right	AOI pack Jardinbio	12903,5	758,4	3435,6	124	1	16	3027,7	23,5	189,2
31	set H1 Page 1	P66_R1	Right	AOI pack Jardinbio	14985,3	838,5	1903,9	132	1	10	1567,9	10,5	156,8
32	set H1 Page 1	P67_R1	Right	AOI pack Jardinbio	5093,9	569	1055,9	124	0	4	931,9	18,3	233
33	set H1 Page 1	P01_R1	Right	AOI pack Jardinbio	25964,1	830,7	3480	80	8	16	2331,8	9	145,7
34	set H1 Page 1	P02_R1	Right	AOI pack Jardinbio	53843,6	629	13855,6	156	3	41	12503,5	23,2	305
35	set H1 Page 1	P03_R1	Right	AOI pack Jardinbio	20241,7	747,8	4787,3	88	1	16	4239,4	20,9	265
36	set H1 Page 1	P04_R1	Right	AOI pack Jardinbio	14963,1	1,9	5511,6	320,2	1	23	4627,8	30,9	201,2

CALCOLI | H1 bon tracking | qualité | H1 set total | H1_R1_oeildroit | H1_R1_oeilgauche | H1_R2_oeildroit | H1_R2_oeilg

Figure 56 – Original Database for eye-tracking data

The data at this point are re-aggregated and are ready to be imported and analyzed in spss.

A	B	C	D	E	F	G	H	I	J	
FC_AOI pack Jardinbio_H1	FC_AOI pack Biocoop_H1	FC_AOI pack VS_H1	FC_AOI pack Bioroc_H1	FC_AOI packsum_H1	FC_AOI pack Cerealpes_H2	FC_AOI pack Karelea_H2	FC_AOI pack Valpibio_H2	FC_AOI pack Pleniday_H2	FC_AOI packsum_H2	FC_AOI p
5,0	7,0	2,0	2,0	16,0	9	15	6	3	33	
9,0	18,0	7,0	12,0	46,0	9	15	12	13	49	
8,0	15,0	13,0	3,0	39,0	13	12	8	4	37	
28,0	18,0	16,0	0,0	62,0	20	19	26	3	68	
22,0	13,0	8,0	5,0	48,0	13	24	7	5	49	
16,0	12,0	13,0	8,0	49,0	15	13	8	9	45	
10,0	11,0	22,0	17,0	60,0	16	17	18	16	67	
4,0	5,0	7,0	2,0	18,0	5	10	8	2	25	
16,0	26,0	15,0	20,0	77,0	13	19	20	17	69	
41,0	38,0	34,0	18,0	131,0	29	22	20	21	92	
16,0	17,0	13,0	19,0	65,0	19	11	19	24	73	
23,0	16,0	7,0	13,0	59,0	16	9	12	7	44	
10,0	16,0	4,0	14,0	44,0	8	19	8	11	46	
12,0	16,0	10,0	7,0	45,0	7	13	10	7	37	
4,0	12,0	12,0	10,0	38,0	5	12	4	8	29	
7,0	10,0	5,0	5,0	27,0	7	6	4	11	28	
19,0	13,0	21,0	5,0	58,0	11	30	21	20	82	
24,0	18,0	18,0	16,0	76,0	18	22	17	15	72	
8,0	19,0	5,0	10,0	42,0	27	21	7	13	68	
8,0	17,0	10,0	6,0	41,0	11	17	6	4	38	
24,0	26,0	23,0	27,0	100,0	23	23	19	24	89	
16,0	18,0	9,0	10,0	53,0	7	9	13	14	43	
13,0	17,0	11,0	21,0	62,0	22	17	12	17	68	
10,0	14,0	2,0	7,0	33,0	6	12	2	3	23	
7,0	15,0	13,0	11,0	46,0	15	18	8	11	52	
5,0	12,0	9,0	8,0	34,0	6	14	5	9	34	
10,0	13,0	10,0	7,0	40,0	6	17	5	6	34	
5,0	27,0	13,0	13,0	58,0	7	18	11	10	46	
34,0	23,0	34,0	20,0	111,0	41	27	43	9	120	
9,0	8,0	8,0	8,0	33,0	9	10	13	4	36	
11,0	23,0	9,0	4,0	47,0	14	11	11	17	53	
18,0	20,0	13,0	7,0	58,0	14	16	12	21	63	

Figure 57 - Data aggregation

Of all the measures obtainable from the'eye-tracker, those that affect the expression are:
- fixation time (FT)
- revisits (R)
- number of fixations (FC = fixation count).

6.3 Quantitative statistical analysis

Before testing the hypotheses, descriptive statistics on the sample of 73 elements were conducted to highlight **the number and total duration of ocular fixations by the participants in each set and pack** during the performance of the experimental tasks.

These data are interesting because they make it possible to evaluate the relative attention given by the participants to each area of interest. . The statistics were obtained with SPSS software.

M1

Detectability: Percentage of participants who set the AOI Packs (look at entry time on the AOI pack)

	Verticals		Horizontals	
Set M1_Temps libre	AOI pack Bonneterre	AOI pack Bioshok	AOI pack Amato	AOI pack LVC
Participants who did not fixed the pack (FC=0)	0	0	0	0
Participants that have fixed at least once the pack	73	73	73	73
Of which only 1 fixation (FC=1)	0	1	0	1
More than one fixation (FC>1)	73	72	73	72
Total number of participants	73	73	73	73

N = 73

Detectability

	Verticals		Horizontals	
Set M1_Temps libre	AOI pack Bonneterre	AOI pack Bioshok	AOI pack Amato	AOI pack LVC
Entry time (ms)	1035,8	321,6	3574	6207,6
Ordre (entry time mini => maxi)	214,8 – 4893,1	0 – 2074,5	0 - 15465	994,5 – 20760,7

N = 73

Interest in the AOI Packs area

	Verticals		Horizontals	
Set M1_Temps libre	AOI pack Bonneterre	AOI pack Bioshok	AOI pack Amato	AOI pack LVC
Fixation number (FC)	12,5	12,2	14,9	11,3
Fixation time (ms)	3204,7	2620,7	3503,8	2368,9
Percentage of time spent in the area (/20000 ms)	20,2	17,0	23,2	15,2
Average duration of fixation (ms)	247,6	219,7	233,0	207,7
Number of revisits	2,3	3,6	3,1	2,1

N = 73

M2

Detectability

	Verticals		Horizontals	
Set M2_Temps libre	AOI pack Corsini	AOI pack Falcone	AOI pack Hedonist	AOI pack Grisbi
Participants who did not fixed the pack (FC=0)	0	0	0	1
Participants that have fixed at least once the pack	73	73	73	72
Of which only 1 fixation (FC=1)	0	2	0	0
More than one fixation (FC>1)	73	71	73	72
Total number of participants	73	73	73	73

N = 73

Detectability

	Horizontals		Verticals	
Set M2_Temps libre	AOI pack Corsini	AOI pack Falcone	AOI pack Hedonist	AOI pack Grisbi
Entry time (ms)	707,7	2979,1	1366.7	4783,3
Ordre (entry time mini => maxi)	0 – 9007,2	940,5 – 11287,2	0,7 – 12301,1	712,9 – 22168,3

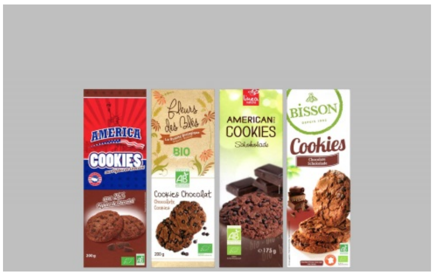
N = 73

Intérêt porté à la zone AOI Packs

	Horizontals		Verticals	
Set M2_Temps libre	AOI pack Corsini	AOI pack Falcone	AOI pack Hedonist	AOI pack Grisbi
Fixation number (FC)	16,3	11,8	11,3	8,1
Fixation time (ms)	3464,9	2596,6	2527,8	1725,9
Percentage of time spent in the area (/20000 ms)	25,3	17,6	18,5	12,7
Average duration of fixation (ms)	216,7	216,1	224,5	213,3
Number of revisits	3,5	2,5	3,7	1,7

N = 73

V1



Detectability

	Verticals			
Set V1_Temps libre	AOI pack America	AOI pack FDB	AOI pack Linea	AOI pack Bisson
Participants qui n'ont pas fixé le pack (FC=0)	1	0	1	0
Participants qui ont fixé au moins une fois le pack	72	73	72	73
Dont seulement 1 fixation (FC=1)	1	0	0	0
Dont plus d'une fixation (FC>1)	71	73	72	73
Nombre total de participants	73	73	73	73

N = 73

Detectability

	Verticals			
Set V1_Temps libre	AOI pack America	AOI pack FDB	AOI pack Linea	AOI pack Bisson
Entry time (ms)	983,8	613,7	1940,6	5065,4
Ordre (entry time mini => maxi)	336 – 4556,6	0,1 – 6419,9	0,2 – 13341,4	990,4 – 18949,3

N = 73

Interest in the AOI Packs area

	Verticaux			
Set V1_Temps libre	AOI pack America	AOI pack FDB	AOI pack Linea	AOI pack Bisson
Fixation number (FC)	9,0	14,9	10,2	10,8
Fixation time (ms)	1965,9	3366,9	2376,2	2456,8
Percentage of time spent in the area (/20000 ms)	14,0	24,5	19,1	17,5
Average duration of fixation (ms)	208,4	222,7	231,2	225,0
Number of revisits	1,8	4,1	3,2	2,2

N = 73

V2

Detectability

	Verticals			
Set V2_Temps libre	AOI pack Cereal	AOI pack Biosoleil	AOI pack Crocs	AOI pack Orlando
Participants who did not fixed the pack (FC=0)	1	1	0	1
Participants that have fixed at least once the pack	72	73	73	72
Of which only 1 fixation (FC=1)	1	0	1	1
More than one fixation (FC>1)	71	72	72	71
Total number of participants	73	73	73	73

N = 73

	Verticals			
Set V2_Temps libre	AOI pack Cereal	AOI pack Biosoleil	AOI pack Crocs	AOI pack Orlando
Entry time (ms)	1009,1	705,9	2384,4	6228,6
Ordre (entry time mini => maxi)	486,6 – 6506,1	0,4 – 6785,8	0,2 – 16834,1	872,5 – 21930,8

N = 73

Interest in the AOI Packs area

	Verticals			
Set V2_Temps libre	AOI pack Cereal	AOI pack Biosoleil	AOI pack Crocs	AOI pack Orlando
Fixation number (FC)	11,2	13,6	13,1	8,8
Fixation time (ms)	2629,6	2860,9	3270,9	2205,1
Percentage of time spent in the area (/20000 ms)	17,1	19,7	24,0	15,7
Average duration of fixation (ms)	228,2	208,6	252,0	251,5
Number of revisits	2,2	3,7	3,5	1,4

N = 73

H1

	Horizontals			
Set H1_Temps libre	AOI pack Jardinbio	AOI pack Biocoop	AOI pack VS	AOI pack Bioroc
Participants who did not fixed the pack (FC=0)	0	0	0	2
Participants that have fixed at least once the pack	73	73	73	71
Of which only 1 fixation (FC=1)	0	0	0	0
More than one fixation (FC>1)	73	73	73	71
Total number of participants	73	73	73	73

N = 73

	Horizontals			
Set H1_Temps libre	AOI pack Jardinbio	AOI pack Biocoop	AOI pack VS	AOI pack Bioroc
Entry time (ms)	803,3	686,8	4074,7	6450,5
Ordre (entry time mini	1,9 - 2951,5	0,1 – 9779,3	0,2 – 53843,6	1952,1 –

=> maxi)				25555,5

N = 73

Interest in the AOI Packs area

	Horizontals			
Set H1_Temps libre	AOI pack Jardinbio	AOI pack Biocoop	AOI pack VS	AOI pack Bioroc
Fixation number (FC)	14	15	12	9
Fixation time (ms)	3140,7	3376.5	2519,8	2061,1
Percentage of time spent in the area (/20000 ms)	20,5	23,2	17,0	14,0
Average duration of fixation (ms)	222,4	222,3	207,1	213,4
Number of revisits	2,2	4,1	2,7	1,3

N = 73

H2

	Horizontals			
Set H2_Temps libre	AOI pack Cerealpes	AOI pack Karelea	AOI pack Valpibio	AOI pack Plenyday
Participants who did not fixed the pack (FC=0)	0	0	0	0
Participants that have fixed at least once the pack	73	73	73	73
Of which only 1 fixation (FC=1)	0	0	0	1
More than one fixation (FC>1)	0	0	0	72
Total number of participants	73	73	73	73

N = 73

	Horizontals			
Set H2_Temps libre	AOI pack Cerealpes	AOI pack Karelea	AOI pack Valpibio	AOI pack Plenyday
Entry time (ms)	845,9	264,1	4120,6	6321,4

Ordre (entry time mini => maxi)	2,1 – 8816,7	0 - 7984	0,3 – 16252,0	326,6 – 17275,6

N = 73

Intérêt porté à la zone AOI Packs

	Horizontals			
Set H2_Temps libre	AOI pack Cerealpes	AOI pack Karelea	AOI pack Valpibio	AOI pack Plenyday
Fixation number (FC)	14	16	11	11
Fixation time (ms)	3013,2	3442,5	2434,8	2413,9
Percentage of time spent in the area (/20000 ms)	19,5	24,3	15,3	16,0
Average duration of fixation (ms)	218,7	225,0	224,5	223,4
Number of revisits	2,5	4,2	2,5	1,5

N = 73

- From these descriptive statistics it can be observed that all the packaging has been fixed at least once, with the exception of one or two participants who have never seen a packaging in the set.

- Regarding the detectability, it is observed that on average the entry time is greater for the horizontal type sets, followed by the mixed sets and finally by the vertical ones.
  ET_V =2366,44
  ET_H = 2945,91
  ET_M = 2801,30
  This would seem to indicate that the vertical sets are more easily detectable than the horizontal ones
  Concerning the attention, the vertical sets have a smaller number of FC than FT, but they are those in which we have focused more before making a decision. As regards the number of revists, on average they have a larger number for mixed sets and less for horizontal sets

FC_V = 11,45	FT_V =2,64 (ms)	A_V =18,95 (%)	R_V =2,76
FC_H = 12,75	FT_H =2,71 (ms)	A_H =18,73 (%)	R_H =2,63
FC_M =12,30	FT_M =2,75 (ms)	A_M =18,71 (%)	R_M =2,81

These early media do not have a significant statistical value. They only show that there would seem to be differences between the attention given to the different set orientations.
In order to find a meaningful answer it is necessary to proceed with the statistical analysis.

We begin to illustrate how to refute or confirm the hypotheses.

The dependent and independent variables are recalled

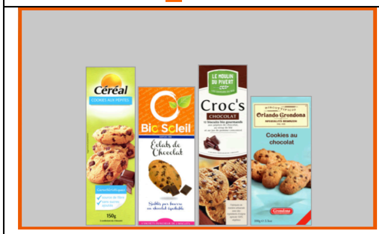
Indipendent variables (IV)	Dependent variables (VD)
Orientation set: • Horizontal (H) • Vertical (V)	Complexity Attractiveness Processing fluency Choice satisfaction

• Mix (M)	Choice difficulty

6.3.1 Manipulation check

Comparisons between sets of the same type – AOI SET TOTAL
Since two sets per condition in order to increase the external validity of the study were designed, it's necessary to make sure that they had a high degree of homogeneity within each condition.
It means that we had to check if the two same type sets (M1 and M2, H1 and H2, V1 and V2) are perceived as equivalent from the point of view of attractiveness, complexity, processing fluency, choice satisfaction and choice difficulty.

Another area of interest that is added to the analysis is given by the sum of the 4 packaging for each set. Unlike AOI SetTotal, the background is not considered in this AOI.
For example, for set V2 we have

AOIsettotal_V2	AOI packsum_V2
	

For greater accuracy, to establish whether there are significant differences between two sets of the same type, significance tests were performed on both SetTotal-type AOIs and Packsum-type AOIs.

To understand if significance exists, hypothesis tests on the means are performed.
Since the experiment is of type within (same stimuli pertutto the sample), the test to be performed is the t-test. Furthermore, as previously illustrated, the functions are normally distributed.

If the experiment were of the between type (different stimuli for different samples), it would have had to use an ANOVA type test, as summarized in the following table (citation source book discovering statistics using IBM SPSS)(See Attachment)

The methodology involves performing the t-test on:

- Revisits
- Fixation time
- Fixation count

for each pair of sets of the same type

The results of the tests are summarized below

AOIsettotal_V1

AOIsettotal_V2

AOIsettotal_H1

AOIsettotal_H2

AOIsettotal_M1

AOIsettotal_M2

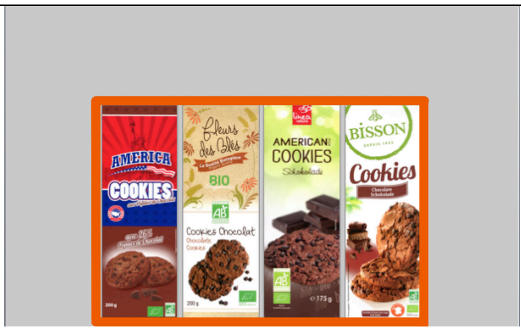
AOI

Couple	Mean	P value
FC_AOIsettotal_H1 - FC_AOIsettotal_H2	-,9589	0,557
FC_AOIsettotal_M1 - FC_AOIsettotal_M2	3,7123	0,064
FC_AOIsettotal_V1 - FC_AOIsettotal_V2	1400,4315	0,447

Couple	Mean	P value
FT_AOIsettotal_V1 - FT_AOIsettotal_V2	-748,4123	0,073
FT_AOIsettotal_H1 - FT_AOIsettotal_H2	-154,0699	0,743
FT_AOIsettotal_M1 - FT_AOIsettotal_M2	-1,5068	0,005

As is clearly visible from the statistics, the 2 horizontal sets H1 and H2 are perceived equivalent in Fixation Count (FC_{H1}=50,425, FC_{H2}=51,384, p=.557) and in fixation time ($FT_{H1=}$11240.11, FT_{H2}=11394.2, p=.654).
Also the 2 vertical sets V1 and V2 have not statistical differences in Fixation Count (FC_{V1}=45,890, FC_{V2}=47,397, p=.447) and Fixation time ($FT_{V1=}$10371,69, FT_{V2}=11120,10, p=.073).
On the contrary, Mix sets M1 and M2 are perceived a little different in Fixation Count ($FC_{M1=}$52,151, FC_{M2}=48,438, p=.064) and in Fixation time (FT_{M1}=11982,552, FT_{M2}=10582,121, p=.005).

Comparisons between sets of the same type – AOI PACKSUM
A more accurate test to understand if there are differences in the attention given to two sets of the same type is to compare the two sets again, but this time looking at another AOI, that given by the sum of the 4 packaging.
The results are shown below



AOI packsum_V1

AOI packsum_V2

AOI packsum_H1

AOI packsum_H2

AOI packsum_M1

AOI packsum_M2

Couple	Mean	P value
FC_AOI packsum_H1 - FC_AOI packsum_H2	-1,2329	0,441
FC_AOI packsum_M1 - FC_AOI packsum_M2	3,4521	0,078
FC_AOI packsum_V1 - FC_AOI packsum_V2	-1,9863	0,300

Couple	Mean	P value
R_AOI packsum_H1 - R_AOI packsum_H2	-,4658	0,406
R_AOI packsum_M1 - R_AOI packsum_M2	-,3288	0,620
R_AOI packsum_V1 - R_AOI packsum_V2	,5000	0,482

Couple	Mean	P value
FT_AOI packsum_M1 - FT_AOI packsum_M2	1382,958903	0,005
FT_AOI packsum_H1 - FT_AOI packsum_H2	-206,2767	0,654
FT_AOI packsum_V1 - FT_AOI packsum_V2	-890,369863	0,029

The 2 horizontal sets H1 and H2 are perceived equivalent in Fixation Count (FC_{H1}=49, 726,FC_{H2}=50,96, p=.441), in fixation time (FT_{H1}=11098,165, FT_{H2}=11304,44, p=.654) and in the number of revisits (R_{H1}=10,274, R_{H2}=10,740, p=.654).

Vertical sets have no differences in FC (FC_{V1}=44,932, FC_{V2}=46,918, P=.300) and in number of revisists (R_{V1}=11,308, R_{V2}=10,808, p=.482), while in FT, V1 and V2 sets have a significant difference (FT_{V1}=10165,74, FT_{V2}=11056,11, p=.029).

The result is the same for mix sets: mix sets have no significant differences in FC (FC_{M1}=50,877, FC_{M2}=47,425, p=.078) and in revisits (R_{M1}=11,137, R_{M2}=11,466, p=.620), while in FT, M1 and M2 have a significant difference (FT_{M1}=11698,13, FT_{M2}=10315,17, p=.005).

6.3.2 Pretest on the same set type

Unlike what could be expected, there are differences on the intention brought to the two sets of the same type.
This, unfortunately, is not a good indicator in the evaluation of the experimental goodness of design.

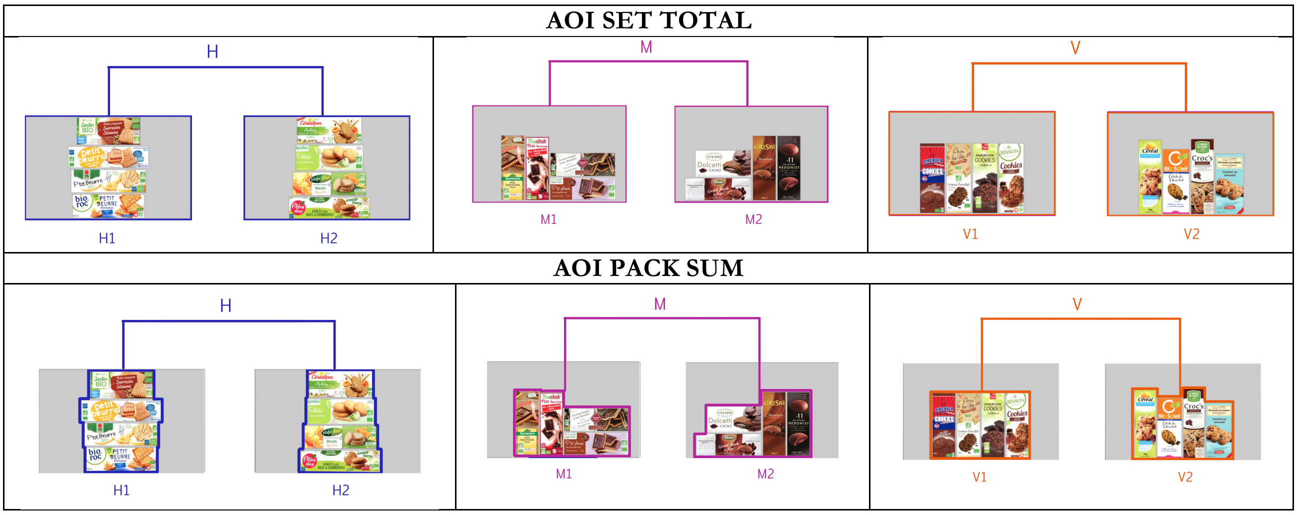
Before the implementation and execution of the experiment it could be a good idea to perform a PRETEST on the sample. In this way the stimulus set could be changed in an iterative manner, until the moment when all the set pairs were statistically identical.
Performing the pretest on the confirmation of the goodness of the stimuli is a very widespread method in the design of a scientific experiment.

However it requires a greater use of resources:

- the time needed to perform the pretest can double or triple the required tmepo for the execution of the experiment
- Subjects can not be subjected to the same stimulus too many times. This means doubling or tripling the participants to the experiment. Since the minimum number required is 70 in the case of a between experiment, the prestest would have dreamed 140 or 200 participants of a homogeneous sample. The management of such a number of participants is obviously challenging in the phases of research and selection of the sample.

6.3.3 Main results

Before proceeding to illustrate the results, the areas of interest are illustrated below.



The questions we try to answer in this chapter about the packaging arrangement are the following:

1. Was the choice faster in a set type?
2. Is the average time spent per pack longer in a set type?
3. More "complex" choice in a set type?
4. For mixed set, the attention is greater in vertical packaging or horizontal packaging??
5. For mixed set, the detection (first fixation = attract attention) is stronger for horizontal or vertical packs?

Hypothesis 1

The attention to horizontal and mixed is higher than the attention paid to vertical sets

I would like to remember that the attention is measured in terms of attention, as the number of total fixations (FC = fixation count) and the duration of fixations (FT = fixation time).

Faster choice

To answer the first question, it is necessary to analyze the fixation time (FT) for each set.
If the fixation time is greater, this indicates that the choice is at less rapid.
The methodology used provides a comparison between the fixation time averages, number of fixations and revisists of the various types of sets.

Since a comparison of several variables in a within-type experiment is performed, an analysis of **repeated measurements** must be performed.
The test compares the three types of sets (M H V). A second more detailed test compares all 6 sets instead, trying to establish order relations.

	Fixation Time		Fixation Time
AOI set total M1	11982,6	AOI set total M (moyenne)	11282,35
AOI set total M2	10582,1		
AOI set total V1	10371,7	AOI set total V (moyenne)	10745,9
AOI set total V2	11120,1		
AOI set total H1	11240,1	AOI set total H (moyenne)	11317,15
AOI set total H2	11394,2		

FC_AOI_SetTotal_General	$FC_H = FC_M > FC_V$
	FC_H=50,904 FC_V=46,644 FC_M=50,295 p_{HV}=,004, p_{MV}=.023

For detailed results see Appendix 3

Going down in detail, a test has been carried out to compare all the sets of all the orientations (for detailed results see Appendix 4)

Finding an interpretation to this result is not very simple as they influence too many factors. The significant relationships are summarized below

FC_AOI_SetTotal_Detail	$FC_{H1} = FC_{H2} > FC_{V1} = FC_{V2} > FC_{M1}$
	p_{H2-V1}=.002 p_{H2-V2}=.054 p_{M1-V2}=.027

Similarly we proceed to the analysis of the FT, first considering the three general sets, then going down in detail with a multivariate analysis on the 6 sets. (for detailed results see Appendix 5)

FT_AOI_SetTotal_General	$FT_H = FT_M = FT_V$
	FT_V=10745,89 FT_H=11317,15 FT_M=11282,33

FT_AOI_SetTotal_Detail	$FT_{H1} = FT_{H2} > FT_{V1} < FT_{M1}$
	p_{H2-V1}=.011 p_{M1-V1}=.002 p_{H1-V1}=.05

(for detailed results see Appendix 6)

In Total set , fixation count of vertical sets is lower than mix and horizontal (FCV=46,644, FCH=50,904, FCM=50,295, pHV=,004, pMV=.023, pHM=.697), while fixation time in horizontal, vertical and mix sets are equivalent (FTV=10745,89, FTH=11317,15, FTM=11282,33, pHV=,080, pHM=.929, pMV=.161).

In detail, fixation count of the vertical set V1 is lower than both horizontal sets H1 and H2 (FCV1=45,89, FCH1=50,425, FCH2=51,384, pH1-V1=.011, pH2-V1=.002) and V1 is lower than mix set M1 (FCV1=45,89, FCM1=52,15, pM1-V1=.008) ; fixation count of the vertical set V2 is lower than H2 (FCV2=47,397, FCH2=51,384, pH2-V2=.054) ans lower than M1 (FCV2=47,397, FCM1=52,15, pM1-V2=.027).

Regarding fixation time, the vertical set V1 is lower than the horizontal sets H1 and H2 (FT_{V1}=10371.69, FT_{H1}=11240.11, FT_{H2}=11394.18, p_{H1-V1}=.05, p_{H2-V1}=.011) and lower than the mix set M1 (FT_{V1}=10371.69, FT_{M1}=11982.55, p_{M1-V1}=.002).

The same type of analysis is performed on different AOIs: now they are considered as areas of interest for the significance of the fixation time and the fixation number, the sum of the areas of a set, excluding the gray background. (see Appendix 7)

FC_AOI_Packsum_General	$FC_V < FC_H = FC_M$
	FC_H =50,342 FC_V =45,925 FC_M =49,151 p_{HV}=,002, p_{MV}=.040

In detail we obtain: (see Appendix 8)

FC_AOI_Packsum_Detail	$FC_{V2} < FC_{H2}, FC_{M1}$ AND $FC_{V1} < FC_{M1}, FC_{H1}$,
	FC_{H1}=49,726 FC_{H2}=50,96 FC_{M1}=50,877 FC_{M2}=47,425 FC_{V1}=44,932 FC_{V2}=46,918 p_{H1V1}=.007 p_{M1V1}=.011 p_{H2V2}=.043 p_{M1V2}=.049

In the case of the sum of the packaging, on the other hand, it makes sense to analyze the significance of the revisits (see Appendix 9).

R_AOI_Packsum_General	$R_H = R_M = R_V$
	R_M=11,301, R_V=11,0582, R_H=10,507

Also the revisits can be analyzed in detail (see Appendix 10)

R_AOI_Packsum_Detail	$R_{H1} = R_{H2} = R_{M1} = R_{M2} = R_{V1} = R_{V2}$
	R_{M1}=11,137 R_{M2}=11,466, R_{H1}=10,274 R_{H2}=10,740 R_{V1}=11,308 R_{V2}=10,808

We proceed in the same way for the FT (see Appendix 11)

FT_AOI_Packsum_General	$FT_H = FT_V = FT_M$
	FT_V=10745,89 FT_H=11201,304 FT_M=11006,65
FT_AOI_Packsum_Detail	$FT_{M1} > FT_{V1}$ AND $FT_{H2} > FT_{M2}$ AND $FT_{H1} > FT_{V1}$ AND $FT_{H1} > FT_{V2}$
	p_{M1M2}=.005 p_{M1V1}=.003 p_{M2H2}=.032 p_{H1V1}=.041 p_{H2V1}=.005 p_{V1V2}=.029

In this case, although significant results have been obtained, finding a view of the order relationship is very complicated (see Appendix 12).

In AOI packsum, vertical fixation count are less than horizontal and mix fixation time (FC_H=50,342, $FC_{V=}$45,925, $FC_{M=}$49,151, p_{HV}=,002, p_{MV}=.040), while the three set types have no significficant differences in revisits (R_M=11,301, R_V=11,0582, R_H=10,507, p_{HV}=,369, p_{MV}=.611, p_{MH}=,121) and in fixation time (FC_H=11201,30, $FC_{V=}$10745,89, $FC_{M=}$11006,65, p_{HV}=,067, p_{MV}=.291, p_{MH}=.618).

In details, fixation count in the vertical set V1 are less than horizontal sets H1 and mix sets M1 (FC_{H1}=49,726, FC_{M1}=50,877, FC_{V1}=44,932, p_{H1V1}=.007, p_{M1V1}=.011), while fixation count in V2 are less than in the horizontal sets H2 and the mix set M1 (FC_{H2}=50,96, FC_{M1}=50,877, FC_{V2}=46,918, p_{H2V2}=.043, p_{M1V2}=.049).
There are no significant differences in revists between the six sets.
We can observe that vertical set V1 is less than M1, H1, H2 in fixation time (FT_{H1}=11098,165, FT_{H2}=11304,44, FT_{M1}=11698,13, p_{M1V1}=.003, p_{H1V1}=.041, p_{H2V1}=.005), while vertical set V2 is more than vertical set V1 (FT_{V2}=11056,11, p_{V1V2}=.029) and mix set M1 is more than M2 in FT (FT_{M2}=10315,17, p_{M1M2}=.005).

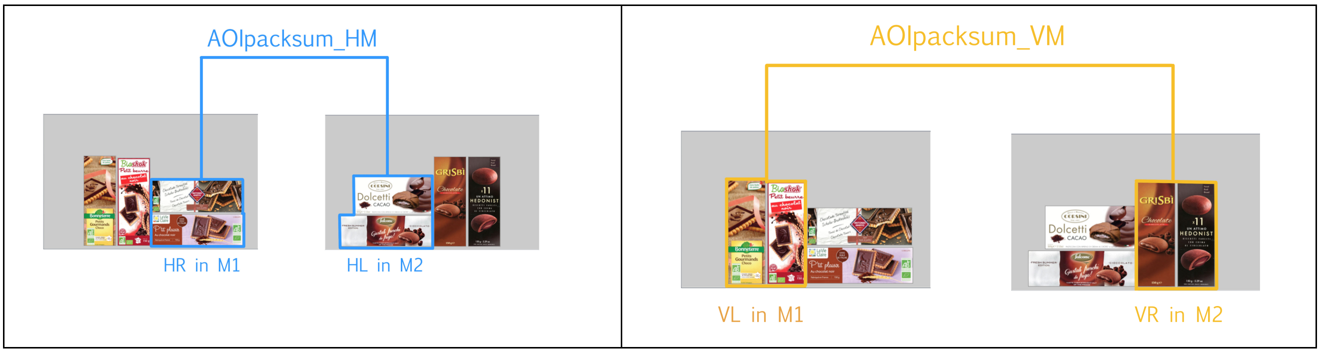
Summary of results

AOI Set Total General	$FT_H = FT_M = FT_V$	$FC_H = FC_M > FC_V$	-
AOI Packsum General	$FT_H = FT_M = FT_V$	$FC_H = FC_M > FC_V$	$R_H = R_M = R_V$

The attention paid to horizontal sets (measured in FC) is higher than the attention paid to vertical sets (checked for AOI set total and for AOI pack sum of 4 packs); not checked on FT and Revisites. Thus, the first hypothesis can be confirmed only for FC.

Hypothesis2
In ***mixed*** *sets, the attention paid to horizontal packs is higher than the attention paid to vertical packs*

It is now necessary to focus exclusively on the two mixed sets M1 and M2
The following image schematizes the areas of interest analyzed



The two variables are used as follows:

AOI_Packsum_HM = sum (AOI_HR in M1, AOI_HL in M2)

where
HR = horizontal right
HL = horizontal left

AOI_Packsum_VM = sum (AOI_VL in M1, AOI_VR in M2)

where
VL = vertical left
VR = vertical right

Also in this case the test that allows to know if there is a significant difference between the various sets is the multivariate analysis. In the case of comparison of the two general variables, a t-test could also be performed. Similarly to the cases illustrated above, the attention measures are FT, FC and R (Appendix 13).

FC_AOI_Packsum_H vs V in Mix	$FC_{H(M)} > FC_{V(M)}$
	$FC_{H(M)}=54{,}260$ $FC_{V(M)}=44{,}041$ $p_{M(HV)}=.000$

Going down in detail we obtain significant relations of order, but difficult to interpret. For this reason the results are not analyzed (see Appendix 14).
FT: VL (M1) < VR (M2) AND VL (M1) < HL (M2) AND VR (M2) < HR (M1) AND VR (M2) < HR (M2)

For the revisits we get (see Appendix 15 for details)

R_AOI_Packsum_H vs V in Mix	$R_{H(M)} = R_{V(M)}$	
	R_{HM}=11,205 R_{VM}=11,397 $p_{M(HV)}$=.732	

A detailed analysis on the sets is given only for completeness (see Appendix 16)

The results obtained are as follows:
VL(M1) > VR (M1)
HR (M1) < HL (M2)
HR (M1) < HL (M2)

FT_AOI_Packsum_H vs V in Mix	$FT_{H(M)} >> FT_{V(M)}$
	FT_{HM}=11934,273 FT_{VM}=10079,043 $p_{M(HV)}$=.000

(see Apppendix 17)

Comparing vertical and horizontals packaging in the mix sets M1 and M2 we observed that fixation count and fixation time are more in horizontal packs than in vertical packs ($FC_{HM=}$54,260, FC_{VM}=44,041, $p_{M(HV)}$=.000, $FT_{HM=}$11934,273, FT_{VM}=10079,043, $p_{M(HV)}$=.000), while revisits are statisticaly the same ($R_{HM=}$11,205, R_{VM}=11,397, $p_{M(HV)}$=.7329).

AOI_Packsum_H vs V in Mix	$FT_{H(M)} >> FT_{V(M)}$	$FC_{H(M)} = FC_{V(M)}$	$R_{H(M)} = R_{V(M}$

Going down in detail we obtain significant relations of order, but difficult to interpret. For this reason the results are not analyzed (see Appendix 18).

VL(M1) > VR(M2)
HR (M1) > VR (M2)
VR (M2) < HL (M2)

Hypothesis 3

according to the composition of the set, the attention is greater in the vertical sets than the mixed ones.

Below is an illustrative diagram of the AOIs that you want to compare

To the left

		
VL in V1	**VL in V2**	**VL in M1**

So the result is FC(VL(V1)) = FC(VL(V2)) = FC(VL(M1)) (see Appendix 19 for stats).

So the result is R(VL(V1)) = R(VL(V2)) = R(VL(M1)) (see Appendix 20)

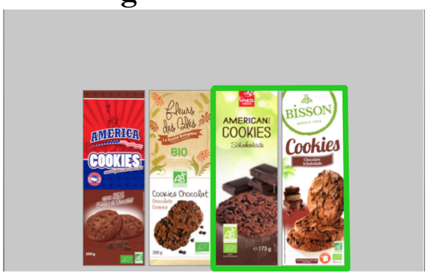
So the result is FT(VL(V1)) = FT(VL(V2)) = FT(VL(M1)) (see Appendix 21).
Then summing up the result is the following for left packagings.

		
VL in V1	**VL in V2**	**VL in M1**
FC	**R**	**FT**
L(V1) = L (V2) = L (M1)	L(V1) = L (V2) = L (M1)	L(V1) = L (V2) = L (M1)

Table 9 - Attention to left packagings in V and M

Let's see what happens to the right (see Appendix 22)

To the right

		
VR in V1	**VR in V2**	**VR in M2**

So the result for fixatin time is FC(V2)) > FC(M2))(see Appendix 23 and 24)

There are no significant differences: VR(V1) = VR(V2) = VR(M2).

Here we have VR (M2) < VR(V1) < VR(V2).
To summarize the results we get

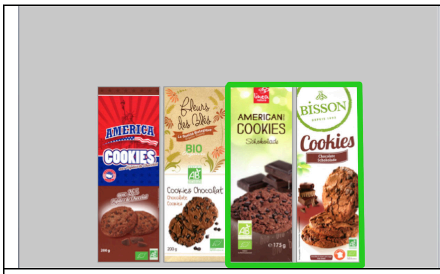
		
VR in V1	**VR in V2**	**VR in M2**
FC	**R**	**FT**
FC(V2)) > FC(M2))	VR(V1) = VR(V2) = VR(M2)	VR (M2) < VR(V1) = VR (V2) More FT on V1 and V2 than M2

Table 10- Attention to right packagings in V and M

For the left packs in vertiacl sets V1 and V2 and for the mix set M1 we noticed that there are no significt differences in fixation count ($FC_{VLinV1=}$23,945, $FC_{VLinV2=}$25,014, $FC_{VLinM1=}$24,699, $p_{VL(M1)-VL(V1)}$=.534, $p_{VL(M1)-VL(V2)}$=.816, $p_{VL(V1)-VL(V2)}$=.412), in revisits ($R_{VLinV1=}$5,911, $R_{VLinV2=}$5,986, $R_{VLinM1=}$5,959, $p_{VL(M1)-VL(V1)}$=.897, $p_{VL(M1)-VL(V2)}$=.956, $p_{VL(V1)-VL(V2)}$=.870) and in fixation time ($FT_{VlLinV1=}$5332,80, $FT_{VLinV2=}$5553,50, $FT_{VLinM1=}$5825,42, $p_{VL(M1)-VL(V1)}$=.081, $p_{VL(M1)-VL(V2)}$=.404, $p_{VL(V1)-VL(V2)}$=.432).
On the contrary, right fixation count ($FC_{VRinV1=}$20,986, $FC_{VRinV2=}$21,904, $FC_{VRinM2=}$19,342, $p_{R(V2)-R(M2)}$=.000) and fixation time (in vertical packs are more than in mix packs ($FT_{VRinV1=}$4832,946575, $FT_{VRinV2=}$5502,6136, $FT_{VrinM2=}$4253,621, $p_{R(V1)-R(M2)}$=.024). Revisits in right packs are no significant different ($R_{VRinV1=}$5,397, $R_{VRinV2=}$4,822, $R_{VRinM2=}$5,438, $p_{VR(M2)-VR(V1)}$=.911, $p_{VR(M2)-VR(V2)}$=.072, $p_{VR(V1)-VR(V2)}$=.102).
Results are statistical significant in fixation time on the right packs in mix sets: VR(V1) is fixed much more than VR(M2) ($FT_{VRinV1=}$4832,946575, $FT_{VRinM2=}$4253,621, $p_{R(V1)-R(M2)}$=.024) and less than VR(V2) ($FT_{VRinV2=}$5502,6136, $p_{R(V1)-R(V2)}$=.012).

	LEFT	**RIGHT**
FC	L(V1) = L (V2) = L (M1)	VR (V2)) > VR(M2))
FT	L(V1) = L (V2) = L (M1)	VR (M2) < VR(V1) = VR (V2)
R	L(V1) = L (V2) = L (M1)	VR(V1) = VR(V2) = VR(M2)

Table 11 - Table 12 - Attention to left and right summerized packagings in V and M

We can therefore see that there are no significant differences for the left-hand elements in mixed and vertical sets: for the elements on the right, the number of fixings is greater for the vertical elements.
So we can conclude that the starting hypothesis 3 according to which the greatest attention in the vertical sets with respect to the mixed sets is verified only minimally, that is, only if we measure the attention n terms of FC and only for the packing that we find right in the various sets.

Focusing exclusively on vertical packaging, we want to highlight if there are differences in attention between right and left.

HYPOTHESIS 4

In the vertical sets, the attention, measured in number of fixations, revisists and fixation time is greater for the packaging on the right.

For FC: the result is L(V) > R(V)(see Appendix 25).
For R: the result is L(V) > R(V) (see Appendix 26)
For FT: rhe result is R(V) = L(V) (see Appendix 27)

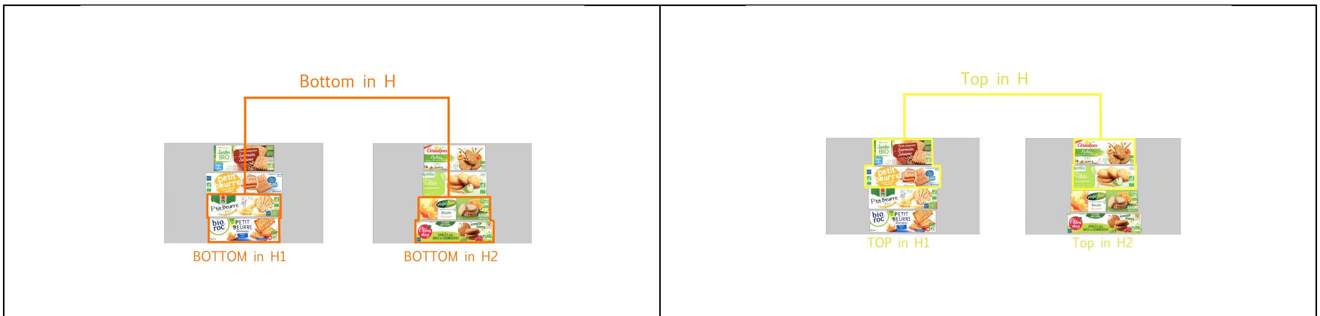
AOI_Packsum_VL in V	$FT_{L(V)} = FT_{L(V)}$	$FC_{L(V)} > FC_{L(V)}$	$R_{L(V)} > R_{L(V)}$

Clearly, from the analysis of the data the starting hypothesis according to which the attention is greater for the elements on the right of the set, can be denied for FC and R.

The last analysis on the attention that is proposed, concerns the xcon facing packaging of horizontal type.

Hypothesis 5

For horizontal sets, the attention, measured in terms of fixation court, revisits and fixation time, is greater for the sets that are in the upper part of the screen compared to those found in the lower part.



Let's compare the bottom and top packaging in sets.
The result that is obtained, very significant, indicates that in terms of FC, the attention is greater for the upper part: T(H) > B(H) (see Appendix 28).

FC_AOI_Packsum_B vs T in Horizontal	$FC_{T(H)} > FC_{B(H)}$

Going down in detail and comparing what happens in the upper and lower part of each set, we obtain extremely significant results.
As can easily be seen from Appendix 29, , the focus is always on packaging in the highest positions, whether it is measured in terms of FC.

FC_AOI_Packsum_B vs T in Horizontal	$FC_{T(H1)} > FC_{B(H1)}$ $FC_{T(H2)} > FC_{B(H1)}$ $FC_{T(H2)} > FC_{B(H1)}$ $FC_{T(H2)} > FC_{B(H2)}$

Also in terms of revisits, both at aggregate packaging levels and at the detailed set level, it is confirmed that the focus is higher on packaging at the top(see Appendix 30).

R_AOI_Packsum_B vs T in Horizontal	$R_{T(H)} > R_{B(H)}$

FC_AOI_Packsum_B vs T in Horizontal	$R_{T(H1)} > R_{B(H1)}$ $R_{T(H2)} > FC_{B(H1)}$ $R_{T(H2)} > R_{B(H1)}$ $R_{T(H2)} > R_{B(H2)}$

(Appendix 31 for more details).

FT_AOI_Packsum_B vs T in Horizontal	$FT_{T(H)} > FT_{B(H)}$

(see Appendix 32)

FC_AOI_Packsum_B vs T in Horizontal	$FT_{T(H1)} > FT_{B(H1)}$ $FT_{T(H2)} > FC_{B(H1)}$ $FT_{T(H2)} > FT_{B(H1)}$ $FT_{T(H2)} > FT_{B(H2)}$

(see Appendix 33)

To summarize, in horizontal sets, we obtained the same result in fixation count, revisits and fixation time, i.e top requeires more number of fixation, more revisits and more ime to fix the packs ($FC_{HBinH=}$42,575, $FC_{HTinH=}$58,110, p_{HT-HB}=.000, $R_{HBinH=}$8,041, $R_{HTinH=}$12,973, p_{HT-HB}=.000, $FT_{HBinH=}$9429,66, $FT_{HTinH=}$12972,94, p_{HT-HB}=.000) .

In details, the 2 top packs in horizontal set H1 needed more fixation count compared to the 2 bottom in the same set H1 ($FC_{HBinH1=}$20,753, $FC_{HTinH1=}$28,973, $p_{HB(H1)-HT(H1)}$=.000) and to the 2 bottom in horizontal set H2 ($FC_{HBinH2=}$21,822, $p_{HB(H2)-HT(H1)}$=.000). Moreover, the 2 top packs in horizontal set H2 needed more fixation count compared to the 2 bottom in the same H2 ($FC_{HTinH2=}$29,137, $p_{HB(H2)-HT(H2)}$=.000) and to the 2 bottom in horizontal set H1 ($p_{HB(H1)-HT(H2)}$=.000).

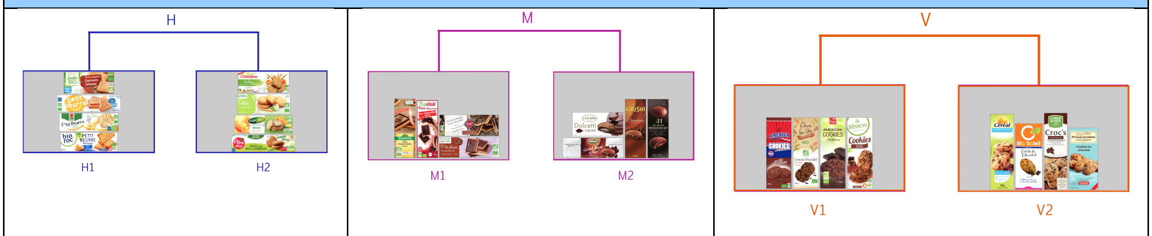
For the revisits and the fixation time we found out the same result: the 2 top packs in horizontal set H1 needed more fixation count compared to the 2 bottom in the same set H1 ($R_{HBinH1=}$4,000, $R_{HTinH1=}$6,274, $p_{HB(H1)-HT(H1)}$=.000) and to the 2 bottom in horizontal set H2 ($R_{HBinH2=}$21,822, $p_{HB(H2)-HT(H1)}$=.000). The 2 top packs in horizontal set H2 needed more fixation count compared to the 2 bottom in the same H2 ($R_{HTinH2=}$6,699, $p_{HB(H2)-HT(H2)}$=.000) and to the 2 bottom in horizontal set H1 ($p_{HB(H1)-HT(H2)}$=.000). For the fixation fime: $FT_{HBinH1=}$4580,90, $FT_{HBinH2=}$4848,750, $FT_{HTinH1=}$6517,25, $FT_{HtinH2=}$6455,69,, $p_{HB(H1)-HT(H1)}$=.000, $p_{HB(H1)-HT(H2)}$=.000, $p_{HB(H2)-HT(H1)}$=.000, $p_{HB(H2)-HT(H2)}$=.000

	TOP VS BOTTOM GENERAL	**TOP VS BOTTOM DETAIL**
FC	$FC_{T(H)} > FC_{B(H)}$	$FC_{T(H1)} > FC_{B(H1)}$ $FC_{T(H2)} > FC_{B(H1)}$ $FC_{T(H2)} > FC_{B(H1)}$ $FC_{T(H2)} > FC_{B(H2)}$
FT	$FT_{T(H)} > FT_{B(H)}$	$FT_{T(H1)} > FT_{B(H1)}$ $FT_{T(H2)} > FC_{B(H1)}$ $FT_{T(H2)} > FT_{B(H1)}$ $FT_{T(H2)} > FT_{B(H2)}$
R	$R_{T(H)} > R_{B(H)}$	$R_{T(H1)} > R_{B(H1)}$ $R_{T(H2)} > FC_{B(H1)}$ $R_{T(H2)} > R_{B(H1)}$ $R_{T(H2)} > R_{B(H2)}$

The last hypothesis according to which the packaging in the upper part has a greater attention, is confirmed in all cases: if measured in terms of fixations and revisits.

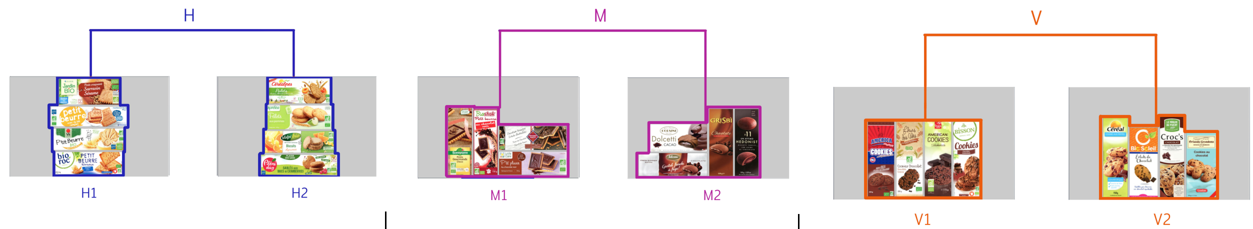
Final results summary

The results achieved are shown in the table below

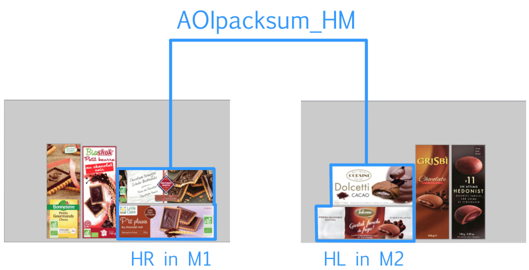
	FC	**REVISITS**	**FT**
AOI SET TOTAL (la page) 			
AOI SET TOTAL (M1 vs M2, H1 vs H2, V1 vs V2)	M1 = M2 V1 = V2 H1 = H2	NO REVISITS	V1 = V2 H1 = H2 M1 > M2 $FT_{H1=}$11240,116,-

	FC_{H1}=50,425 - FC_{H2}=51,384 FC_{V1}=45,890 - FC_{V2}=47,397 FC_{M1}=52,151- FC_{M2}=48,438		FT_{H2}=11394,186, FT_{V1}=10371,69 - FT_{V2}=11120,10 FT_{M1}=11982,552 - FT_{M2}=10582 p_{M1M2}=.005
AOI SET TOTAL (M H V)	V <H V < M V < H,M FC_{H}=50,904 FC_{V}=46,644 FC_{M}=50,295 p_{HV}=,004, p_{MV}=.023	NO REVISITS	M = H = V FT_{V}=10745,89 FT_{H}=11317,15 FT_{M}=11282,33
AOI SET TOTAL (M1 H1 V1 M2 H2 V2)	H1 > V1 H2 > V1 H2 > V2 M1 < V1 M1 < V2 H1 =H2 >V1=V2 > M1 p_{H2-V1}=.002 p_{H2-V2}=.054 p_{M1-V2}=.027	NO REVISITS	M1 > V1 H2 > V1 H1 > V1 V1 < H1, H2 H1=H2 > V1 < M1 p_{H2-V1}=.011 p_{M1-V1}=.002 p_{H1-V1}=.05
	FC	**REVISITS**	**FT**

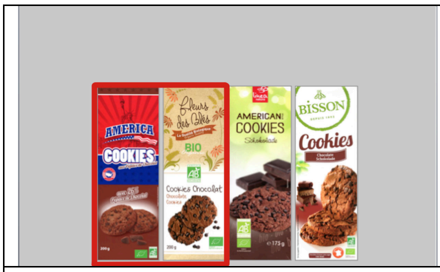
AOI PACK SUM (les 4 packs seulement)



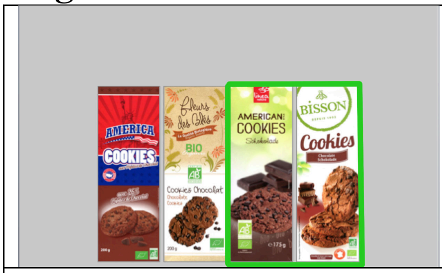
AOI PACK SUM (M1 VS M2, H1 VS H2, V1 VS V2)	M1 = M2 H1 = H2 V1 = V2	H1 = H2 M1 = M2 V1 = V2	M1 > M2 H1 = H2 V1 <V2
AOI PACK SUM (M H V)	V < H, M FC_{H}=50,342	M = H = V R_{M}=11,301, R_{V}=11,0582, R_{H}=10,507	M = H = V FT_{V}=10745,89 FT_{H}=11201,304 FT_{M}=11006,65

	FC_{V}=45,925 FC_{M}=49,151 p_{HV}=,002, p_{MV}=.040		
AOI PACK SUM (M1 M2 H1 H2 V1 V2)	FC_{H1}=49,726 FC_{H2}=50,96 FC_{M1}=50,877 FC_{M2}=47,425 FC_{V1}=44,932 FC_{V2}=46,918 p_{H1V1}=.007 p_{M1V1}=.011 p_{H2V2}=.043 p_{M1V2}=.049 H1 > V1 H2 > V1 H2 > V2 M1 > V1 M1 > V2 V2 < H2, M1 AND V1 < H1, M1	M1 = M2 = H1 = H2 = V1 = V2 R_{M1}=11,137 R_{M2}=11,466, R_{H1}=10,274 R_{H2}=10,740 R_{V1}=11,308 R_{V2}=10,808	FT_{H1}=11098,165 FT_{H2}=11304,44 FT_{M1}=11698,13 FT_{M2}=10315,17 FT_{V1}=10165,74 FT_{V2}=11056,11 M1 > M2 M1 > V1 H2 > M2 H1 > V1 H2 > V1 V2 > V1 V1 < H1 = H2, V1 < M1 ?? p_{M1M2}=.005 p_{M1V1}=.003 p_{M2H2}=.032 p_{H1V1}=.041 p_{H2V1}=.005 p_{V1V2}=.029
AOI IN MIX : H VS V			
			
AOI IN MIX : H VS V	**HM > VM** FC_{HM}=54,260 FC_{VM}=44,041 $p_{M(HV)}$=.000	H(M) = V(M) R_{HM}=11,205 R_{VM}=11,397 $p_{M(HV)}$=.732	FT (H(M)) >> FT (V(M)) FT_{HM}=11934,273 FT_{VM}=10079,043 $p_{M(HV)}$=.000

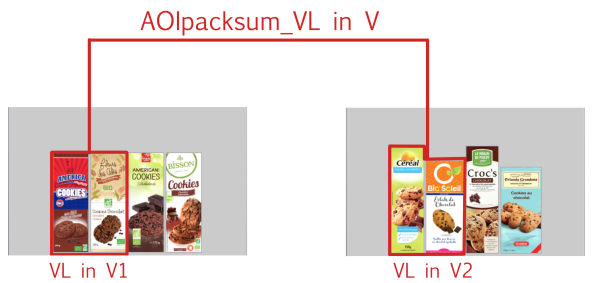
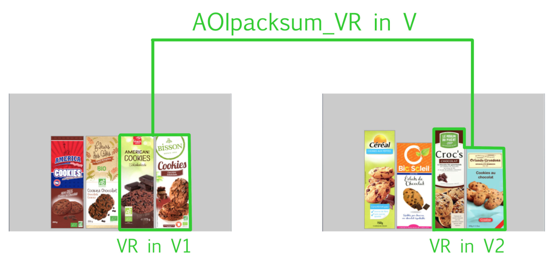
Left

		
VL in V1	**VL in V2**	**VL in M1**
FC	**R**	**FT**
L(V1) = L (V2) = L (M1) $FC_{VlLinV1}=23,945$ $FC_{VLinV2}=25,014$ $FC_{VLinM1}=24,699$	L(V1) = L (V2) = L (M1) $R_{VLinV1}=5,911$ $R_{VLinV2}=5,986$ $R_{VLinM1}=5,959$	L(V1) = L (V2) = L (M1) $FT_{VLinV1}=5332,80$ $FT_{VLinV2}=5553,50$ $FT_{VLinM1}=5825,42$

Right

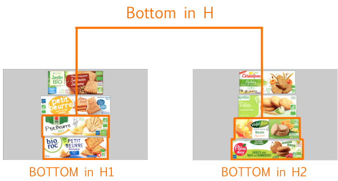
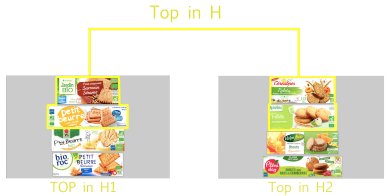
		
VR in V1	**VR in V2**	**VR in M2**
FC	**R**	**FT**
R(V2)) > R(M2)) $FC_{VRinV1}=20,986$ $FC_{VRinV2}=21,904$ $FC_{VrinM2}=19,342$ $P_{R(V2)-R(M2)}=.000$ Plus de FC sur V2 que sur M2	VR(V1) = VR(V2) = VR(M2) $R_{VRinV1}=5,397$ $R_{VRinV2}=4,822$ $R_{VrinM2}=5,438$	VR(M2) < VR(V1) VR(M2) < VR(V2) VR (V1) < VR (V2) VR (M2) < VR(V1) < VR(V2) $FT_{VRinV1}=4832,946575$ $FT_{VRinV2}=5502,6136$ $FT_{VrinM2}=4253,621$ $P_{R(V1)-R(M2)}=.024$ $P_{R(V2)-R(M2)}=.000$ $P_{R(V1)-R(V2)}=.012$ Plus de FT sur V1 et V2 que M2

In vertical sets

FC	R	FT
L(V) > R(V)	L(V) > R(V)	R(V) = L(V)

Plus de FC à gauche $FC_{VLinV=}$48,959 $FC_{VRinV=}$42,890 P_{VL-VR}=.002	Plus de revisites à gauche $R_{VLinV=}$11,897 $R_{VRinV=}$10,219 P_{VL-VR}=.004	$FC_{VLinV=}$10886,30 $FC_{VRinV=}$10335,56

		
T(H) > B(H) $FC_{HBinH=}$42,575 $FC_{HTinH=}$58,110 P_{HT-HB}=.000	T(H) > B(H) $R_{HBinH=}$8,041 $R_{HTinH=}$12,973 p_{HT-HB}=.000	T(H) > B(H) $FT_{HBinH=}$9429,66 $FT_{HTinH=}$12972,94 p_{HT-HB}=.000
HB(H1) < HT(H1) HB(H1) < HT(H2) HB(H2) < HT(H1) HB(H2) < HT(H2) $FC_{HBinH1=}$20,753 $FC_{HBinH2=}$21,822 $FC_{HTinH1=}$28,973 $FC_{HtinH2=}$29,137 $p_{HB(H1)-HT(H1)}$=.000 $p_{HB(H1)-HT(H2)}$=.000 $p_{HB(H2)-HT(H1)}$=.000 $p_{HB(H2)-HT(H2)}$=.000	HB(H1) < HT(H1) HB(H1) < HT(H2) HB(H2) < HT(H1) HB(H2) < HT(H2) $R_{HBinH1=}$4,000 $R_{HBinH2=}$4,041 $R_{HTinH1=}$6,274 $R_{HtinH2=}$6,699 $p_{HB(H1)-HT(H1)}$=.000 $p_{HB(H1)-HT(H2)}$=.000 $p_{HB(H2)-HT(H1)}$=.000 $p_{HB(H2)-HT(H2)}$=.000	HB(H1) < HT(H1) HB(H1) < HT(H2) HB(H2) < HT(H1) HB(H2) < HT(H2) $FT_{HBinH1=}$4580,90 $FT_{HBinH2=}$4848,750 $FT_{HTinH1=}$6517,25 $FT_{HtinH2=}$6455,69 $p_{HB(H1)-HT(H1)}$=.000 $p_{HB(H1)-HT(H2)}$=.000 $p_{HB(H2)-HT(H1)}$=.000 $p_{HB(H2)-HT(H2)}$=.000

6.3.4 Validation of hypotheses

	FT		**FC**		**R**	
H1 : The attention to horizontal and mixed is higher than the attention paid to vertical sets	no		yes		no	
H2 In mixed sets, the attention paid to horizontal packs is higher than the attention paid to vertical packs	yes		no		no	
H3 according to the composition of the set, the attention is greater in the vertical sets than the mixed ones.	L no	R yes	L no	R yes	L no	R yes
H4 In the vertical, the attention, measured in number of fixations, revisists and fixation time is greater for the packaging on the right	no		yes		yes	
H5 for horizontal sets, the attention, measured in terms of fixation court, revisits and fixation time, is greater for the sets that are in the upper part of the screen compared to those found in the lower part.	yes		yes		yes	

Table 13 - Hypothesis resume results

Summarizing the starting hypotheses, it is found that the only one that can be confirmed is the number 5, which concerns the attention brought to the elements above and below.
There are not enough elements to be able to affirm that the orientation of the packaging is an element of significance in the attention paid.

6.4 Detailed analysis of the scan path in the assortments

By measuring the time of entry (ET) it is possible to precisely identify the moment when the packaging has been detected. After a first fixation generally in the center of the screen, the participants adopted a specific sense of reading for each format.
In horizontal assortments, the visual path is most often directed from top to bottom (Tabel 23).

Horizontal set_H1	Horizontal set_H2
	
ET_Biocoop = 0,68 s ET_Jardin Bio = 0,80 s ET_VS = 4,07 s ET_Bioroc = 6,45 s	ET_Karelea = 0,26 s ET_Céréalpes = 0,84 s ET_Valpibio = 4,12 s ET_Plenyday = 6,32 s

Table 14 - Scan path for H packaging ad ET measurement

The results also reveal that the two top packagings are more looked at than the two bottom packagings (M_{FC_TOP} = 29,05 (13,20), M_{FC_BOTTOM} = 21,28 (10,24), *F* = 63,12, *p* = 0,000 ; M_{FT_TOP} = 6,48 sec (3,36), M_{FT_BOTTOM} = 4,71 sec (2,82), *F* = 69,70, *p* = 0,000). Top packagings are also the most chosen: they represent 63% of the choices.

In vertical assortments, the visual pathway is from left to right (Table 24).

Vertical set_V1	**Vertical set _V2**
	
ET_FDB = 0,61 s ET_America = 0,98 s ET_Linea = 1,94 s ET_Bisson = 5,06 s	ET_ Biosoleil = 0,70 s ET_Céréal = 1,01 s ET_Crocs = 2,38 s ET_Orlando = 6,22 s

Table 15 - Scan path for V packaging ad ET measurement

The results also reveal that the two packagings on the left are more watched than the two packagings of right in number of fixings (M_{FC_LEFT} = 24,47 (12,88), M_{FC_RIGHT} = 21,44 (9,18), *F* = 10,06, *p* = 0,002), but there is no significant difference in fixation times (M_{FT_LEFT} = 5,44 sec (3,18), M_{FT_RIGHT} = 5,16 sec (2,46), *F* = 1,36, *p* = 0,24). On the other hand it is the packagings of right which are the most chosen: they represent 58% of the choices.
In mixed assortments, the visual paths are different depending on the layout of the packaging (Figure 5). They start more often on the left center (on a vertical packaging in the M1 assortment and on a

horizontal packaging in the M2 assortment). For the M1 assortment, we find the reading direction from left to right, but this movement is not observed for the M2 assortment.

<table>
<tr><th>Mix set_M1</th><th>Mix set_M2</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>ET_ Bioshok = 0,32 s
ET_ Bonneterre = 1,03 s
ET_ Amato = 3,57 s
ET_ LVC = 6,20 s</td><td>ET_ Corsini = 0,70 s
ET_ Hedonist = 1,36 s
ET_ Falcone = 2,97 s
ET_ Grisbi = 4,78 s</td></tr>
</table>

Table 16 - Scan path for M packaging ad ET measurement

Comparing vertical and horizontal packagings in mixed assortments, we observed that horizontal packaging is more popular than vertical packaging (M_{FC_H} = 27,13 (13,87), M_{FC_V} = 22,02 (11,31), F = 26,79, p = 0,000 ; M_{FT_H} = 5,96 sec (3,18), M_{FT_V} = 5,03 sec (2,77), F = 19,74, p = 0,000). In mixed assortments, horizontal packaging is also the most popular: it represents 67% of the choices.

7. Influence of conditions on visual complexity, processing fluency, perceived variety and atttractiveness of assortment

7.1 Results of the questionnaire

The data in the questionnaire are statistically treated.
Similarly to the data related to the ae-tracking, the first operation to be performed is a descriptive analysis.
Following are descriptive statistics.

Sample description

sex		Effective	Percentage
Valide	Male	19	26,0
	Female	54	74,0
	Total	73	100,0

age		Effective	Percentage
Valid	21	1	1,4
	22	4	5,5
	23	17	23,3
	24	25	34,2
	25	4	5,5
	26	6	8,2
	27	2	2,7
	28	2	2,7
	30	2	2,7
	31	1	1,4
	35	1	1,4
	37	2	2,7
	38	1	1,4
	39	2	2,7
	42	1	1,4
	45	1	1,4
	47	1	1,4
	Total	73	100,0

		Moyenne	26,25
		Ecart type	5,617

Activity		Effective	Percentage
Valid	Bachelor	6	8,2
	Master	24	32,9
	Working student	41	56,2
	Professional activity	2	2,7
	Total	73	100,0

Buyer		Effective	Percentage
Valid	oui	56	76,7
	non	17	23,3
	Total	73	100,0

Wiew		Effective	Percentage
Valid	yes	68	93,2
	no	5	6,8
	Total	73	100,0

Choice

M1	**M2**
	

		M1_choice1		**M1_choice2**		**M1 choice1+M1 choice2**	
		Effective	Percentage	Effective	Percentage	Effective	Percentage
Valid	Bonneterre	37	50,7	5	6,8	42	29
	Bioshok	7	9,6	5	6,8	12	8
	Amato	23	31,5	23	31,5	46	32
	La vie claire	6	8,2	40	54,8	46	32
	Total	73	100,0	73	100,0	146	100

		M2_choice1		**M2_choice2**		**M2 choice1+M2 choice2**	
		Effective	Percentage	Effective	Percentage	Effective	Percentage
Valid	Corsini	52	71,2	18	24,7	70	47,9
	Falcone	14	19,2	20	27,4	34	23,3
	Hedonist	5	6,8	21	28,8	26	17,8

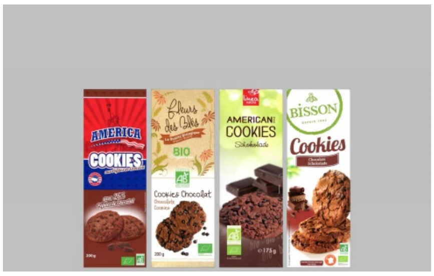
	Grisby	2	2,7	14	19,2	16	11,0
	Total	73	100,0	73	100,0	146	100

M2_choice1

		Effective	Percentage	Valid Percentage	Sum Percentage
Valid	Corsini	52	71,2	71,2	71,2
	Falcone	14	19,2	19,2	90,4
	Hedonist	5	6,8	6,8	97,3
	Grisby	2	2,7	2,7	100,0
	Total	73	100,0	100,0	

M2_choice2

		Effective	Percentage	Valid Percentage	Sum Percentage
Valid	Corsini	18	24,7	24,7	24,7
	Falcone	20	27,4	27,4	52,1
	Hedonist	21	28,8	28,8	80,8
	Grisby	14	19,2	19,2	100,0
	Total	73	100,0	100,0	

V1	**V2**
	

		V1_choice1		V1_choice2		V1 choice1+M1 choice2	
		Effective	Percentage	Effective	Percentage	Effective	Percentage
Valid	America cookies	12	16,4	2	2,7	14	9,6
	Fleur de blé	48	65,8	9	12,3	57	39,0
	Linea natura	6	8,2	8	11,0	14	9,6
	Bisson	7	9,6	54	74,0	61	41,8
	Total	73	100,0	73	100,0	146	100

		V2_choice1		V2_choice2		V2 choice1+V2 choice2	
		Effective	Percentage	Effective	Percentage	Effective	Percentage
Valid	Cereal	33	45,2	5	6,8	38	26,0

	Biosoleil	9	12,3	4	5,5	13	8,9
	Crocs	29	39,7	37	50,7	66	45,2
	Orlando	2	2,7	27	37,0	29	19,9
	Total	73	100,0	73	100,0	146	100

V1_choice2

		Effective	Percentage	Valid Percentage	Sum Percentage
Valid	America cookies	2	2,7	2,7	2,7
	Fleur de blé	9	12,3	12,3	15,1
	Linea natura	8	11,0	11,0	26,0
	Bisson	54	74,0	74,0	100,0
	Total	73	100,0	100,0	

V2_choice1

		Effective	Percentage
Valid	Cereal	33	45,2
	Biosoleil	9	12,3
	Crocs	29	39,7
	Orlando	2	2,7
	Total	73	100,0

V2_choice2

		Effective	Percentage
Valid	Cereal	5	6,8
	Biosoleil	4	5,5
	Crocs	37	50,7
	Orlando	27	37,0
	Total	73	100,0

H1

H2

H1_choice

		Effective	Percentage
Valide	Jardin Bio	39	53,4
	Biocoop	24	32,9
	VS	5	6,8
	Bioroc	5	6,8
	Total	73	100,0

H1_choice2

		Effective	Percentage
Valide	Jardin Bio	9	12,3
	Biocoop	26	35,6
	VS	11	15,1
	Bioroc	27	37,0
	Total	73	100,0

		H1_choice1		**H1_choice2**		**H1 choice1+H1 choice2**	
		Effective	Percentage	Effective	Percentage	Effective	Percentage
Valide	Jardin Bio	39	53,4	7	6,8	46	31,5
	Biocoop	24	32,9	19	5,5	43	29,5
	VS	5	6,8	11	50,7	16	11,0
	Bioroc	5	6,8	36	37,0	41	28,1
	Total	73	100,0	73	100,0	146	100

		H2_choice1		**H2_choice2**		**H2 choice1+H2 choice2**	
		Effective	Percentage	Effective	Percentage	Effective	Percentage
Valide	Cerealpes	32	43,8	7	6,8	39	26,7
	Karelea	27	37,0	19	5,5	46	31,5
	Valpibio	10	13,7	11	50,7	21	14,4
	Pleni Day	4	5,5	36	37,0	40	27,4
	Total	73	100,0	73	100,0	146	100

H2_choice1

		Effective	Percentage
Valide	Cerealpe	32	43,8
	Karelea	27	37,0

	Valpibio	10	13,7
	Pleni Day	4	5,5
	Total	73	100,0

H2_choice2

		Effective	Percentage
Valide	Cerealpe	7	9,6
	Karelea	19	26,0
	Valpibio	11	15,1
	Pleni Day	36	49,3
	Total	73	100,0

Each item is subsequently analyzed, starting from the analysis of normality.

7.1.1 Analysis of the results of the VARIETY scale

Also for the items of the questionnaire an equality test was performed to understand if, from the point of view of the attractiveness, variety, complexity, and processing fluency, the two sets of the same type (M1 and M2, V1 and V2, H1 and H2). The results of the manipulation check briefly shown in the summary table at the end of the analyzes and the statistics obtained are shown in the Appendix 40.

Normality

Statistiques descriptives

	N	Asymétrie		Kurtosis	
	Statistique	Statistique	Erreur std	Statistique	Erreur std
M1_variete	73	,608	,281	-,652	,555
M2_variete	73	1,222	,281	1,019	,555
V1_variete	73	,093	,281	-1,298	,555
V2_variete	73	,177	,281	-,915	,555
H1_variete	73	-,284	,281	-1,174	,555
H2_variete	73	-1,050	,281	,290	,555
Moy_V1V2_variete	73	,031	,281	-,871	,555
Moy_H1H2_variete	73	-,581	,281	-,284	,555
N valide (listwise)	73				

Since the values of kurtosis are between -3 and +3 and symmetry between -1 and +1, the function is normal.

A comparison is made between the average of the three orientation (H, v and M). Because there are three variables to compare, from a study of type within, the test of repeated measures must be used. (see Appendix 34)

Variety perception of the	**H > V > M**

3 assortments	M_{VAR_H} =5,9521 p_{VAR_HM}=.000	M_{VAR_V} =4,6986 p_{VAR_VM}=.000	M_{VAR_M} =3,301 p_{VAR_HV}=.000

Hence the horizontal sets are perceived to be more varied than vertical and mixed.

7.2.1 Analysis of the results of the Complexity scale

Normality

Statistiques descriptives					
	N	Asymétrie		Kurtosis	
	Statistique	Statistique	Erreur std	Statistique	Erreur std
Moy_complexite_M1	73	-,570	,281	-,411	,555
Moy_complexite_M2	73	-,936	,281	,108	,555
Moy_complexite_V1	73	-,629	,281	-,494	,555
Moy_complexite_V2	73	-,617	,281	-,398	,555
Moy_complexite_H1	73	-,578	,281	-,635	,555
Moy_complexite_H2	73	-,238	,281	-,962	,555
Moy_M1M2_complexite	73	-,284	,281	-,583	,555
Moy_V1V2_complexite	73	-,407	,281	-,634	,555
Moy_H1H2_complexite	73	-,362	,281	-,463	,555
N valide (listwise)	73				

Variables are normal distributed.

Comparison of the 3 averages for COMPLEXITY

While for the variety the item is only one, for the complexity the items are two. Therefore it is necessary to make an average between the two before being able to make the average between the value obtained for the two sets.
Only for the variables of Complexity are reported the operations performed on SPSS for example.

```
Moy_complexite_M1=(M1_complexite1 + M1_complexite2) / 2.
Moy_complexite_M2=(M2_complexite1 + M2_complexite2) / 2.
Moy_complexite_V1=(V1_complexite1 + V1_complexite2) / 2.
Moy_complexite_V2=(V2_complexite1 + V2_complexite2) / 2.
Moy_complexite_H1=(H1_complexite1 + H1_complexite2) / 2.
Moy_complexite_H2=(H2_complexite1 + H2_complexite2) / 2.
Moy_M1M2_complexite=(Moy_complexite_M1 + Moy_complexite_M2) / 2.
Moy_V1V2_complexite=(Moy_complexite_V1 + Moy_complexite_V2) / 2.
Moy_H1H2_complexite=(Moy_complexite_H1 + Moy_complexite_H2) / 2.
```

The procedure to understand if there are differences is to compare the averages of the values obtained on the scale 1-9 for the averages of the 3 orientations.
Being a test in a "between" experiment and being the number of variables greater than two, also in this case a text of repeated measures must be used (see Appendix 35).

Complexity perception of the 3 assortments	H < M= V (H more complex thab V-M) M_{COMPL_H}= 5.64 M_{COMP_V} = 6.26 M_{COMPL_M}= 6.54 p_{COM_HM}=.000, p_{COM_VM}=.139, p_{COM_HV}=.007

	The perception of complexity is higher in horizontal sets.

7.3.1 Analysis of the results of the Processing fluency

Normality

Statistiques descriptives					
	N	Asymétrie		Kurtosis	
	Statistique	Statistique	Erreur std	Statistique	Erreur std
Moy_fluency_M1	73	-,012	,281	-1,041	,555
Moy_fluency_M2	73	-,660	,281	-,240	,555
Moy_fluency_V1	73	-,379	,281	-,454	,555
Moy_fluency_V2	73	-,275	,281	-,479	,555
Moy_fluency_H1	72	-,097	,283	-1,041	,559
Moy_fluency_H2	73	,093	,281	-1,045	,555
Moy_M1M2_fluency	73	-,339	,281	-,217	,555
Moy_H1H2_fluency	72	,027	,283	-,532	,559
Moy_V1V2_fluency	73	-,056	,281	-,342	,555
N valide (listwise)	72				

Variables are normal distributed.

Process fluency of the 3 assortments	H < M=V (H less fluent than V-M) M_{PF_H} =4.93 M_{PF_V} =5.31 M_{PF_M} =5.41 p_{PF_HM}=.027 p_{PF_VM}=.596 p_{PF_HV}=.065 Horizontal sets are less "fluent" (more diffucult to process) than vertical and mixed sets.

For details see Appendix 36.

7.4.1 Analysis of the results of Attractiveness

Normality

Statistiques descriptives					
	N	Asymétrie		Kurtosis	
	Statistique	Statistique	Erreur std	Statistique	Erreur std
Moy_attractivite_M1	73	-,559	,281	,144	,555
Moy_attractivite_M2	73	-,695	,281	,018	,555
Moy_attractivite_V1	73	-,727	,281	,098	,555

Moy_attractivite_V2	73	-,493	,281	-,517	,555
Moy_attractivite_H1	73	-,317	,281	-,671	,555
Moy_attractivite_H2	73	-,970	,281	1,300	,555
Moy_M1M2_attractivite	73	-,878	,281	1,157	,555
Moy_H1H2_attractivite	73	-,201	,281	,466	,555
Moy_V1V2_attractivite	73	,033	,281	-,679	,555
N valide (listwise)	73				

Variables are normal distributed.

Attractiveness of the 3 the assortments	H < M=V M_{PF_H} =4.93 M_{PF_V} =5.31 M_{PF_M} =5.41 p_{PF_HM}=.027 p_{PF_VM}=.596 p_{PF_HV}=.065 Horizontal sets are less "fluent" (more diffucult to process) than vertical and mixed sets.

For details see Appendix 37.

7.5.1 Analysis of the results of Choice

Please note that the participant was invited to indicate two preferences for each set (ie for each type of biscuit assortment).
It was decided to let the participant choose two products and not just one to have a greater wealth of data. The procedure for comparing the values is similar to that used to analyze the other items.

```
Moy_M1M2_qualif_choix=(M1_decide1 + M2_decide1) / 2.
Moy_H1H2_qualif_choix=(H1_decide1 + H2_decide1) / 2.
Moy_V1V2_qualif_choix=(V1_decide1 + V2_decide1) / 2.
Moy_M1M2_qualif_decision=(M1_decide2 + M2_decide2) / 2.
Moy_H1H2_qualif_decision=(H1_decide2 + H2_decide2) / 2.
Moy_V1V2_qualif_decision=(V1_decide2 + V2_decide2) / 2.
```

Normality

Statistiques descriptives

	N	Asymétrie		Kurtosis	
	Statistique	Statistique	Erreur std	Statistique	Erreur std
Moy_M1M2_qualif_choix	73	-,179	,281	-,594	,555
Moy_H1H2_qualif_choix	73	-,166	,281	-,401	,555
Moy_V1V2_qualif_choix	73	-,416	,281	-,416	,555
Moy_M1M2_qualif_decision	73	-,370	,281	-,477	,555
Moy_H1H2_qualif_decision	73	-,673	,281	,252	,555
Moy_V1V2_qualif_decision	73	-,578	,281	,606	,555

N valide (listwise)	73				

Variables are normal distributed for both choice satisfaction and choice difficulty.

Difficulty of choice for the 3 assortments	The level of difficulty of choice is the same according to the sets M = V = H M_{DD_H} =5.17 M_{DD_V} =5.45 M_{DD_M} =5.28 p_{DD_HM}= .742 p_{DD_VM}= .511 p_{DD_HV}=.296
Satisfaction of choice for the 3 assortments	Participants are more satisfied when choosing mix sets than when choosing horizontal sets M > H M_{DS_H} = 6.5 M_{DS_V} = 6.69 M_{DS_M} = 6.95 p_{DS_HM}= .034 p_{DS_VM}= .194 p_{DS_HV}=.371

For details see Appendix 38 and Appendix 39.

Summary of results	
Variety (1 = min variety, 9 = max variety)	Perception of variety differs within the same condition $M_{VAR\_H1}=5,11$, $M_{VAR\_H2}=6,79$, $p_{VAR\_H1H2}=.000$, $M_{VAR\_V1}=4,40$, $M_{VAR\_V2}=5,00$, $p_{VAR\_V1V2}=.015$, $M_{VAR\_M1}=3,81$, $M_{VAR\_M2}=2,79$, $p_{VAR\_M1M2}=.000$).
	The perception of variety is higher in horizontal sets. H > V > M $M_{VAR\_H}=5,9521$ $M_{VAR\_V}=4,6986$ $M_{VAR\_M}=3,301$ $p_{VAR\_HM}=.000$, $p_{VAR\_VM}=.000$, $p_{VAR\_HV}=.000$)
Complexity (1 = max complexity, 9 = min complexity)	Perception of complexity differs within the same condition $M_{COMP\_H1}=5,8973$, $M_{COMPL\_H2}=5,3973$, $p_{COMPL\_H1H2}=.059$, $M_{COMPL\_V1}=6,5205$, $M_{COMPL\_V2}=6,0068$, $p_{COMPL\_V1V2}=.042$, $M_{COMPL\_M1}=6,0890$, $M_{COMPL\_M2}=7,000$, $p_{COMPL\_M1M2}=.001$,
	The perception of complexity is higher in horizontal sets. H < M= V (H more complex thab V-M) $M_{COMPL\_H}= 5.64$ $M_{COMP\_V} = 6.26$ $M_{COMPL\_M}= 6.54$ $p_{COM\_HM}=.000$, $p_{COM\_VM}=.139$, $p_{COM\_HV}=.007$
Fluency (1 = more difficult, 9 = easy to process)	The perception of fluency differs within the same condition $M_{FLUENCY\_H1}=4,82$, $M_{FLUENCY\_H2}=5,03$, $p_{FLUENCY\_H1H2}=.513$ $M_{FLUENCY\_V1}=5,63$, $M_{FLUENCY\_V2}=5,01$, $p_{FLUENCY\_V1V2}=.011$ $M_{FLUENCY\_M1}=4,88$, $M_{FLUENCY\_M2}=5,99$, $_{FLUENCY\_M1M2}=.000$
	horizontal sets are less "fluent" (more diffucult to process) than vertical and mixed sets. H < M=V (H less fluent than V-M) $M_{PF\_H}=4.93$ $M_{PF\_V}=5.31$ $M_{PF\_M}=5.41$ $p_{PF\_HM}=.027$ $p_{PF\_VM}=.596$ $p_{PF\_HV}=.065$

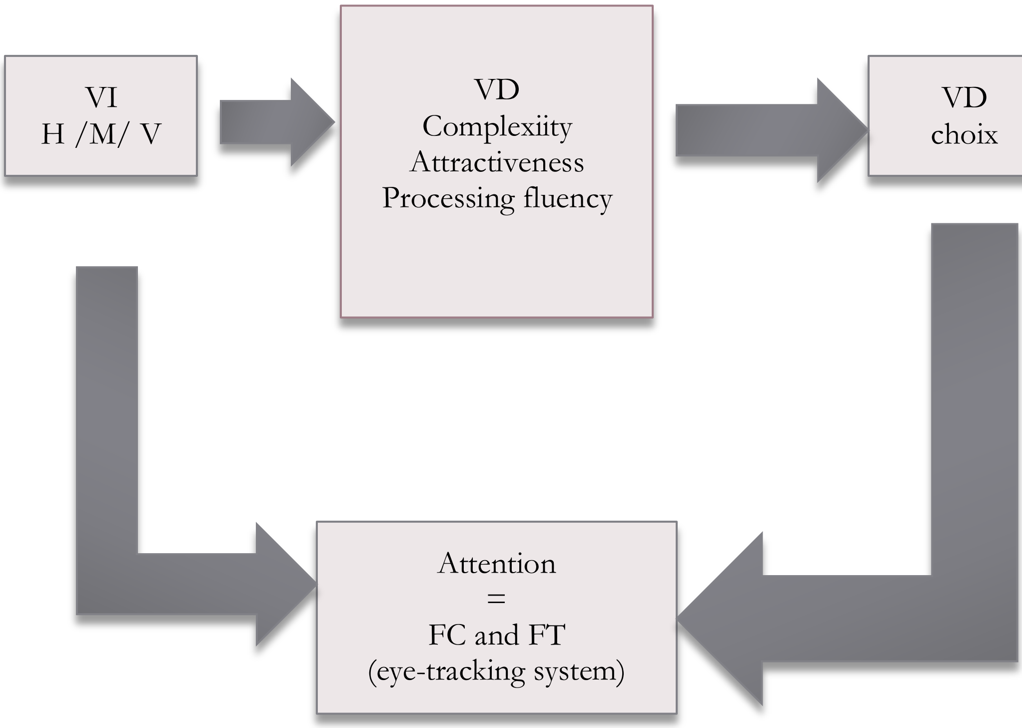
Attractiveness (1 = less attractive, 9 = more attractive)	Attractiveness does not differ within the same condition M_{ATT_H1}=4,7226, $M_{ATT—H2}$=5,2363, $p_{ATT—HIH2}$=,013 $M_{ATT—M1}$= 4,8253, $M_{ATT—M2}$= 4,8904, p_{M1M2}=.729 $M_{ATT—V1}$= 4,9315, M_{ATT_V2}= 4,6541, p_{ATT_M1M2}=.174
	Sets have the same level of Attractiveness M = V = H M_{ATT_H} =4.97 M_{ATT_V} =4.79 $M_{ATT\_—M}$ =4.85 p_{ATT_HM}=.380 p_{ATT_VM}=.588 p_{ATT_HV}=.167
Choice difficulty (1= difficile, 9 = facile)	The difficulty of choice does not differ within the same condition M_{DD_H1}=5,11, $M_{DD\_—H2}$=5,25, p_{DD_HIH2}=.687 M_{DD_V1}=5,34, $M_{DD\_—V2}$=5,58, p_{DD_VIV2}=.407 M_{DD_M1}=5,23, M_{DD_M2}=5,33, $_{DD\_—MIM2}$=.767
	The level of difficulty of choice is the same according to the sets M = V = H M_{DD_H} =5.17 M_{DD_V} =5.45 $M_{DD\_—M}$ =5.28 p_{DD_HM}= .742 p_{DD_VM}= .511 p_{DD_HV}=.296
Choice satisfaction (1 = not satisfied, 9 = well satisfied)	M_{DS_H1}=6,60, $M_{DS\_—H2}$=6,40, p_{DS_HIH2}=.416, M_{DS_V1}=6,74, $M_{DS\_—V2}$=6,66 , p_{DS_VIV2}=.0744, M_{DS_M1}=6,89, M_{DS_M2}=7,03, $_{DS\_—MIM2}$=.584
	Participants are more satisfied when choosing mix sets than when choosing horizontal sets M > H M_{DS_H} = 6.5 M_{DS_V} = 6.69 $M_{DS\_—M}$= 6.95 p_{DS_HM}= .034 p_{DS_VM}= .194 p_{DS_HV}=.371

7.2 Towards the creation of a model

The aim of this study was to measure the influence of a horizontal versus vertical arrangement of information on packaging, on the one hand, on visual attention and, on the other hand, on the perception of the qualities of the display through measures of visual complexity, perceptual fluency and perceived variety.

It would therefore seem that the two aspects are completely disconnected, betray them.
But what do visual attention and the perception of qualities have in common?
What we tried to understand is whether attention can play a role in the choice of the product and in the perception of the quality of the product.

The concept is expressed in the following diagram



What it must be done, in a nutshell, is to check whether you have an effect of mediation or moderation. Moderation and mediation are two very common concepts in applied psychology.

The following is a theoretical explanation:

Mediation: when the effect of the independent variable on the dependent variable is not direct, but is related to the effect of a third variable that intervenes in the relationship between the VI and the VD.

Moderation [35]
Moderation means that the effect of a variable on an outcome is altered (i.e., moderated) by a covariate. Moderation is usually captured by an interaction between the causal variable and the covariate.

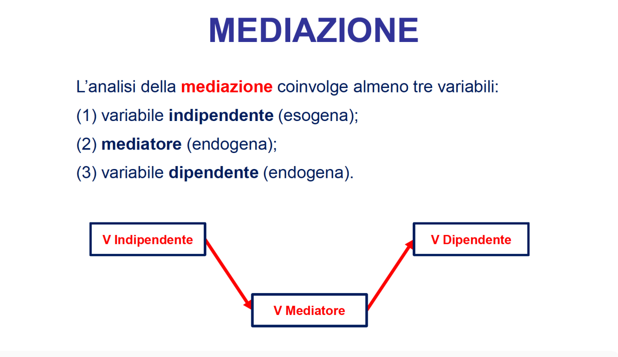


Table 17 - Mediation (Prof. Senese, Metodi e Tecniche della Psicologia clinica)

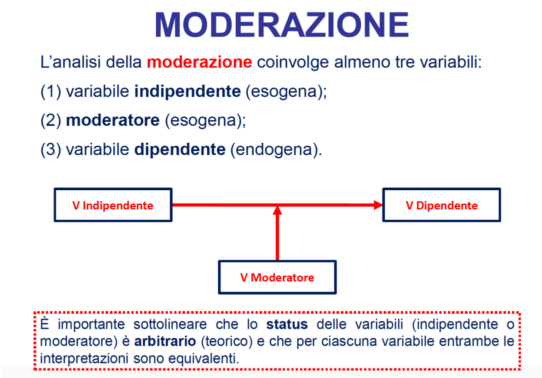


Table 18 - Moderation (Prof. Senese, Metodi e Tecniche della Psicologia clinica)

MEDIATION [35]

Step 1: The VD must be predicted by the VI (c). There is an effect that it could be mediated [M1].
Step 2: The variable M is predicted by the VI (a). There is a relationship between the independent variable and the mediator (collinearity) [M2].
Step 3: The VD must be predicted by M (b) net of the VI (c ').
There is a specific relationship between the mediator and the variable employee [M3].
Step 4: To establish that it is a total mediation, the effect of the VI on the VD (c ') should be equal to 0 when is checked for the effect of the mediator (b). The effects of steps 3 and 4 are estimated in the same equation [M3].

The first step to understand if there are mediation or moderation effects, being the within-type experiment, the data must be completely reorganized.
The statistical method is that of logistic regression (LOGIT regression).

The idea is to make a logistic regression for each brand.

For example:
y = choice of bonneterre (0 or 1) = caterogiric variable
x1 = covariant FC_Bonneterre
x2 = covariant FT_Bonneterre
x3 = covariant R_Bonneterre

Unfortunately for all brands we haven't a significant beta, if not the first iteration (the process to get the cofficients for logistic regression is iterative).
It means there is no relationship because of the effect between choice and attention.
Unfortunately, no significant correlation is found, therefore it makes no sense to proceed in the search for a mediation effect.
The result of statistics regarding logistic regression are not listed in this document as they are not part of the main study and would have unnecessarily burdened the document. However, they are listed in the additional material folder.

8. Conclusions

This study, even if carried out in a short period of time (less than a year), has allowed us to deepen the theme of the packaging 's packaging in a consumer product.
The eye-tracker has proved to be an extremely valuable tool, capable of providing data, whose answers can be interpreted knowingly and scientifically.
One of the great limitations of this project was the lack of time: a study of several years allows to reach a level of detail and analysis of the major data. Suffice it to say that, if we had chosen to implement a "between" experiment, we could have reached a cause-effect relationship by means of linear regression.
The experience, extremely educational from an educational point of view, has allowed us to know an instrument from which I have always been fascinated and to be able to admire its potential. A scientific experiment has been conducted with rigid initial hypotheses, subject to refutation or confirmation, by means of statistical data analysis.
If I have to find a weak point, this consists in the formalization of the concept of attention: if on the one hand it is true that the use of both the revisists, both the fixation count, and delel fixation number, provides a greater wealth of data, from other increases the difficulty in tracing precise answers. What better identifies the concept of attention? The number of fixations? The time of fixation of the point? The number of rivisites? Depending on how you choose to formalize the concept of attention, you can get different answers, because the three measures (FC, FT, R) is not said to have a relationship of the same sign. So the doubt does not concern the potential of the instrument, but the formalization of a concept.
This exploratory study can be seen as a starting point for a more in-depth survey on the verticality and horizontality of the presentation of the product.

Another doubt concerns the formulation of experiments in the laboratory: how far are you from reality? Which and how many variables are not considered in the analysis of the data? For example, the position of sitting on the chair, associated with a feeling of relaxation, how much is considered a residual in the treatment of data?

In my opinion, an experiment must be considered as a partial and simplified analysis of reality. If you have this awareness, it makes sense to keep questioning in the laboratory.

9. Acknowledgements

I thank myself. For the tenacity, courage, resourcefulness, which led me to try to do a thesis in a completely new context and a field that really fascinated me.

I can not fail to mention my Relator, Prof. Silvano Guelfi, who has always granted me trust and availability, with a contagious enthusiasm.

Not second in the mention is my Co-Relator, Prof. Droulers, who first believed in my capacities, proposing me a concrete date to leave in France in order to start the experiment. Later he accepted me in his laboratory, he trained me giving me access to his courses, free access to his databases and stimulated me to think actively and concretely about the experiment.

It would not have been possible to obtain the current results without the help of Prof. Lacoste-Badie, who supported me throughout the execution phase of the experiment and in the analysis of the data.

Last, but not least, it is Ludovico. To this day, the most important person in my life, who has always made me feel free to choose what was right for me, but supported in my choices and has concretely helped me to realize this important step towards the future.

Appendixes

Appendix 1 – Manipulation check on AOISET_TOTAL

TOTAL - FC

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FC_AOIsettotal_H1	50,425	73	24,8238	2,9054
	FC_AOIsettotal_H2	51,384	73	22,6946	2,6562
Pair 2	FC_AOIsettotal_M1	52,151	73	28,2679	3,3085
	FC_AOIsettotal_M2	48,438	73	22,9044	2,6808
Pair 3	FC_AOIsettotal_V1	45,890	73	19,6062	2,2947
	FC_AOIsettotal_V2	47,397	73	25,9533	3,0376

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	FC_AOIsettotal_H1 - FC_AOIsettotal_H2	-,9589	13,8849	1,6251	-4,1985	2,2807	-,590	72	,557
Pair 2	FC_AOIsettotal_M1 - FC_AOIsettotal_M2	3,7123	16,8543	1,9727	-,2201	7,6447	1,882	72	,064
Pair 3	FC_AOIsettotal_V1 - FC_AOIsettotal_V2	-1,5068	16,8252	1,9692	-5,4325	2,4188	-,765	72	,447

AOI TOTAL - FT

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FT_AOIsettotal_V1	10371,690	73	5144,8228	602,1560
	FT_AOIsettotal_V2	11120,103	73	6317,3246	739,3869
Pair 2	FT_AOIsettotal_H1	11240,116	73	7070,5214	827,5419
	FT_AOIsettotal_H2	11394,186	73	5623,6541	658,1989
Pair 3	FT_AOIsettotal_M1	11982,552	73	6789,0143	794,5940
	FT_AOIsettotal_M2	10582,121	73	5381,1499	629,8160

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	FT_AOIsettotal_V1 - FT_AOIsettotal_V2	-748,4123	3512,6190	411,1210	-1567,9670	71,1423	-1,820	72	,073
Pair 2	FT_AOIsettotal_H1 - FT_AOIsettotal_H2	-154,0699	3994,9354	467,5718	-1086,1573	778,0175	-,330	72	,743
Pair 3	FT_AOIsettotal_M1 - FT_AOIsettotal_M2	1400,4315	4113,6586	481,4673	440,6439	2360,2191	2,909	72	,005

Appendix 2 – Manipulation check on AOIPACK_SUM

AOI PACKSUM - FC

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FC_AOI packsum_H1	49,726	73	23,9033	2,7977
	FC_AOI packsum_H2	50,96	73	22,327	2,613
Pair 2	FC_AOI packsum_M1	50,877	73	27,4444	3,2121
	FC_AOI packsum_M2	47,425	73	22,8625	2,6758
Pair 3	FC_AOI packsum_V1	44,932	73	18,9585	2,2189
	FC_AOI packsum_V2	46,918	73	25,3184	2,9633

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	FC_AOI packsum_H1 - FC_AOI packsum_H2	-1,2329	13,5816	1,5896	-4,4017	1,9359	-,776	72	,441
Pair 2	FC_AOI packsum_M1 - FC_AOI packsum_M2	3,4521	16,4807	1,9289	-,3932	7,2973	1,790	72	,078
Pair 3	FC_AOI packsum_V1 - FC_AOI packsum_V2	-1,9863	16,2459	1,9014	-5,7768	1,8042	-1,045	72	,300

Then $FC_{H1} = FC_{H2}$, $FC_{V1} = FC_{V2}$, $FC_{M1} = FC_{M2}$

AOI PACKSUM - REVISITS

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	R_AOI packsum_H1	10,274	73	6,2099	,7268
	R_AOI packsum_H2	10,740	73	5,2441	,6138
Pair 2	R_AOI packsum_M1	11,137	73	7,3282	,8577
	R_AOI packsum_M2	11,466	73	6,6208	,7749
Pair 3	R_AOI packsum_V1	11,308	73	5,6092	,6565
	R_AOI packsum_V2	10,808	73	7,9156	,9265

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	R_AOI packsum_H1 - R_AOI packsum_H2	-,4658	4,7583	,5569	-1,5759	,6444	-,836	72	,406
Pair 2	R_AOI packsum_M1 - R_AOI packsum_M2	-,3288	5,6348	,6595	-1,6435	,9859	-,499	72	,620
Pair 3	R_AOI packsum_V1 - R_AOI packsum_V2	,5000	6,0507	,7082	-,9117	1,9117	,706	72	,482

AOI PACKSUM - FT

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FT_AOI packsum_M1	11698,13836	73	6664,506135	780,0214436
	FT_AOI packsum_M2	10315,17945	73	5365,635327	628,0001142
Pair 2	FT_AOI packsum_H1	11098,16575	73	6870,812508	804,16777819
	FT_AOI packsum_H2	11304,44247	73	5558,03745	650,5190794
Pair 3	FT_AOI packsum_V1	10165,74795	73	4971,657772	581,888529
	FT_AOI packsum_V2	11056,11781	73	6157,863262	720,7233804

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	FT_AOI packsum_M1 - FT_AOI packsum_M2	1382,958903	4060,26765	475,21838	435,628368	2330,2894	2,910	72	,005
Pair 2	FT_AOI packsum_H1 - FT_AOI packsum_H2	-206,276712299999990	3910,83996	457,7291957	-1118,743180	706,189762799999900	-,451	72	,654
Pair 3	FT_AOI packsum_V1 - FT_AOI packsum_V2	-890,369863	3422,424952000	400,5645424	-1688,880684	-91,8590413	-2,223	72	,029

Appendix 3 – Repeated musure tests on H M V on FC for AOI_SETTOTAL

FC – AOISET TOTAL

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	FC_AOIsettotal_H
2	FC_AOIsettotal_M
3	FC_AOIsettotal_V

Descriptive Statistics			
	Mean	Std. Deviation	N
FC_AOIsettotal_H	50,904	22,7472	73
FC_AOIsettotal_M	50,295	24,3069	73
FC_AOIsettotal_V	46,644	21,4060	73

Multivariate Tests[a]									
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
factor1	Pillai's Trace	,123	4,963[b]	2,000	71,000	,010	,123	9,927	,795
	Wilks' Lambda	,877	4,963[b]	2,000	71,000	,010	,123	9,927	,795
	Hotelling's Trace	,140	4,963[b]	2,000	71,000	,010	,123	9,927	,795
	Roy's Largest Root	,140	4,963[b]	2,000	71,000	,010	,123	9,927	,795
a. Design: Intercept Within Subjects Design: factor1									
b. Exact statistic									
c. Computed using alpha = ,05									

Pairwise Comparisons						
Measure: MEASURE_1						
(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	,610	1,560	,697	-2,499	3,719
	3	4,260*	1,423	,004	1,424	7,097
2	1	-,610	1,560	,697	-3,719	2,499
	3	3,651*	1,576	,023	,509	6,793
3	1	-4,260*	1,423	,004	-7,097	-1,424
	2	-3,651*	1,576	,023	-6,793	-,509

Based on estimated marginal means
*. The mean difference is significant at the ,05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 4 – Repeated misure test on all sets on FC for AOI_SETTOTAL

Within-Subjects Factors	
Measure: MEASURE_1	
ff	Dependent Variable
1	FC_AOIsettotal_H1
2	FC_AOIsettotal_H2
3	FC_AOIsettotal_M1
4	FC_AOIsettotal_M2
5	FC_AOIsettotal_V1
6	FC_AOIsettotal_V2

Descriptive Statistics			
	Mean	Std. Deviation	N
FC_AOIsettotal_H1	50,425	24,8238	73
FC_AOIsettotal_H2	51,384	22,6946	73
FC_AOIsettotal_M1	52,151	28,2679	73
FC_AOIsettotal_M2	48,438	22,9044	73
FC_AOIsettotal_V1	45,890	19,6062	73
FC_AOIsettotal_V2	47,397	25,9533	73

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
ff	Pillai's Trace	,162	2,633[b]	5,000	68,000	,031	,162	13,165	,774
	Wilks' Lambda	,838	2,633[b]	5,000	68,000	,031	,162	13,165	,774
	Hotelling's Trace	,194	2,633[b]	5,000	68,000	,031	,162	13,165	,774
	Roy's Largest Root	,194	2,633[b]	5,000	68,000	,031	,162	13,165	,774

a. Design: Intercept
Within Subjects Design: ff

b. Exact statistic

c. Computed using alpha = ,05

Pairwise Comparisons						
Measure: MEASURE_1						
(I) ff	(J) ff	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-,959	1,625	,557	-4,198	2,281
	3	-1,726	2,026	,397	-5,766	2,314
	4	1,986	2,037	,333	-2,075	6,048

	5	4,534*	1,738	,011	1,070	7,998
	6	3,027	2,116	,157	-1,192	7,246
2	1	,959	1,625	,557	-2,281	4,198
	3	-,767	2,063	,711	-4,880	3,346
	4	2,945	1,936	,133	-,914	6,804
	5	5,493*	1,721	,002	2,063	8,923
	6	3,986	2,039	,054	-,079	8,051
3	1	1,726	2,026	,397	-2,314	5,766
	2	,767	2,063	,711	-3,346	4,880
	4	3,712	1,973	,064	-,220	7,645
	5	6,260*	2,280	,008	1,716	10,805
	6	4,753*	2,105	,027	,557	8,950
4	1	-1,986	2,037	,333	-6,048	2,075
	2	-2,945	1,936	,133	-6,804	,914
	3	-3,712	1,973	,064	-7,645	,220
	5	2,548	1,758	,152	-,957	6,052
	6	1,041	2,233	,642	-3,411	5,493
5	1	-4,534*	1,738	,011	-7,998	-1,070
	2	-5,493*	1,721	,002	-8,923	-2,063
	3	-6,260*	2,280	,008	-10,805	-1,716
	4	-2,548	1,758	,152	-6,052	,957
	6	-1,507	1,969	,447	-5,432	2,419
6	1	-3,027	2,116	,157	-7,246	1,192
	2	-3,986	2,039	,054	-8,051	,079
	3	-4,753*	2,105	,027	-8,950	-,557
	4	-1,041	2,233	,642	-5,493	3,411
	5	1,507	1,969	,447	-2,419	5,432

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appenidx 5 – Repeated misure test on H M V sets on FT for AOI_SETTOTAL

Within-Subjects Factors

Measure: MEASURE_1

factor1	Dependent Variable
1	FT_AOIsettotal_V
2	FT_AOIsettotal_H
3	FT_AOIsettotal_M

Descriptive Statistics

	Mean	Std. Deviation	N
FT_AOIsettotal_mV	10745,89658000000000	5486,736061000000000	73
FT_AOIsettotal_mH	11317,151370000001000	6067,866336000000000	73
FT_AOIsettotal_mM	11282,336300000000000	5770,025839000000000	73

Pairwise Comparisons

Measure: MEASURE_1

(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-571,255	321,626	,080	-1212,404	69,894
	3	-536,440	378,679	,161	-1291,323	218,444
2	1	571,255	321,626	,080	-69,894	1212,404
	3	34,815	388,196	,929	-739,039	808,669
3	1	536,440	378,679	,161	-218,444	1291,323
	2	-34,815	388,196	,929	-808,669	739,039

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appenidx 6 – Repeated misure test on all sets on FT for AOI_SETTOTAL

Within-Subjects Factors

Measure: MEASURE_1

factor1	Dependent Variable
1	FT_AOIsettotal_V1
2	FT_AOIsettotal_V2
3	FT_AOIsettotal_H1
4	FT_AOIsettotal_H2
5	FT_AOIsettotal_M1
6	FT_AOIsettotal_M2

Descriptive Statistics

	Mean	Std. Deviation	N
FT_AOIsettotal_V1	10371,690	5144,8228	73
FT_AOIsettotal_V2	11120,103	6317,3246	73
FT_AOIsettotal_H1	11240,116	7070,5214	73
FT_AOIsettotal_H2	11394,186	5623,6541	73
FT_AOIsettotal_M1	11982,552	6789,0143	73
FT_AOIsettotal_M2	10582,121	5381,1499	73

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
factor1	Pillai's Trace	,166	2,707[b]	5,000	68,000	,027	,166	13,534	,787
	Wilks' Lambda	,834	2,707[b]	5,000	68,000	,027	,166	13,534	,787
	Hotelling's Trace	,199	2,707[b]	5,000	68,000	,027	,166	13,534	,787
	Roy's Largest Root	,199	2,707[b]	5,000	68,000	,027	,166	13,534	,787

a. Design: Intercept
Within Subjects Design: factor1

b. Exact statistic

c. Computed using alpha = ,05

Pairwise Comparisons

Measure: MEASURE_1

(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-748,412	411,121	,073	-1567,967	71,142

	3	-868,426	448,287	,057	-1762,069	25,217
	4	-1022,496*	394,154	,011	-1808,228	-236,763
	5	-1610,862*	507,423	,002	-2622,391	-599,333
	6	-210,430	440,088	,634	-1087,729	666,869
2	1	748,412	411,121	,073	-71,142	1567,967
	3	-120,014	493,766	,809	-1104,318	864,290
	4	-274,084	448,657	,543	-1168,465	620,298
	5	-862,449	496,259	,087	-1851,723	126,825
	6	537,982	526,304	,310	-511,185	1587,149
3	1	868,426	448,287	,057	-25,217	1762,069
	2	120,014	493,766	,809	-864,290	1104,318
	4	-154,070	467,572	,743	-1086,157	778,018
	5	-742,436	548,201	,180	-1835,255	350,384
	6	657,996	567,005	,250	-472,307	1788,299
4	1	1022,496*	394,154	,011	236,763	1808,228
	2	274,084	448,657	,543	-620,298	1168,465
	3	154,070	467,572	,743	-778,018	1086,157
	5	-588,366	472,876	,217	-1531,028	354,296
	6	812,066	455,617	,079	-96,189	1720,321
5	1	1610,862*	507,423	,002	599,333	2622,391
	2	862,449	496,259	,087	-126,825	1851,723
	3	742,436	548,201	,180	-350,384	1835,255
	4	588,366	472,876	,217	-354,296	1531,028
	6	1400,432*	481,467	,005	440,644	2360,219
6	1	210,430	440,088	,634	-666,869	1087,729
	2	-537,982	526,304	,310	-1587,149	511,185
	3	-657,996	567,005	,250	-1788,299	472,307
	4	-812,066	455,617	,079	-1720,321	96,189
	5	-1400,432*	481,467	,005	-2360,219	-440,644

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 7 - Repeated misure test on H M V sets on FC for AOI_PACKSUM

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	FC_AOIpacksum_H
2	FC_AOIpacksum_M
3	FC_AOIpacksum_V

Descriptive Statistics			
	Mean	Std. Deviation	N
FC_AOI packsum_H	50,342	22,1091	73
FC_AOI packsum_M	49,151	23,8755	73
FC_AOI packsum_V	45,925	20,8384	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	1,192	1,563	,448	-1,924	4,307
	3	4,418*	1,397	,002	1,632	7,204
2	1	-1,192	1,563	,448	-4,307	1,924
	3	3,226*	1,539	,040	,157	6,295
3	1	-4,418*	1,397	,002	-7,204	-1,632
	2	-3,226*	1,539	,040	-6,295	-,157
Based on estimated marginal means						
*. The mean difference is significant at the ,05 level.						
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 8 - Repeated misure test on all sets on FC for AOI_PACKSUM

Within-Subjects Factors	
Measure: MEASURE_1	
FF	Dependent Variable
1	FC_AOIpacksum_H1
2	FC_AOIpacksum_H2
3	FC_AOIpacksum_M1
4	FC_AOIpacksum_M2
5	FC_AOIpacksum_V1
6	FC_AOIpacksum_V2

Descriptive Statistics			
	Mean	Std. Deviation	N
FC_AOI packsum_H1	49,726	23,9033	73
FC_AOI packsum_H2	50,96	22,327	73
FC_AOI packsum_M1	50,877	27,4444	73
FC_AOI packsum_M2	47,425	22,8625	73
FC_AOI packsum_V1	44,932	18,9585	73
FC_AOI packsum_V2	46,918	25,3184	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) FF	(J) FF	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-1,233	1,590	,441	-4,402	1,936
	3	-1,151	2,060	,578	-5,256	2,955
	4	2,301	2,000	,254	-1,686	6,289
	5	4,795*	1,736	,007	1,335	8,255
	6	2,808	2,034	,172	-1,246	6,863
2	1	1,233	1,590	,441	-1,936	4,402
	3	,082	2,041	,968	-3,987	4,151
	4	3,534	1,899	,067	-,252	7,320
	5	6,027*	1,721	,001	2,596	9,459
	6	4,041*	1,960	,043	,134	7,948
3	1	1,151	2,060	,578	-2,955	5,256
	2	-,082	2,041	,968	-4,151	3,987
	4	3,452	1,929	,078	-,393	7,297
	5	5,945*	2,268	,011	1,423	10,467
	6	3,959*	1,974	,049	,024	7,893
4	1	-2,301	2,000	,254	-6,289	1,686
	2	-3,534	1,899	,067	-7,320	,252
	3	-3,452	1,929	,078	-7,297	,393

	5	2,493	1,778	,165	-1,051	6,037
	6	,507	2,148	,814	-3,775	4,789
5	1	-4,795*	1,736	,007	-8,255	-1,335
	2	-6,027*	1,721	,001	-9,459	-2,596
	3	-5,945*	2,268	,011	-10,467	-1,423
	4	-2,493	1,778	,165	-6,037	1,051
	6	-1,986	1,901	,300	-5,777	1,804
6	1	-2,808	2,034	,172	-6,863	1,246
	2	-4,041*	1,960	,043	-7,948	-,134
	3	-3,959*	1,974	,049	-7,893	-,024
	4	-,507	2,148	,814	-4,789	3,775
	5	1,986	1,901	,300	-1,804	5,777
Based on estimated marginal means						
*. The mean difference is significant at the ,05 level.						
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 9 - Repeated misure test on H M V sets on R for AOI_PACKSUM

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	R_AOIpacksum_H
2	R_AOIpacksum_M
3	R_AOIpacksum_V

Descriptive Statistics			
	Mean	Std. Deviation	N
R_AOI packsum_H	10,507	5,2318	73
R_AOI packsum_M	11,301	6,3900	73
R_AOI packsum_V	11,0582	6,15688	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-,795	,507	,121	-1,805	,216
	3	-,551	,610	,369	-1,768	,666
2	1	,795	,507	,121	-,216	1,805
	3	,243	,477	,611	-,707	1,193
3	1	,551	,610	,369	-,666	1,768
	2	-,243	,477	,611	-1,193	,707

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 10 - Repeated misure test on all sets on R for AOI_PACKSUM

Within-Subjects Factors	
Measure: MEASURE_1	
ff	Dependent Variable
1	R_AOIpacksum_H1
2	R_AOIpacksum_H2
3	R_AOIpacksum_M1
4	R_AOIpacksum_M2
5	R_AOIpacksum_V1
6	R_AOIpacksum_V2

Descriptive Statistics

	Mean	Std. Deviation	N
R_AOI packsum_H1	10,274	6,2099	73
R_AOI packsum_H2	10,740	5,2441	73
R_AOI packsum_M1	11,137	7,3282	73
R_AOI packsum_M2	11,466	6,6208	73
R_AOI packsum_V1	11,308	5,6092	73
R_AOI packsum_V2	10,808	7,9156	73

Pairwise Comparisons

Measure: MEASURE_1

(I) ff	(J) ff	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-,466	,557	,406	-1,576	,644
	3	-,863	,633	,177	-2,124	,398
	4	-1,192	,681	,084	-2,549	,166
	5	-1,034	,601	,089	-2,232	,163
	6	-,534	,899	,554	-2,326	1,258
2	1	,466	,557	,406	-,644	1,576
	3	-,397	,691	,567	-1,775	,981
	4	-,726	,656	,272	-2,035	,582
	5	-,568	,612	,356	-1,789	,652
	6	-,068	,871	,938	-1,804	1,667
3	1	,863	,633	,177	-,398	2,124
	2	,397	,691	,567	-,981	1,775
	4	-,329	,660	,620	-1,643	,986
	5	-,171	,644	,791	-1,456	1,114
	6	,329	,780	,675	-1,227	1,884
4	1	1,192	,681	,084	-,166	2,549
	2	,726	,656	,272	-,582	2,035
	3	,329	,660	,620	-,986	1,643
	5	,158	,553	,777	-,945	1,260

	6	,658	,717	,362	-,772	2,087
5	1	1,034	,601	,089	-,163	2,232
	2	,568	,612	,356	-,652	1,789
	3	,171	,644	,791	-1,114	1,456
	4	-,158	,553	,777	-1,260	,945
	6	,500	,708	,482	-,912	1,912
6	1	,534	,899	,554	-1,258	2,326
	2	,068	,871	,938	-1,667	1,804
	3	-,329	,780	,675	-1,884	1,227
	4	-,658	,717	,362	-2,087	,772
	5	-,500	,708	,482	-1,912	,912
Based on estimated marginal means						
a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 11 - Repeated misure test on H M V sets on FT for AOI_PACKSUM

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	FT_AOIpacksum_M
2	FT_AOIpacksum_H
3	FT_AOIpacksum_V

Descriptive Statistics			
	Mean	Std. Deviation	N
FT_AOI packsum_M	11006,6589	5699,245467000000000	73
FT_AOI packsum_H	11201,30411	5935,171026999999000	73
FT_AOI packsum_V	10610,93288	5328,234448000000000	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-194,645	388,726	,618	-969,556	580,266
	3	395,726	371,915	,291	-345,674	1137,126
2	1	194,645	388,726	,618	-580,266	969,556
	3	590,371	318,013	,067	-43,577	1224,319
3	1	-395,726	371,915	,291	-1137,126	345,674
	2	-590,371	318,013	,067	-1224,319	43,577
Based on estimated marginal means						
a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 12 - Repeated misure test on all sets on FT for AOI_PACKSUM

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	FT_AOIpacksum_M1
2	FT_AOIpacksum_M2
3	FT_AOIpacksum_H1
4	FT_AOIpacksum_H2
5	FT_AOIpacksum_V1
6	FT_AOIpacksum_V2

Descriptive Statistics			
	Mean	Std. Deviation	N
FT_AOI packsum_M1	11698,13836	6664,506135000000000	73
FT_AOI packsum_M2	10315,17945	5365,635327999999000	73
FT_AOI packsum_H1	11098,16575	6870,812508999999000	73
FT_AOI packsum_H2	11304,44247	5558,037451000000000	73
FT_AOI packsum_V1	10165,74795	4971,657772000000000	73
FT_AOI packsum_V2	11056,11781	6157,863262000000000	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	1382,959*	475,218	,005	435,628	2330,289
	3	599,973	548,814	,278	-494,068	1694,013
	4	393,696	470,677	,406	-544,582	1331,974
	5	1532,390*	501,444	,003	532,779	2532,002
	6	642,021	480,442	,186	-315,723	1599,764
2	1	-1382,959*	475,218	,005	-2330,289	-435,628
	3	-782,986	558,046	,165	-1895,430	329,457
	4	-989,263*	453,466	,032	-1893,230	-85,296
	5	149,432	441,433	,736	-730,549	1029,412
	6	-740,938	512,284	,152	-1762,157	280,280
3	1	-599,973	548,814	,278	-1694,013	494,068
	2	782,986	558,046	,165	-329,457	1895,430
	4	-206,277	457,729	,654	-1118,743	706,190
	5	932,418*	448,718	,041	37,914	1826,921
	6	42,048	481,536	,931	-917,877	1001,973
4	1	-393,696	470,677	,406	-1331,974	544,582
	2	989,263*	453,466	,032	85,296	1893,230
	3	206,277	457,729	,654	-706,190	1118,743
	5	1138,695*	388,531	,005	364,172	1913,217

	6	248,325	436,252	,571	-621,329	1117,978
5	1	-1532,390*	501,444	,003	-2532,002	-532,779
	2	-149,432	441,433	,736	-1029,412	730,549
	3	-932,418*	448,718	,041	-1826,921	-37,914
	4	-1138,695*	388,531	,005	-1913,217	-364,172
	6	-890,370*	400,565	,029	-1688,881	-91,859
6	1	-642,021	480,442	,186	-1599,764	315,723
	2	740,938	512,284	,152	-280,280	1762,157
	3	-42,048	481,536	,931	-1001,973	917,877
	4	-248,325	436,252	,571	-1117,978	621,329
	5	890,370*	400,565	,029	91,859	1688,881

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 13 - Test for H vs V in Mix sets for FC

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FC_AOI packsum_VM	44,041	73	22,6209	2,6476
	FC_AOI packsum_HM	54,260	73	27,7599	3,2491

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	FC_AOI packsum_VM - FC_AOI packsum_HM	-10,2192	16,8665	1,9741	-14,1544	-6,2839	-5,177	72	,000

Appendix 14 - Test for H vs V in all Mix sets for FC

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	FC_AOIpacksum_VLinM1
2	FC_AOIpacksum_HRinM1
3	FC_AOIpacksum_VRinM2
4	FC_AOIpacksum_HLinM2

Descriptive Statistics			
	Mean	Std. Deviation	N
FC_AOI packsum_VL in M1	24,699	14,7673	73
FC_AOI packsum_HR in M1	26,178	14,3782	73
FC_AOI packsum_VR in M2	19,342	9,7599	73
FC_AOI packsum_HL in M2	28,082	15,4108	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-1,479	1,149	,202	-3,770	,812
	3	5,356*	1,255	,000	2,855	7,858
	4	-3,384*	1,337	,014	-6,049	-,718
2	1	1,479	1,149	,202	-,812	3,770
	3	6,836*	1,421	,000	4,002	9,669
	4	-1,904	1,271	,138	-4,437	,629
3	1	-5,356*	1,255	,000	-7,858	-2,855
	2	-6,836*	1,421	,000	-9,669	-4,002
	4	-8,740*	1,399	,000	-11,528	-5,952
4	1	3,384*	1,337	,014	,718	6,049
	2	1,904	1,271	,138	-,629	4,437
	3	8,740*	1,399	,000	5,952	11,528
Based on estimated marginal means						
*. The mean difference is significant at the ,05 level.						
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 15 - Test for H vs V in Mix sets for FC

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	R_AOI packsum_VM	11,397	73	7,0233	,8220
	R_AOI packsum_HM	11,205	73	6,6122	,7739

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	R_AOI packsum_VM - R_AOI packsum_HM	,1918	4,7716	,5585	-,9215	1,3051	,343	72	,732

Appendix 16 - Test for H vs V in all Mix sets for R

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	R_AOIpacksum_VLinM1
2	R_AOIpacksum_HRinM1
3	R_AOIpacksum_VRinM2
4	R_AOIpacksum_HLinM2

Descriptive Statistics

	Mean	Std. Deviation	N
R_AOI packsum_VL in M1	5,959	3,9806	73
R_AOI packsum_HR in M1	5,178	3,8921	73
R_AOI packsum_VR in M2	5,438	3,8908	73
R_AOI packsum_HL in M2	6,027	3,5472	73

Pairwise Comparisons

Measure: MEASURE_1

(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	,781*	,337	,023	,109	1,452
	3	,521	,416	,215	-,309	1,350
	4	-,068	,454	,880	-,973	,836
2	1	-,781*	,337	,023	-1,452	-,109
	3	-,260	,409	,527	-1,076	,555
	4	-,849*	,401	,038	-1,649	-,050
3	1	-,521	,416	,215	-1,350	,309
	2	,260	,409	,527	-,555	1,076
	4	-,589	,399	,144	-1,384	,206
4	1	,068	,454	,880	-,836	,973
	2	,849*	,401	,038	,050	1,649
	3	,589	,399	,144	-,206	1,384

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 17 - Test for H vs V in Mix sets for Ft

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FT_AOI packsum_VM	10079,04384	73	5544,228784000000000	648,902897100000000
	FT_AOI packsum_HM	11934,27397	73	6370,907467000000000	745,658318599999900

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	FT_AOI packsum_VM - FT_AOI packsum_HM	- 1855,23 01	3567,6706	417,564	- 2687,629 29	-1022,8309	-4,443	72	,000

Appendix 18 - Test for H vs V in all Mix sets for FT

Within-Subjects Factors

Measure: MEASURE_1

FF	Dependent Variable
1	FT_AOIpacksum_VLinM1
2	FT_AOIpacksum_HRinM1
3	FT_AOIpacksum_VRinM2
4	FT_AOIpacksum_HLinM2

Descriptive Statistics

	Mean	Std. Deviation	N
FT_AOI packsum_VL in M1	5825,421918	3795,187259000000000	73
FT_AOI packsum_HR in M1	5872,71643	3305,434147000000000	73
FT_AOI packsum_VR in M2	4253,621918	2283,681842000000000	73
FT_AOI packsum_HL in M2	6061,557534	3548,313808000000000	73

Pairwise Comparisons

Measure: MEASURE_1

(I) FF	(J) FF	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-47,295	292,440	,872	-630,263	535,674
	3	1571,800*	341,207	,000	891,616	2251,984
	4	-236,136	327,064	,473	-888,126	415,855
2	1	47,295	292,440	,872	-535,674	630,263
	3	1619,095*	305,164	,000	1010,760	2227,429
	4	-188,841	297,118	,527	-781,136	403,453
3	1	-1571,800*	341,207	,000	-2251,984	-891,616
	2	-1619,095*	305,164	,000	-2227,429	-1010,760
	4	-1807,936*	305,686	,000	-2417,310	-1198,561
4	1	236,136	327,064	,473	-415,855	888,126
	2	188,841	297,118	,527	-403,453	781,136
	3	1807,936*	305,686	,000	1198,561	2417,310

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 19 - Test for attention to Left in V and M sets for FC

Within-Subjects Factors	
Measure: MEASURE_1	
FF	Dependent Variable
1	FC_AOIpacksum_VLinM1
2	FC_AOIpacksum_VLinV1
3	FC_AOIpacksum_VLinV2

Descriptive Statistics			
	Mean	Std. Deviation	N
FC_AOI packsum_VL in M1	24,699	14,7673	73
FC_AOI packsum_VL in V1	23,945	11,6260	73
FC_AOI packsum_VL in V2	25,014	16,0732	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) FF	(J) FF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	,753	1,207	,534	-1,653	3,160
	3	-,315	1,352	,816	-3,010	2,380
2	1	-,753	1,207	,534	-3,160	1,653
	3	-1,068	1,295	,412	-3,650	1,513
3	1	,315	1,352	,816	-2,380	3,010
	2	1,068	1,295	,412	-1,513	3,650
Based on estimated marginal means						
a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 20 - Test for attention to Left in V and M sets for R

Within-Subjects Factors

Measure: MEASURE_1

FF	Dependent Variable
1	R_AOIpacksum_VLinM1
2	R_AOIpacksum_VLinV1
3	R_AOIpacksum_VLinV2

Descriptive Statistics

	Mean	Std. Deviation	N
R_AOI packsum_VL in M1	5,959	3,9806	73
R_AOI packsum_VL in V1	5,911	3,2525	73
R_AOI packsum_VL in V2	5,986	4,6830	73

Pairwise Comparisons

Measure: MEASURE_1

(I) FF	(J) FF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	,048	,369	,897	-,687	,783
	3	-,027	,490	,956	-1,004	,949
2	1	-,048	,369	,897	-,783	,687
	3	-,075	,457	,870	-,987	,836
3	1	,027	,490	,956	-,949	1,004
	2	,075	,457	,870	-,836	,987

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 21 - Test for attention to Left in V and M sets for ft

Within-Subjects Factors

Measure: MEASURE_1

FF	Dependent Variable
1	FT_AOIpacksum_VLinM1
2	FT_AOIpacksum_VLinV1
3	FT_AOIpacksum_VLinV2

Descriptive Statistics

	Mean	Std. Deviation	N
FT_AOI packsum_VL in M1	5825,421918000000000	3795,187259000000000	73
FT_AOI packsum_VL in V1	5332,801370000000000	3042,970840000000000	73
FT_AOI packsum_VL in V2	5553,504110000000000	3723,870196000000000	73

Pairwise Comparisons

Measure: MEASURE_1

(I) FF	(J) FF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	492,621	278,153	,081	-61,867	1047,108
	3	271,918	323,592	,404	-373,151	916,986
2	1	-492,621	278,153	,081	-1047,108	61,867
	3	-220,703	279,233	,432	-777,343	335,938
3	1	-271,918	323,592	,404	-916,986	373,151
	2	220,703	279,233	,432	-335,938	777,343

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 22 - Test for attention to Right in V and M sets for FC

Within-Subjects Factors

Measure: MEASURE_1

FF	Dependent Variable
1	FC_AOIpacksum_VRinM2
2	FC_AOIpacksum_VRinV1
3	FC_AOIpacksum_VRinV2

Descriptive Statistics

	Mean	Std. Deviation	N
FC_AOI packsum_VR in M2	19,342	9,7599	73
FC_AOI packsum_VR in V1	20,986	9,0038	73
FC_AOI packsum_VR in V2	21,904	11,3812	73

Pairwise Comparisons

Measure: MEASURE_1

(I) FF	(J) FF	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-1,644	1,027	,114	-3,691	,404
	3	-2,562*	1,126	,026	-4,806	-,317
2	1	1,644	1,027	,114	-,404	3,691
	3	-,918	1,071	,394	-3,054	1,218
3	1	2,562*	1,126	,026	,317	4,806
	2	,918	1,071	,394	-1,218	3,054

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 23 - Test for attention to Right in V and M sets for R

Within-Subjects Factors

Measure: MEASURE_1

FF	Dependent Variable
1	R_AOIpacksum_VRinM2
2	R_AOIpacksum_VRinV1
3	R_AOIpacksum_VRinV2

Descriptive Statistics

	Mean	Std. Deviation	N
R_AOI packsum_VR in M2	5,438	3,8908	73
R_AOI packsum_VR in V1	5,397	3,0765	73
R_AOI packsum_VR in V2	4,822	3,7206	73

Pairwise Comparisons

Measure: MEASURE_1

(I) FF	(J) FF	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	,041	,365	,911	-,687	,769
	3	,616	,338	,072	-,057	1,290
2	1	-,041	,365	,911	-,769	,687
	3	,575	,348	,102	-,118	1,269
3	1	-,616	,338	,072	-1,290	,057
	2	-,575	,348	,102	-1,269	,118

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 24 - Test for attention to Right in V and M sets for FT

Within-Subjects Factors

Measure: MEASURE_1

FF	Dependent Variable
1	FT_AOIpacksum_VRinM2
2	FT_AOIpacksum_VRinV1
3	FT_AOIpacksum_VRinV2

Descriptive Statistics

	Mean	Std. Deviation	N
FT_AOI packsum_VR in M2	4253,621918000000000	2283,681842000000000	73
FT_AOI packsum_VR in V1	4832,946575000000000	2328,731093000000000	73
FT_AOI packsum_VR in V2	5502,613698999999500	3036,951568000000000	73

Pairwise Comparisons

Measure: MEASURE_1

(I) FF	(J) FF	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-579,325*	252,094	,024	-1081,865	-76,784
	3	-1248,992*	282,468	,000	-1812,082	-685,901
2	1	579,325*	252,094	,024	76,784	1081,865
	3	-669,667*	260,470	,012	-1188,904	-150,430
3	1	1248,992*	282,468	,000	685,901	1812,082
	2	669,667*	260,470	,012	150,430	1188,904

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 25 - Test for attention to Right in V sets for FC

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FC_AOI packsum_VL in V	48,959	73	25,7798	3,0173
	FC_AOI packsum_VR in V	42,890	73	18,3686	2,1499

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	FC_AOI packsum_VL in V - FC_AOI packsum_VR in V	6,0685	16,3413	1,9126	2,2558	9,8812	3,173	72	,002

Appendix 26 - Test for attention to Right in V sets for R

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	R_AOI packsum_VL in V	11,897	73	7,0538	,8256
	R_AOI packsum_VR in V	10,219	73	6,1469	,7194

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	R_AOI packsum_VL in V - R_AOI packsum_VR in V	1,6781	4,8429	,5668	,5481	2,8080	2,961	72	,004

Appendix 27 - Test for attention to Right in V sets for FT

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FT_AOI packsum_VL in V	10886,30548	73	6368,821271000000000	745,414147900000000
	FT_AOI packsum_VR in V	10335,560270	73	4933,505040999999000	577,423089700000000

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	FT_AOI packsum_VL in V - FT_AOI packsum_VR in V	550,745205500	4030,1840399990	471,6973635000	-389,56630309999	1491,0567139	1,168	72	,247

Appendix 28 - Test for attention Top vs Bottom in H sets for FC

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FC_AOI packsum_HB in H	42,575	73	20,4877	2,3979
	FC_AOI packsum_HT in H	58,110	73	26,4084	3,0909

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	FC_AOI packsum_HB in H - FC_AOI packsum_HT in H	-15,5342	16,7050	1,9552	-19,4318	-11,6367	-7,945	72	,000

Appendix 29 - Test for attention Top vs Bottom in all H sets for FC

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	FC_AOIpacksum_HBinH1
2	FC_AOIpacksum_HBinH2
3	FC_AOIpacksum_HTinH1
4	FC_AOIpacksum_HTinH2

Descriptive Statistics			
	Mean	Std. Deviation	N
FC_AOI packsum_HB in H1	20,753	10,5380	73
FC_AOI packsum_HB in H2	21,822	11,4678	73
FC_AOI packsum_HT in H1	28,973	15,2825	73
FC_AOI packsum_HT in H2	29,137	13,0217	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-1,068	,946	,263	-2,955	,818
	3	-8,219*	1,271	,000	-10,752	-5,686
	4	-8,384*	1,148	,000	-10,672	-6,095
2	1	1,068	,946	,263	-,818	2,955
	3	-7,151*	1,363	,000	-9,867	-4,434
	4	-7,315*	1,192	,000	-9,691	-4,940
3	1	8,219*	1,271	,000	5,686	10,752
	2	7,151*	1,363	,000	4,434	9,867
	4	-,164	1,221	,893	-2,598	2,270
4	1	8,384*	1,148	,000	6,095	10,672
	2	7,315*	1,192	,000	4,940	9,691
	3	,164	1,221	,893	-2,270	2,598
Based on estimated marginal means						
*. The mean difference is significant at the ,05 level.						
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 30 - Test for attention Top vs Bottom in H sets for FC

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	R_AOI packsum_HB in H	8,041	73	4,8403	,5665
	R_AOI packsum_HT in H	12,973	73	6,5553	,7672

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	R_AOI packsum_HB in H - R_AOI packsum_HT in H	-4,9315	4,8285	,5651	-6,0581	-3,8049	-8,726	72	,000

Appendix 31 - Test for attention Top vs Bottom in all H sets for R

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	R_AOIpacksum_HBinH1
2	R_AOIpacksum_HBinH2
3	R_AOIpacksum_HTinH1
4	R_AOIpacksum_HTinH2

Descriptive Statistics			
	Mean	Std. Deviation	N
R_AOI packsum_HB in H1	4,000	2,6405	73
R_AOI packsum_HB in H2	4,041	2,8599	73
R_AOI packsum_HT in H1	6,274	4,3245	73
R_AOI packsum_HT in H2	6,699	3,2816	73

Pairwise Comparisons

Measure: MEASURE_1

(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-,041	,307	,894	-,653	,571
	3	-2,274*	,418	,000	-3,108	-1,440
	4	-2,699*	,378	,000	-3,451	-1,946
2	1	,041	,307	,894	-,571	,653
	3	-2,233*	,415	,000	-3,060	-1,406
	4	-2,658*	,377	,000	-3,410	-1,905
3	1	2,274*	,418	,000	1,440	3,108
	2	2,233*	,415	,000	1,406	3,060
	4	-,425	,468	,367	-1,357	,508
4	1	2,699*	,378	,000	1,946	3,451
	2	2,658*	,377	,000	1,905	3,410
	3	,425	,468	,367	-,508	1,357

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 32 - Test for attention Top vs Bottom in all H sets for FC

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FT_AOI packsum_HB in H	9429,6602	73	5644,376370999999000	660,624285700000000
	FT_AOI packsum_HT in H	12972,9479	73	6720,724729000000000	786,601332300000000

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	FT_AOI packsum_HB in H - FT_AOI packsum_HT in H	-3543,287671000	3626,186776000	424,4130603000	-4389,33964400000	-2697,235698 0	-8,349	72	,000

Appendix 33 - Test for attention Top vs Bottom in all H sets for FT

Within-Subjects Factors	
Measure: MEASURE_1	
factor1	Dependent Variable
1	FT_AOIpacksum_HBinH1
2	FT_AOIpacksum_HBinH2
3	FT_AOIpacksum_HTinH1
4	FT_AOIpacksum_HTinH2

Descriptive Statistics			
	Mean	Std. Deviation	N
FT_AOI packsum_HB in H1	4580,909589000000000	3045,753670000000000	73
FT_AOI packsum_HB in H2	4848,750685000000000	2954,568160000000000	73
FT_AOI packsum_HT in H1	6517,256163999999000	4147,913625000000000	73
FT_AOI packsum_HT in H2	6455,691780999999500	3110,883364000000000	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-267,841	238,523	,265	-743,327	207,645
	3	-1936,347*	280,790	,000	-2496,091	-1376,602
	4	-1874,782*	286,565	,000	-2446,039	-1303,525
2	1	267,841	238,523	,265	-207,645	743,327
	3	-1668,505*	335,711	,000	-2337,732	-999,279
	4	-1606,941*	284,830	,000	-2174,739	-1039,143
3	1	1936,347*	280,790	,000	1376,602	2496,091
	2	1668,505*	335,711	,000	999,279	2337,732
	4	61,564	343,181	,858	-622,554	745,682
4	1	1874,782*	286,565	,000	1303,525	2446,039
	2	1606,941*	284,830	,000	1039,143	2174,739
	3	-61,564	343,181	,858	-745,682	622,554
Based on estimated marginal means						
*. The mean difference is significant at the ,05 level.						
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 34 – Orientation comparison on the 3 sets on Variety

Statistiques descriptives			
	Moyenne	Ecart-type	N
Moy_M1M2_variete	3,3014	1,56289	73
Moy_V1V2_variete	4,6986	1,81953	73
Moy_H1H2_variete	5,9521	1,64605	73

Facteurs intra-sujets	
Mesure: MEASURE_1	
factor1	Variable dépendante
1	Moy_M1M2_variete
2	Moy_V1V2_variete
3	Moy_H1H2_variete

Comparaisons par paire						
Mesure: MEASURE_1						
(I) factor1	(J) factor1	Différence des moyennes (I-J)	Erreur standard	Sig.[b]	Intervalle de confiance de la différence à 95%[b]	
					Borne inférieure	Limite supérieure
1	2	-1,397*	,251	,000	-1,898	-,897
	3	-2,651*	,231	,000	-3,111	-2,190
2	1	1,397*	,251	,000	,897	1,898
	3	-1,253*	,220	,000	-1,693	-,814
3	1	2,651*	,231	,000	2,190	3,111
	2	1,253*	,220	,000	,814	1,693
Basée sur les moyennes marginales estimées						
*. La différence des moyennes est significative au niveau ,05.						
b. Ajustement des comparaisons multiples : Différence la moins significative (équivalent à aucun ajustement).						

Appendix 35 – Orientation comparison on the 3 sets on Complexity

Facteurs intra-sujets	
Mesure: MEASURE_1	
factor1	Variable dépendante
1	Moy_M1M2_complexite
2	Moy_V1V2_complexite
3	Moy_H1H2_complexite

Statistiques descriptives			
	Moyenne	Ecart-type	N
Moy_M1M2_complexite	6,5445	1,47039	73
Moy_V1V2_complexite	6,2637	1,60614	73
Moy_H1H2_complexite	5,6473	1,60611	73

Comparaisons par paire						
Mesure: MEASURE_1						
(I) factor1	(J) factor1	Différence des moyennes (I-J)	Erreur standard	Sig.[b]	Intervalle de confiance de la différence à 95%[b]	
					Borne inférieure	Limite supérieure
1	2	,281	,188	,139	-,094	,655
	3	,897*	,230	,000	,439	1,355
2	1	-,281	,188	,139	-,655	,094
	3	,616*	,222	,007	,174	1,059
3	1	-,897*	,230	,000	-1,355	-,439
	2	-,616*	,222	,007	-1,059	-,174
Basée sur les moyennes marginales estimées						
*. La différence des moyennes est significative au niveau ,05.						
b. Ajustement des comparaisons multiples : Différence la moins significative (équivalent à aucun ajustement).						

Appendix 36 – Orientation comparison on the 3 sets on Process Fluency

Statistiques descriptives			
	Moyenne	Ecart-type	N
Moy_M1M2_fluency	5,4144	1,56247	72
Moy_H1H2_fluency	4,9329	1,42459	72
Moy_V1V2_fluency	5,3102	1,43217	72

Facteurs intra-sujets	
Mesure: MEASURE_1	
factor1	Variable dépendante
1	Moy_M1M2_fluency
2	Moy_H1H2_fluency
3	Moy_V1V2_fluency

Comparaisons par paire						
Mesure: MEASURE_1						
(I) factor1	(J) factor1	Différence des moyennes (I-J)	Erreur standard	Sig.[b]	Intervalle de confiance de la différence à 95%[b]	
					Borne inférieure	Limite supérieure
1	2	,481*	,214	,027	,055	,908
	3	,104	,196	,596	-,286	,494
2	1	-,481*	,214	,027	-,908	-,055
	3	-,377	,202	,065	-,779	,025
3	1	-,104	,196	,596	-,494	,286
	2	,377	,202	,065	-,025	,779
Basée sur les moyennes marginales estimées						
*. La différence des moyennes est significative au niveau ,05.						
b. Ajustement des comparaisons multiples : Différence la moins significative (équivalent à aucun ajustement).						

Appendix 37 – Orientation comparison on the 3 sets on Attractiveness

Facteurs intra-sujets	
Mesure: MEASURE_1	
factor1	Variable dépendante
1	Moy_M1M2_attractivite
2	Moy_H1H2_attractivite
3	Moy_V1V2_attractivite

Statistiques descriptives			
	Moyenne	Ecart-type	N
Moy_M1M2_attractivite	4,8579	,86435	73
Moy_H1H2_attractivite	4,9795	,90380	73
Moy_V1V2_attractivite	4,7928	,89999	73

Comparaisons par paire						
Mesure: MEASURE_1						
(I) factor1	(J) factor1	Différence des moyennes (I-J)	Erreur standard	Sig.[a]	Intervalle de confiance de la différence à 95%[a]	
					Borne inférieure	Limite supérieure
1	2	-,122	,138	,380	-,396	,153
	3	,065	,120	,588	-,173	,303
2	1	,122	,138	,380	-,153	,396
	3	,187	,134	,167	-,080	,453
3	1	-,065	,120	,588	-,303	,173
	2	-,187	,134	,167	-,453	,080
Basée sur les moyennes marginales estimées						
a. Ajustement des comparaisons multiples : Différence la moins significative (équivalent à aucun ajustement).						

Appendix 38 – Orientation comparison on the 3 sets on Choice Difficulty

Within-Subjects Factors	
Measure: MEASURE_1	
F	Dependent Variable
1	Moy_M1M2_qualif_choix
2	Moy_H1H2_qualif_choix
3	Moy_V1V2_qualif_choix

Descriptive Statistics			
	Mean	Std. Deviation	N
Moy_M1M2_qualif_choix	5,2808	2,02414	73
Moy_H1H2_qualif_choix	5,1781	1,88998	73
Moy_V1V2_qualif_choix	5,4589	1,66198	73

Pairwise Comparisons						
Measure: MEASURE_1						
(I) F	(J) F	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	,103	,311	,742	-,516	,722
	3	-,178	,270	,511	-,716	,359
2	1	-,103	,311	,742	-,722	,516
	3	-,281	,267	,296	-,813	,251
3	1	,178	,270	,511	-,359	,716
	2	,281	,267	,296	-,251	,813
Based on estimated marginal means						
a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).						

Appendix 39 – Orientation comparison on the 3 sets on Choice Satisfaction

Within-Subjects Factors

Measure: MEASURE_1

sat	Dependent Variable
1	Moy_M1M2_qualif_decision
2	Moy_H1H2_qualif_decision
3	Moy_V1V2_qualif_decision

Descriptive Statistics

	Mean	Std. Deviation	N
Moy_M1M2_qualif_decision	6,9589	1,19534	73
Moy_H1H2_qualif_decision	6,5000	1,54335	73
Moy_V1V2_qualif_decision	6,6986	1,43067	73

Pairwise Comparisons

Measure: MEASURE_1

(I) sat	(J) sat	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	,459*	,213	,034	,035	,883
	3	,260	,199	,194	-,136	,656
2	1	-,459*	,213	,034	-,883	-,035
	3	-,199	,220	,371	-,638	,241
3	1	-,260	,199	,194	-,656	,136
	2	,199	,220	,371	-,241	,638

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Appendix 40 – Manipulation check for Items

Variety

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	M1_variete - M2_variete	1,014	1,837	,215	,585	1,442	4,715	72	,000
Pair 2	V1_variete - V2_variete	-,603	2,073	,243	-1,086	-,119	-2,484	72	,015
Pair 3	H1_variete - H2_variete	-1,685	2,350	,275	-2,233	-1,137	-6,125	72	,000

Complexity

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	Moy_complexite_M1 - Moy_complexite_M2	-,91096	2,35310	,27541	-1,45998	-,36194	-3,308	72	,001
Pair 2	Moy_complexite_V1 - Moy_complexite_V2	,51370	2,11800	,24789	,01953	1,00786	2,072	72	,042
Pair 3	Moy_complexite_H1 - Moy_complexite_H2	,50000	2,22361	,26025	-,01881	1,01881	1,921	72	,059

Fluency

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	Moy_fluency_M1 - Moy_fluency_M2	-1,10502	2,43171	,28461	-1,67238	-,53766	-3,883	72	,000
Pair 2	Moy_fluency_V1 - Moy_fluency_V2	,61187	2,00386	,23453	,14434	1,07941	2,609	72	,011
Pair 3	Moy_fluency_H1 - Moy_fluency_H2	-,20833	2,69087	,31712	-,84066	,42399	-,657	71	,513

Attractiveness

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	Moy_attractivite_M1 - Moy_attractivite_M2	-,06507	1,59754	,18698	-,43780	,30766	-,348	72	,729
Pair 2	Moy_attractivite_V1 - Moy_attractivite_V2	,27740	1,72581	,20199	-,12526	,68006	1,373	72	,174
Pair 3	Moy_attractivite_H1 - Moy_attractivite_H2	-,51370	1,72949	,20242	-,91722	-,11018	-2,538	72	,013

Appendix 41 – Method of medium comparing

Si les données sont normales => tests paramétriques

	Comparaison de 2 moyennes dans 2 échantillons différents (design intergroupe)	Comparaison de 2 moyennes dans un seul échantillon (design intragroupe)	Comparaison de plus de 2 moyennes dans 2 échantillons différents (design intergroupe)	Comparaison de plus de 2 moyennes dans un seul échantillon (design intragroupe)
Tests paramériques	Test T pour échantillons indépendants	Test T pour échantillons appariés	ANOVA	Modèle linéaire général / mesures répétées

Si les données ne sont pas normales => tests non paramétriques

	Comparaison de 2 moyennes dans 2 échantillons différents (design intergroupe)	Comparaison de 2 moyennes dans un seul échantillon (design intragroupe)	Comparaison de plus de 2 moyennes dans 2 échantillons différents (design intergroupe)	Comparaison de plus de 2 moyennes dans un seul échantillon (design intragroupe)
Tests non paramétriques	Test non paramétrique pour 2 échantillons indépendants (U Mann Whitney, Z de Kolmogorov Smirnof	Test non paramétrique pour 2 échantillons liés (Wilcoxon signed-rank) AFp552	Test non paramétriques pour K échantillons indépendants (H de Kruskal Wallis	Test non paramétrique pour k échantillons liés (Friedman) AF p573

Table 19 - From A. Field, Discovering Statistics using IBM SPSS

Appendix 42 - Literature review - Hotizontal/vertical layout

Articles	Main subject	Experiment	Results
A "Wide" Variety: Effects of Horizontal Versus Vertical Display on Assortment Processing, Perceived Variety, and Choice Deng, Unnava (2016)	Hotizontal/vertical layout	5 studies	The process fluency is more efficient when the display is horizontal beacuase of the dominant direction of eye movment. (the visual factos influences the assortiment) When more variety is not necessarily positive, for example, in a choice of a single most-preferred option, these effects disappear (generally more variety → easy choice)

Appendix 43 - Literature review - Product position

Articles	**Main subject**	**Experiment**	**Results**
Christenfeld (1995)	Position on shelves	Choice of a bathroom	The product the most chosen is the product in the center of the shelf
Atalay (2012)	Relationship between product position on array and on shelves	3 experiments: - 1A - 1B - 2 (see eye-tracking methods file)	no significant advantage of horizontal left or right location on choice The brands in the horizontal center received more frequent eye fixations, and overall they were looked at longer Results showed that the centrally located brand within a product category is chosen more often even when it is not placed in the center of the shelf or the visual field. → The effect of horizontal centrality on visual attention and choice was robust
Drèze et al. (1994)	Position on the shelves (eye-level)	they examined the effect of vertical and horizontal placement on brand choice. Across eight product categories (with an average of 115 items per category), they showed that while physical location had a general effect on sales, the magnitude of the shock varied according to product category and, more importantly, position on the shelf.	putting products at the eye level can increase sales. Limits: it considers only the postion on the shelves as variables, not other variables shelf position is more important than the number of facings because a large facing placed at a less prominent location will not be effective For example, moving a product from the worst to the best vertical position increased sales by up to 40%, whereas a similar horizontal movement increased sales by 15%; although the "best" position was contingent on product category itself. . position advantages contingent on product category

Valenzuela, Raghubir (2009)	Meaning of the positioning on the shelves	extract meaning study 1: Tested three basic hypotheses: consumers believe products are placed in decreasing order of price from top to bottom rows (H1: verticality) and from right to left rows (H2: horizontality), leading to preferences for center positions in both orientations as they represent a balanced price/ quality tradeoff (H3: centrality).	How, and when consumers extract meaning from the position of products in both horizontal and vertical shelf space arrays, and how these inferences translate into their preferences. Study 1 finds evidence that consumers have shared shelf layout schemas regarding retail practice for verticality and centrality, but not for horizontality: premium brand are on top rows, cheaper brands are on the bottom rows, promoted brands are on the extremes and popular brands occupy central positions.
Valenzuela, Raghubir (2009)	Meaning of the positioning on the shelves (top and right = high quality)	extract meaning: Tested three basic hypotheses: consumers believe products are placed in decreasing order of price from top to bottom rows (H1: verticality) and from right to left rows (H2: horizontality), leading to preferences for center positions in both orientations as they represent a balanced price/ quality tradeoff (H3: centrality).	occupy central positions. Study 2 shows that verticality and horizontality beliefs do not universally reflect retailers' pricing practice. Study 3 shows that these schemas affect product inferences: consumers infer that products placed on the top (and on the right) have higher prices and higher quality than those placed on the bottom (or on the left) Study 6 finds that when consumer purchase goals move towards a higher quality/higher price alternative, choice patterns move from the center to the extreme the preference for the center of an array is stronger in the horizontal orientation than in the vertical orientation

Appendix 44 - Literature review - Verticality

Articles	Main subject	Experiment	Results
Sundar & Noseworthy, (2014)	Logo position, verticality		brand logos that appear in high locations on packages convey power-related information compared to when those same logos appear low on packaging
Schubert (2005)	Verticality & power	Study 1: people more quickly recognized stimuli representing power when the stimuli appeared at the top of the page than when they appeared at the bottom. Study3: the amount of power attributed to an agent (in particular, to animals) is influenced by their position on the vertical dimension; that is, animals appearing in the upper part of a computer screen were more respected than those appearing at the bottom.	vertical positions are indeed perceptual symbols of power.
Giessner and Schubert (2007)	Verticality & power	Study 1: physical representation of vertical position influences judgments of a leader's power. In a series of studies, the authors changed the length of a line in an organization chart, asking participants to evaluate the leader's power. Participants received information about the power of a leader and were then asked to place the picture of the leader on a screen to a position that would best represent that leader's relation to his followers	More powerful the leader was described to be, the higher he was placed in the chart.
Meier, Sellbom, and Wygant (2007)	Verticality & morality (coerence between meaning of word and position)		Study1: People recognize words with a moral meaning (e.g., caring, charity, nurture, truthful, and trustworthy) more quickly when they appear in the higher part of the screen. Conversely, people recognize words with an immoral meaning (e.g., adultery, corrupt, dishonest, evil, and molest) more

			quickly when they are shown in the lower part of the screen.

Appendix 45 - Literature review – Design perception

Articles	Main subject	Experiment	Results
Reber et al., (2004)	Design perception,		four core visual stimulus characteristics that facilitate perceptual processing are discussed: simplicity (i.e., amount of information), prototypicality, symmetry, and contrast/clarity
Berlyne, (1970, 1971)	Design perception, novelty		sometimes a non-linear, inverted u-shaped relationship between a fluency-related stimulus characteristic (i.e., complexity) and preference has been found. The key idea of Berlyne's model is that the beholder of a visual stimulus assesses the arousal potential of these collative variables and that people prefer a medium level of arousal potential. That is, because arousal potential is assumed to increase monotonically with increasing novelty and complexity, respectively, individuals will exhibit an inverted u-shaped relationship between the intensity of the collative variables and their aesthetic liking.

Appendix 46 - Literature review – Cognition/novelty

Articles	**Main subject**	**Experiment**	**Results**
Norman & Shallice, 1986	Cognition, novelty		If the brain is unfamiliar with sthg, it will devote more attentional resources to studying it (it's positive)
Nadal, Munar, Cap., Rossell., & Cela-Conde, 2008	Cognition, novelty	Alessi Juicy Salif, along with a list of other juicers in her search results. As she views the Juicy Salif for the first time, visual information is captured on her retina, then sent for processing through the optic nerve to the visual cortex. This region of the brain is made up of more than two-dozen visual areas that analyze different visual attributes, such as motion, color, depth, and form.	more attention to new
Berlyne's (1971)	Cognition, novelty		if the stimulus requires extreme levels of attention to the extent that the system is overwhelmed, the task is more likely to be abandoned and a negative valence will be attached to it.
Articles	Main subject	Experiment	Results
Tatler 2005 (see article)	Information retention	Study 1: Information about object presence in the scene, the colour of objects, and positions of objects, distances, all show evidence that they are encoded and retained. Increasing numbers of fixations, or total fixation time, did not appear to increase performance for either of these object properties. This result implies that these types of information are not accumulated during revisits to an object. For object position information, there was no observed change in performance with intervening fixations. This result shows that object	Information retention: The relationship between fixations and properties of object memory was investigated. Study 1: 6 rooms showed (reality) questionnaire about: presence, colours, shape, position, relative distance. Study 2: (pc) participants viewed computer-displayed photographic images of the real-world scenes used in Experiment 1. - existent models on information retantion

		position information is not transient, but is retained stably once encoded. Study 2: (same result) .	

Appendix 47 - Literature review – Dynamic trasnfer/decision making

Articles	Main subject	Experiment	Results
Aly, Ranganath, & Yonelinas, 2014	Cognition. Changing in visual stimoulus		feeling of knowing that something changed, but with little to no ability to identify what the change was". This neuroscience research shows that discrete changes lead to greater parietal activation and are more likely to be consciously reported, whereas relative and subtle changes lead to weaker occipito-temporal activation and are less likely to be consciously reported
Nelson and Ellison 2005	decision making		when someone notices an item on a store shelf, the "first moment of truth" and believes they are a crucial determinant of product choice (3 to 7 seconds)

Appendix 48 - Literature review – Cognition, visual packaging

Articles	Main subject	Experiment	Results
Elder and Krishna (2012)	Cognition, visual packaging		manipulation of object-orientation in an ad design can impact purchase behavior: (soup spoon on the right, mug in a coffee shop)
Veryzer, (1993)	aesthetics		people prefer products with dimensions that adhere to the golden ratio

Appendix 49 - Literature review – Variety perception

Articles	Main subject	Experiment	Results
Townsend and Kahn (2014)	variety perception		show that even if the actual variety is held constant**, higher perceptions of variety** can attract consumers, making them more likely to choose;
Kahn and Wansink (2004)	variety perception		**higher levels of perceived variety can cause people to consume more**

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