MASTER THESIS INDUSTRIAL DESIGN ENGINEERING

Enhancing the User Experience of Energy Gels Through Packaging Design

Applying Generic Design Implications with the Use of a Explanatory Framework

Management of Product Design -
Industrial Design Engineering

Silke Jonkman

15-12-2022

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Master Assignment Industrial Design Engineering

UNIVERSITY OF TWENTE.

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Master student Industrial Design Engineering (IDE)
Management of Product Design (MoPD)
silkejonkman@live.nl
s2412373

Assessment committee

Prof.dr.ir. R. ten Klooster
Dr.ir. A. Karahanoğlu
Ir. W. Dankers
Dhr. B. Vriends

University of Twente

Faculty of Engineering
Technology
Drienerlolaan 5
7522 NB Enschede The
Netherlands www.utwente.nl

Maurten

Gibraltargatan 1A
411 32 Gothenburg
Sweden
www.maurten.com

ABSTRACT

The benefits of carbohydrate supplements in prolonged exercise are well established and known to enhance performance. However, fueling the body while exercising can be challenging for many athletes, especially in (marathon) running. This thesis aims to brings novel insights for improving the user experience of energy gels through packaging design by conducting a participants study .

In this thesis, the user experience of using energy gels was found to be influenced by three dimensions: the Energy Gel Product, Packaging Design and Brand Image. To unpack the influence of these dimensions, a participant study with 33 participants was conducted. Participants received a research kit containing five different type of energy gels (packages) and a booklet/journal as references. During the research, the participants were asked to use at least three of the five gels in regular running training and evaluate the use of the energy gel packages by answering questions from the journal.

Results showed that energy gel users, especially runners, are extremely varied. To satisfy all athletes within this diverse group, product options are endless. The difference in user types and the wide range of products make a one-line solution for 'the' most user-friendly energy gel package impossible to achieve. Nevertheless, the results showed that satisfaction in users' experience is determined by the alignment of the user characteristics, needs and wishes and the their preferred packaging interactions (carrying, opening, consuming). Despite differing demands per user type, I also found overlapping user needs. These are used to define generic design implications for enhancing user experience of energy gel packages.

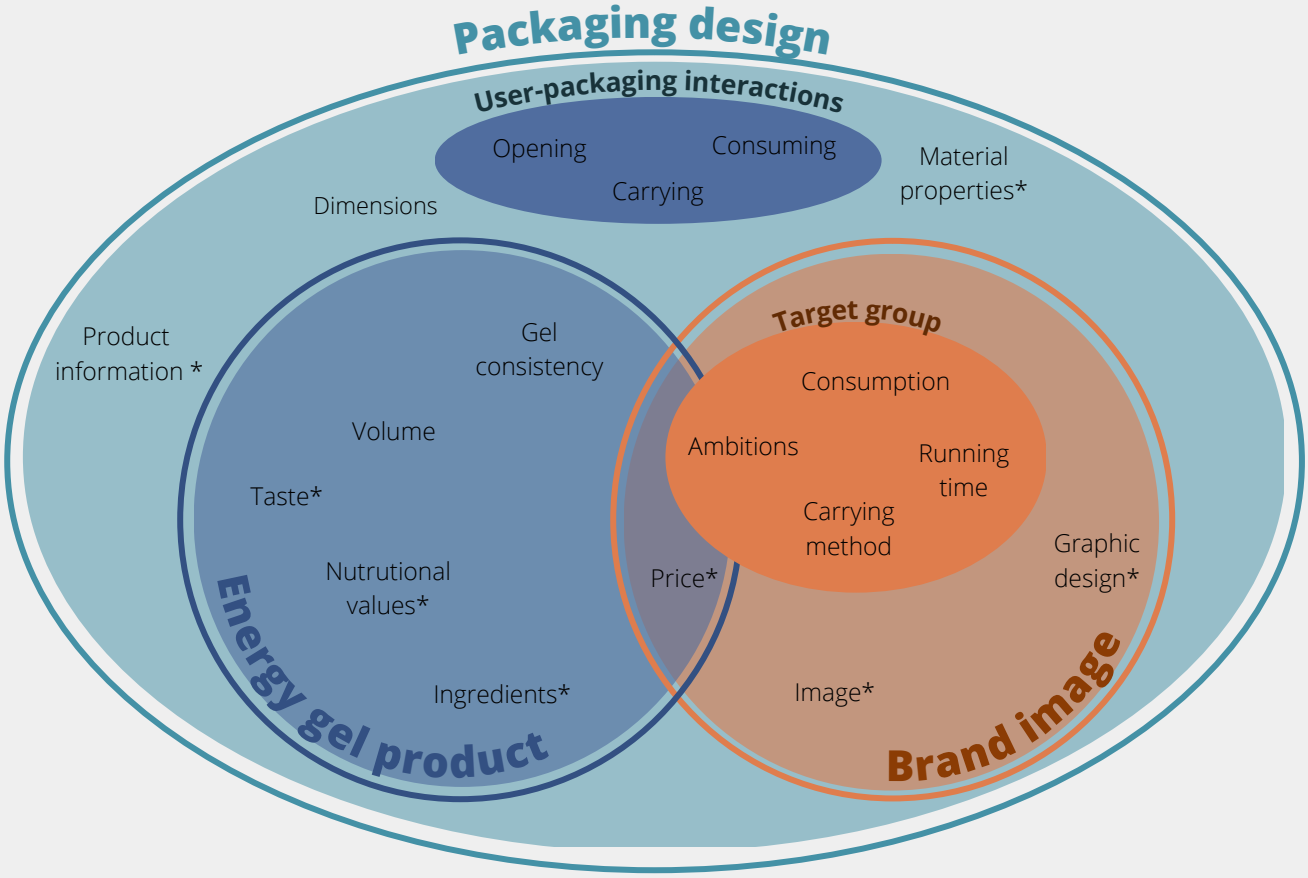
1. Consider Target Users' Goals in using Energy Gel
2. Enable Comfortable Carrying
3. Design Easy and Intuitive Opening
4. Providing Convenient and Clean Gel Consumption

These implications are widely applicable but do need to be specified within specific application. The implications are intended to aid future design of any type of energy gel packaging.

The influence of design on the experience of energy gels is mainly in the Packaging Design dimensions. This dimension is primarily influenced by the Energy Gel Product- and Brand Image dimension. These insights led to revision of the prior model which resulted in the Framework for Explaining user experience of Energy Gel Packages.

The framework consists of factors which have been shown to impact runners' experience when using energy gels. These factors are divided into dimensions defined at the start of the research. The framework explains how the experience of energy gel packages can be influenced. This should provide structure when deciding on a strategy to improve the user experience of a specific packages. The design implications and framework jointly support future designers to enhance user experience of energy gel packages.

User Experience of Energy Gel Packages



* Dimensions which do influence packaging design but are outside the scope of this assignment

ACKNOWLEDGEMENTS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@SILKEJONKMAN_

First of all, I would like to express my appreciation to my thesis supervisor Armağan Karahanoğlu for the helpful, empathetic and enthusiastic support during the period that I worked on this master assignment. It has been a long process in which, due to my own running ambitions, I occasionally had other things on my mind than writing this thesis. Armağa managed to guide me in exactly the right way by providing me with freedom but also kept me sharp and pulled me back into work with her enthusiasm and good ideas. I am grateful for this pleasant collaboration and the fact that she understood my situation so well and actually encourage me in both my academic and sporting achievements. I would like to thank Ben Vriends, , my company supervisor, for the time and effort he put into supporting me throughout this assignment and for the opportunity he gave me to work with an interesting brand like Maurten. Beside Ben, I want to thank David Zeeberg, Packaging Specialist at Maurten, for his expertise and instructive input. In addition to the facilities and financial support they offered me during the research, it was interesting to see how a company deals with a subject such as packaging design and what considerations they make. Furthermore, I want to thank Maarten Nieuwstraten from Wielervoeding.nl for providing around 250 (!) energy gels for the research.

I would also like to thank Roland ten Klooster for his interesting and instructive lectures, which made me enthusiastic about the subject of packaging design. In addition, I am grateful for the fact that he approached me, as he found me a suitable student for this assignment.

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Silke Jonkman
1 December 2022

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Introduction


MAURTEN
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On 12th of October 2019, Eliud Kipchoge wrote history. On this day he became the first human to break the two-hour barrier on the marathon by covering 42,195kilometres in a remarkable time of 1:59.40.1 (Ineos, 2022). The historical performance delivered by Eliud was no ordinary one. Besides the exceptionally talented and well-trained athlete Eliud had to be at this specific day, running a sub two-hour marathon was a scientific achievement. It took years of preparation to optimize all facets of marathon running. The running formation was thoroughly tested in the wind tunnel to minimize resistive forces, the course was mathematically calculated to minimize speed loss, Eliud wore the revolutionary light and responsive Nike Alpha fly running shoes and the enormous carbohydrate supply the human body requires during prolonged activity was optimally supplemented by the ergogenic aids from Maurten.

However, Eliud and his team are not the only ones seeking a high-class performance. Worldwide, millions of people are preparing to run the magical marathon distance. For some it is all about covering the distance, others have time-related goals. Although running a marathon has a different meaning to anyone, all runners will have to cope with the inevitable fatigue caused by the prolonged activity. Only good preparation can limit this fatigue and result in an optimal performance. The degree of preparation cannot be compared with Eliud's individually guided sub two-hour marathon plan. We cannot all wear a personalized shoe, have an individual pacer during the race or supplement our carbohydrate needs with a sign to the motor next to us.

Yet, more and more is being done to improve marathon running for the masses. As for Eliud, proper carbohydrate fuelling is key. Not executing a proper nutrition plan will result in drainage of energy causing the body to stop functioning properly. To execute this nutrition plan, many carbohydrate supplements are offered. Still runners seem to struggle with carbohydrate fuelling, both physically and practically. Carbohydrate supplements require a convenient handling and way of consuming while running. However, using and consuming an energy gel while running turns out not to be an easy task.


GEL

1.1. Research Gap

Sports science literature shows that a proper nutrition strategy is key for running a good marathon(Burke et al., 2011; Coyle et al., 1983; Jeukendrup, 2010). Carbohydrate intake while running is an important aspect and accessible way to enhance marathon experience and performance. Smooth carbohydrate fuelling can be done in several ways, depending on the runner and context.

Elite runners often benefit from personalized fuelling stations in races. They can prepare their own nutrition and place it at designated fuelling stations. This enables the elite runner to use their own nutritional aids, without having to carry them during the race. A major benefit is the ability to choose carbohydrate in liquid forms, such as drink. Drinks are often found to be easy to consume but are also voluminous and heavy, making them difficult to carry while running. As most runners do not have the possibility to use the fuelling stations, liquid carbohydrate consumption is not an accessible strategy for everyone. A more accessible way of carbohydrate fuelling is to use energy gels. Energy gels contain a high concentration of carbohydrates, making them smaller, lighter, and easier to carry. However, consuming energy gels can be more difficult and less comfortable than consuming carbohydrate rich drink mixes.

In addition, carbohydrate fuelling between runners vary on other aspects as well. The amount of carbohydrates that the body requires during the marathon also differs, mostly depending on training and duration of the exercise. With an average speed of just over 21 kilometres per hour, Eliud Kipchoge only needs two hours to complete the marathon. This is exceptionally fast, as only 5 % of elite runners cover the same distance in three hours or less and an average athlete needs 4 hours and 21 minutes to run 42 kilometers (Asics, n.d.). By running for a longer period, it only makes sense that these athletes must consume a higher quantity of the carbohydrates. In addition, the body of a well-trained marathon athlete is able to store a higher quantity of glycogen providing them with a lower carbohydrate need than the average marathon runner (Rapoport, 2010).

These are just a few of many factors on which individual carbohydrate needs in marathon running depends on. Prior research has been done into how sports nutrition and carbohydrate fuelling strategies can meet different marathon runner's needs (Rapoport, 2010) (Berning & Nelson Steen, 2006) (Sjödin & Svedenhag, 1985)(di Prampero et al., 1986). However, it seems to only make sense that different fuelling strategies and carbohydrate needs will also result in different expectations in usage of sport nutrition products. However, there

is little to no work done into how marathon runners experience current sport nutrition products. As carbohydrate fuelling is such an important part of marathon running, there should be an appropriate way of consuming sport nutrition for all athletes.

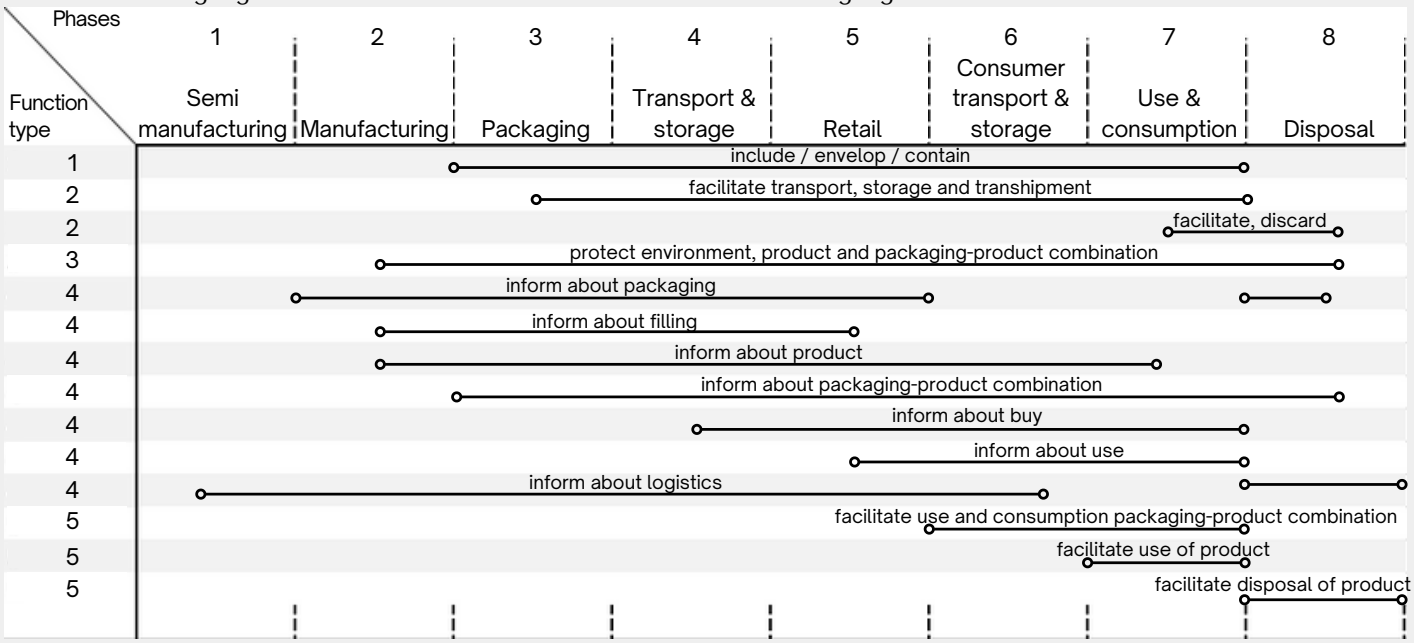
1.2 Context of the assignment

In this thesis I discuss how marathon runners experience the use of sport nutrition products and how packaging design can enhance this experience. In the following section I describe how the concepts packaging design and user experience of packaging are interpreted in the context of this thesis. Furthermore, I will elaborate on the collaboration with the company Maurten.

1.2.1. Packaging design

Traditionally speaking, packaging design is subordinate to product design, seen as a tool to provide protection to its content (Azzi et al., 2012). Although protection is a key function of packaging, in many cases its usefulness is greater than that. Within this thesis I will focus on other functions than protecting. Packaging fulfils many other functions, and occurs in different phases of a products lifecycle. Tabel 1 shows five types of packaging functions, occurring in eight different phases of the packaging chain, as described in the 'Zakboek Verpakkingen'(ten Klooster et al., 2020) . Within this thesis I will be mainly looking into the user phases, which are phase six, seven, and eight. Therefore, when talking about packaging, I will refer to the primary packaging (also called consumer unit), as outer packaging layers (secondary and tertiary packaging) generally do not contribute to the user phases.

Tabel 1: Packaging Functions in Different Phases of the Packaging Chain



Five type of packaging functions
1. Include / envelope (to contain): the content, the product
2. Facilitate transport, storage and transhipment: the packaging-product combination
3. Protecting environment, of product or packaging-product combination
4. Inform
5. Use and consumption and facilitate disposal

Figure 1: Maurtel GEL100

1.2.2. user experience of Packaging design

In the previous section I explained this thesis' perspective on packaging design to be on the user experience. Phase seven of the packaging chain, use and consumption, is the phase in which users mostly interact with the packaging. Use and consumption implies interaction with a product, which will contribute to an experience. When experience is created and shaped through design or technology it can be defined as user experience (Hassenzahl, 2010). By changing the design, we can influence the user experience. This can be done in infinitely different ways depending on both the user and the product. To provide this thesis with a bit more structure, I defined three dimensions which play a role in influencing the user experience of energy gel packages in marathon running, the energy gel product, brand image and packaging design. How runners experience these factors seem to be highly subjective and be dependent on different situations and perceptions (Karahanoĝlu, 2022).

1.2.3. Collaboration with Maureen

This assignment is carried out in collaboration with the Swedish company Maurten. Maurten is launched in 2016 and positions itself as an innovative brand, specialized in the field of sport nutrition developing energy gels, drinks and bars. The company's mission is to optimally provide athletes in their carbohydrate needs during prolonged endurance exercise such as running or biking. The company is research-focused, always innovating and working with latest technologies to provide athletes with the state-of-the-art fuelling strategies. Initially, the company aim was to support the fastest athletes in the world. They did so by providing elite athletes with their product Drink Mix. At Maurten they were convinced that drinking was the most efficient and comfortable way of carbohydrate fuelling. The Drink Mix turned out to be very successful, making a new demand to arise. More athletes wanted to use Maurten's products. Hence, to also enable the everyday, ambitious marathon runner to use their carbohydrate-rich products, Maurten launched a new product: GEL100 (Figure 1). By offering carbohydrate in the form of an energy gel, Maurten enabled runners to transport sport nutrition in an efficient and more comfortable way. This greatly increased their target audience. Maurten will benefit from the results of this thesis by learning how to provide this wider target audience with a pleasant user experience using the GEL100.

1.3. Aim, Scope and Research Question

The aim of this thesis is to find out how packaging design can enhance the experience of marathon runners in using energy gels. The focus will be on the user interaction and experiences of energy gel packages. The goal is to provide design guidelines which can be used by sport nutrition brands to improve usability and enhance the experience of their product usage. These guidelines are widely applicable for different users and brands, but will be applied within this thesis to improve the user experience of the Maurten GEL100. As the focus of this thesis will be on the experience of the energy gel packages, packaging design topics such as production, logistics, retail and are outside the scope of this study. Sustainability balances on the edge of the scope. Users nowadays have a strong opinion on this subject which could interfere with their experience. Therefore, users' opinion on sustainability will be considered. However, practical implementation of sustainable principles is a comprehensive and complex topic which will likely need supplementary research.

This thesis aims to provide an answer the following research question:

How can design enhance the user experience of energy gel packages in marathon running?

I will answer the research question by addressing the following sub-questions:

1. Who is the user of energy gels and how do they use the energy gel and its packaging?

2. What are the current energy gel options on the market?

3. How do marathon runners experience current energy gel packages?

4. What are the points of improvement in current energy gel packages?

5. How can the points of improvement be translated to design guidelines for Maurten?

1.4. Structure of the thesis

This thesis is divided into four different phases: the research, analysis, implication and solution phase. These self-defined phases are inspired by the phases that are often used in user centered design models. Each phase consists of its own objectives, used to address the research questions. The research phase is the starting point and will support this thesis with background information, prior literature and market research as well as novel insights from the user research. The outcomes of the research phase will be evaluated in the analysis phase. In the analysis phase, I will evaluate the current state to find

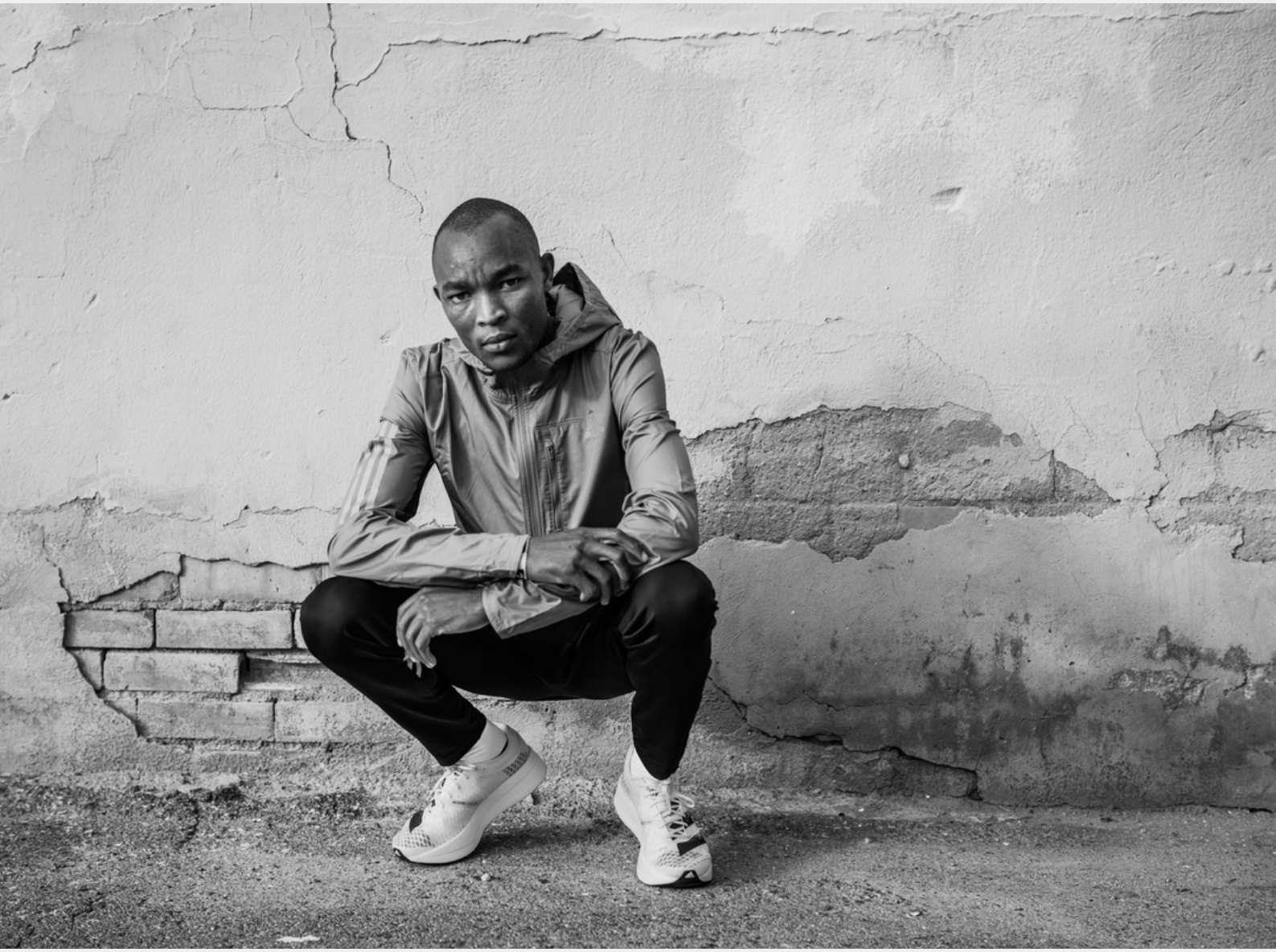
where there is room for improvement. The area of improvements are the starting point of the implication phase, in which I define how the user experience of energy gel packaging can be improved.

Finally, I will use these implications to answer the main question in the solution space. Table 2 provides an overview of all the phases with corresponding sub-questions and objectives.

Tabel 2: Overview of research phases and research questions

Research Question				
How can design enhance the user experience of energy gel packages in marathon running?				
	Research	**Analysis**	**Implications**	**Solution space**
Sub questions & objectives	Who is the user of energy gels and how do they use the energy gel and its packaging?	What are the points of improvement in current energy gel packages	How can these points be improved?	How can the design implications be applied to a specific energy gel packaging?
	What are the current energy gel options on the market?		How do the points for improvement translate into applicable design implications?	How can the design implications be used to enhance the user experience of the Maurten GEL100?
	How do marathon runners experience current energy gel packages?			
	Which packaging qualities play a role in consuming sports nutrition during marathon running?			
Envisioned methods & results	Literature review Market research User Research	Analysis of the research	Area of improvements Design implications	Application of design implications
Chapter(s)	2, 3, 4	4, 5	5	5, 6, 7

Related work



To be able to substantiate this assignment scientifically, I did literature research into various relevant topics. In this chapter describe related work and summarize how this information can be used for this research.

2.1. Demands of Marathon Running
2.2. Sport Nutrition
2.3. Innovation in Marathon Running
2.4. Hydrogel Technology
2.5. Packaging Design
2.6. Psychological Effect of Energy Gel Consumption and Design for Packaging Experience

2.1. Demands of marathon running

Marathon running is often seen as one of the ultimate prolonged endurances exercises. Completing the 42,195 kilometres is a popular bucket list item for many people, some aiming to complete it as quick as possible, others just striving to get to the finish line (Hammer & Podlog, 2016). Despite these different intentions, all runners will cope with inevitable fatigue. Running a marathon is a challenging activity where the result is determined by defying the physical and mental demand (Sperlich, 2016).

Joyner and Coyle propose three important components which describe the physiological capacity of an endurance athlete. These components are: the involvement of aerobic and anaerobic energy production (VO2peak), velocity at lactate threshold and running economy (Joyner & Coyle, 2008). The VO2peak and lactate threshold are indicators which define the duration an athlete can maintain both aerobic and anaerobic performance, while the runners economy is an indicator for energy consumption at a given running speed (Sperlich, 2016). The importance of these physiological components are shown by the fact that more than 70% of the difference in performance levels between individuals can be explained by VO2peak, lactate threshold and running economy (di Prampero et al., 1986). Therefore, the training goal of a marathon runner can be stated to increase the velocity that can be maintained over a 42 kilometre race by increasing these three components. Both VO2peak and lactate threshold are components that respond well to training stimuli and can be enhanced by training strategies such as high intensity training (Baquet et al., 2002; Laursen & Jenkins, 2002) . However and in contrast, enhancing a runner's economy seems to be less sensitive to specific training strategies. Methods such as high-intensity training and forms of strength training seem to benefit the running economy (Barnes & Kilding, 2014), but the most important factor for improving running economy seems to be the number of accumulated years of running (Jones, 2006).

Yet the physical demand of marathon running is not just about endurance and an efficient running economy. An infinite amount of training can be done to improve these facets, but after about 60-90 minutes the energy in the human body will be depleted and the performance will decrease. When performing prolonged exercises (>90 minutes) the body burns large amounts of energy, which is advised to replenish during the activity. Replenishing during exercise is done mostly by fuelling with carbohydrates. Carbohydrate intake during exercise conserves the glycogen stock which allows the effort to be sustained longer and can enhance performance (Jeukendrup, 2013).

Therefore, an athlete is recommended to consume 60-90 grams of carbohydrates each hour of exercise (Burke et al., 2011). The efficiency of the intake is dependent on the type of carbohydrates and their ratio (Jeukendrup, 2010, 2013). Some carbohydrates (e.g. glucose, fructose) are absorbed quickly, while other carbohydrates (e.g. maltodextrin) are used more slowly. Glucose and fructose, often referred to as short carbohydrates, are known to cause a sugar peak. Slow carbohydrates like maltodextrin releases energy slowly. Combining these two type of carbohydrate in the right compositions provide the most efficient energy supply (Jeukendrup & Gleeson, 2019).

2.2. Sport Nutrition

The benefits of carbohydrate supplementation in extrprolonged exercise are well established and known to enhance performance. However, fuelling the body while exercising can be challenging for many athletes, especially in (marathon) running. Special sports nutrition has been developed to provide the body with the right nutrients in the most convenient and efficient way. Sport nutrition come in a variety of forms such as energy bars, drinks and gels. Whether one choses to consume carbohydrate in solid of liquid form does not seem to influence the carbohydrate intake and does not affect performance (Jeukendrup & Gleeson, 2019). However, the form of carbohydrate does affect practical feasibility of consumption. For most (marathon) runners it is not comfortable to carry large volumes, like bottles of energy drinks. Therefore, bars and gels are more practical as these tent to have a higher calorie density. Energy gels are often the product of choice in (marathon) running as chewing and swallowing while (high-intensity) running can be challenging.

Athletes can choose from a wide range of energy gels nowaday where energy gels differ in composition, consistency, volume, taste and way of use. In addition, other nutrients like caffeine or sodium can be added to energy gels.

2.3. Innovation in Marathon Running

Sports is about improving, whether that means getting faster, stronger, or going further (Jang et al., 2021). Therefore, there is a lot of innovation in the field of sport. In swimming for example, world record after world record was broken after the introduction of the increasingly faster aerodynamic swimsuits. Or ice-skating, where times that were skated in the era before the clap skate, cannot be compared with the times skated now. Running on the other hand, lagged in these kinds of innovations for a long time. As running is a fairly simple sport with few tools and relatively low in speed, it is less sensible for such revolutionary aids and aerodynamic impact.

However, over the last decades focus shifted and running became more and more scientific-based. Research proved how one could sustain a higher speed for a longer period of time by wearing shoes which enhance running economy (Saunders et al., 2004). Nike leads the way in 2016 when the first revolutionary running shoe with an uncommonly compliant and resilient foam and stiff carbon fiber plate arises (Wouter Hoogkamer et al., 2018). The shoe is completely different from the traditional, minimalistic race day shoe, but has quickly become a favourite for many runners (Gonzalez, 2019).

Parallel, research is progressing in the field of sport nutrition. In 2015, scientists discover a method that makes it easier for the human body to tolerate higher concentrations of carbohydrates. The Swedish brand Maurten takes the lead when it comes to sport nutrition using this specific technology. This new technology is explained in the next section.

2.4. Hydrogel technology

Maurten mainly owes their popularity due to the innovative hydrogel technology they use in their products. By encapsulating carbohydrates into the hydrogel, Maurten can facilitate higher carbohydrate intake due to minimising gastrointestinal distress. The hydrogel is not new to the food industry, it is often used as thickener and structuring. Chemically speaking, a hydrogel is a biopolymer- and water-based structure. In simpler terms, a hydrogel is a three-dimensional structure which behave like a sponge, characterized by the ability to retain water. By crosslinking two natural ingredients, alginate and pectin, with calcium, the hydrogel is formed. Technically speaking it is a biopolymer matrix, filled with a blend of fructose and glucose. The concept is similar for the Drink Mix, where the technology enables a smooth transportation of the nutrients through the stomach to the intestines. Contrary to the GEL, the Drink Mix forms a hydrogel by the acidity of the stomach.

2.5. Packaging design

Nowadays, packaging is no longer simply a casings for the product. Packages have an important contribution to the experience, usability and quality of a product. The term packaging is quite comprehensive and difficult to describe. Ten Klooster formulates the core of packaging design to as follows:

"Packaging is a functional addition to a product, with the aim of allowing this product to cover time and distance at the desired cost and environmental impact, whereby the packaging ensures that the end user can ultimately use the product in acceptable quality." - (ten Klooster et al., 2020)

Opening of packages is an area which has previously been researched. Packages can be classified into one of nine opening strategies, and a number of matching packaging types. The most obvious opening strategy for an energy gel package would be pulling or tearing, but flipping, pressing or twisting can also be used. Difficulties in package opening are generally caused by complexity of the opening system, useless instructions and variability in ergonomic capabilities. The ergonomic capabilities concern cognitive and physical capabilities as well as fine motor skills (Mumani & Stone, 2018). Opening and handling actions should be evaluated jointly given that these two factors influence each other. For example, the preferred grip (handling) can provide useful insights about users' opening strategy (Karwowski et al., 2011; Robertson, 2013). A side branch of opening strategy is the ability to reseal a package. This branch is particularly interesting to prevent wastage of product (energy gel) (Mumani & Stone, 2018) and possibly improve user experience by facilitating dosing options. Finally packaging disposal is important to consider in energy gel packaging as this type op product is often used in nature and should have as little sustainable impact as possible. Packaging attributes can truly affect users behavior while dealing with empty packages and also influences users perception on environmental impact (Mumani & Stone, 2018) .

People are prone to familiarity and often act out of habit. Practical importance of this in packaging design is that people show little to no interest in finding out how to use the packaging. For this reason, instructions for use should be indicated extremely clear. Even better, usage should be completely intuitive. The importance of this becomes even greater when it is assumed that package handling will often take place in suboptimal circumstances. For example, having wet hands from rain or sweat or the lack of light during a night run. In addition, handling of energy gel packaging is often performed while running, the user will be multitasking, which is known to cause failures (Burgess, 1999) Whether a packaging is ultimately experienced as user-friendly depends mainly on the match between the capacities of the user, handling method, and the context of use.

2.6. Psychological Effect of Energy Gel Consumption and Design for Packaging Experience

In general, running a marathon will be seen as a physical strain. Yet the mental aspect of running a marathon should not be underestimated. (Zepp, 2016) (Karahanoĝlu, 2022). There are various strategies runners can cope with the psychological demand of running the marathon. Energy gel consumption initially seems to be beneficial in

the physiological part of marathon running (balancing energy). However, the consumption of high energy foods can also provide a mental boost to the runner (Phillips et al., 2012). Research shows that some runners associate energy gel products with encouragement, a performance reward, a savior from energy depletion, a stimulus for emotional support and a milestone to keep track of the covered distance (Karahanoğlu, 2022).

When looking into the different phases of the packaging chain, usage and consumption will be the main contributor to the experience of energy gel packages. The usage and consumption phases consist of several stages in which user interacts with the packaging. Important user packaging interactions (UPI) are handling, opening and disposal (Mumani & Stone, 2018). This is in line with the interactions Karahanoğlu described to stimulate the psychological experience of marathon running, being carrying, opening and consuming (Karahanoğlu, 2022).The user should be able to handle the packaging intuitively and without considerable problems. Handling actions concern holding, gripping, picking, carrying, and controlling the package. Inconveniences in these action makes it difficult to, safely, manipulate the package (Karwowski et al., 2011). Ease of handling is often dependent on package shape, weight, size, rigidity, and the handling options offered (Wever, 2016). Difficulties in retrieving ingredients from packaging, especially when using long tubes, are also considered to be an occurring handeling problem (Mumani & Stone, 2018). Furthermore, Shifferstein describes how sensory characteristics can influence perception and experience of the use of packaging and how sensory characteristics also determine how user perceives the content (Schifferstein et al., 2013). The multi-sensory experience in food packaging design stands out compared to other industrial products, due to the inclusion of all five senses: sight, sound, smell, taste, and touch (Schifferstein et al., 2013).

2.7. Conclusion

This chapter provided answers to several research questions addressed in the research phase. When one performs prolonged exercise (>90 minutes), it is advised to supplement carbohydrates during the activity. This is done most efficiently through sports nutrition, which can be in the form of energy bars, drinks or gels. Energy gels are often product of choice within running as they are a convenient in size, making them easy to carry while running. Runners can choose from a large variety of energy gels and corresponding packaging options. In section 3.2. different energy gels are compared to see what the current options are.

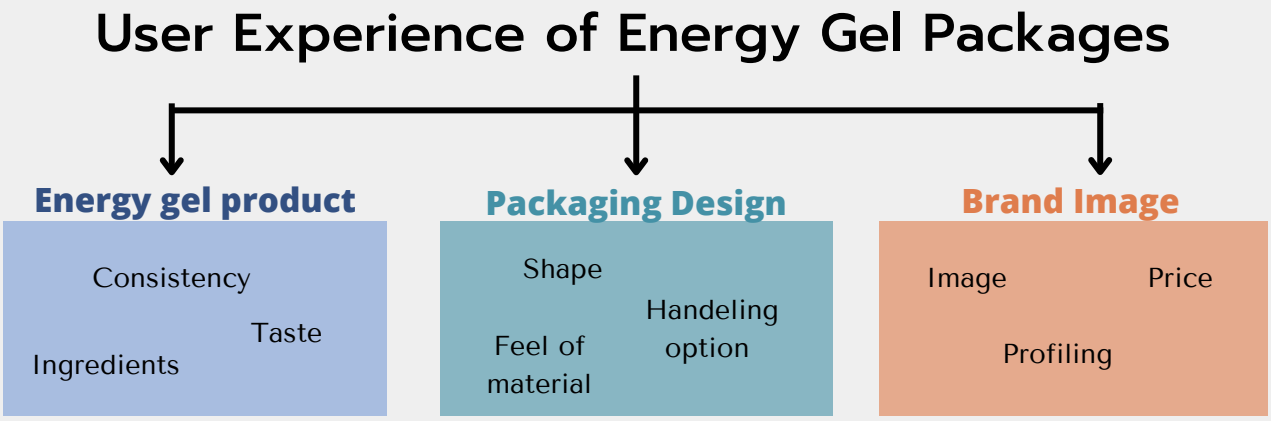
Besides the functional importance of energy gels, also the psychological effect of energy consumptions appears to be relevant. Carrying, consuming and opening of energy gel packs influence the psychological experience of marathon running. However, how specific packaging properties can enhance this experience is still unknown. Furthermore, relevance of the multi-sensory experience of food-packaging was found in the usage and perception of the packaging and its content.

To find an answer to how packaging design can enhance the user experience of energy gel packages, I divided several variables which are likely to influence the user experience of energy gel packages in to the three dimensions introduced in section 1.2.:

1. The Energy Gel Product
2. Packaging Design
3. Brand Image.

For better understanding, figure 2 provides a schematic overview of these dimensions and variables. To find out if and how these dimensions and variables influence the user experience, I will perform user research into current energy gel (packaging) use in marathon running.

Figure 2: Schematic Overview Factors Influencing User Experience of Energy Gel Packages



Participant study

In this chapter, I will explain the participant study I conducted to address the following questions:

1. Who are the users of energy gel packaging?
2. What are their current options in energy gel choices?
3. How do they experience these option within the actual use context
4. Which packaging qualities (both positive and negative) are key in determining the user experience?

The study is designed to answer these questions and will provide better understanding of the energy gel user, their preferences, capabilities, needs and wishes. By including different types of energy gel packages, the study provides valuable information on strong and weak packaging qualities. The results of the research will contribute to defining a strategy to enhance the experience of energy gel packages.

3.1. Study Design

To gather the experiences and opinions on energy gel use, participants received five energy gels and a diary. The energy gels are the testing material, participants findings on these tested energy gels were documented using the diary. Diary studies have been priorly used to reflect upon people's behaviour, actions and intentions within a specific context as they have been proven to increase peoples reflective capacity and ability to recall events (Carter & Mankoff, 2005). Therefore, diary studies are used to understand physical activity and sport practices (Smits et al., 2018)(Hayman et al., 2012). The questions in the diary were carefully formulated to address the research questions. In user research, is it vital to keep in mind that participants might (unintentionally) alter reality and/or provide biased answers. Although participants will not mean to do so, they might provide positive answers to negative experiences. This may be because they are used to certain inconveniences making them to longer notice the disadvantages or give positive answers to appear clumsy (ten Klooster et al., 2020). The questions in the diary were carefully formulated to provide a reliable and complete picture of energy gel use and specifically address the research questions. Several rounds of testing were conducted to check whether the questions were clearly formulated and yield the desired and useful answers. Answers were collected by a combination of multiple choice questions, grades, five-point Likert-type scales (e.g., the range is 1-not at all to 5-very much) and explanation/elaboration options via open-ended questions.

Ethical approval was obtained after the study design, prior to participant recruitment and can be found in appendix 1.

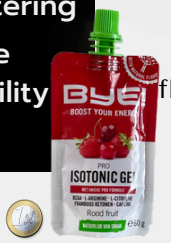
3.2. Current Energy Gel Market and Selection for research

There are many types of energy gels on the market. To have an overview, another partner of this study (Wielervoeding.nl) provided twenty-two different energy gels from seventeen different brands (see Appendix 2 for overview). The energy gel (packages) were analysed and compared based on properties which are likely to influence consumers experience and decision making for purchasing energy gels. The analyses can be found in appendix 3.

- Price*
- Volume/weight
- Dimension
- Kcal per serving/100gr
- Shape of the package
- Opening strategy
- Resealability
- Anti-littering or not
- Look of material
- Flexibility of material
- Colour use
- Flavour of the energy gel
- Caffeinated energy gel

Tabel 3: Schematic overview selected energy gel packages and their properties

	Bye! Isotonic Gel	Maurten GEL 100	PowerBar Original	SiS Beta Fuel	Sponser
Dimensions	140x65x10 mm	130x40x15 mm	185x50x5 mm	160x40x10 mm	140x45x25 mm
Opening strategy	Twisting	Tearing (1-way)	Tearing (1-way)	Tearing (2-ways)	Flip cap
Reclosability	Yes	No	No	No	Yes
Anti littering	No	No	Yes	No	Yes
Relative flexibility	Most flexibel	Medium flexibel	Most flexibel	Least flexibel	Least flexibel
Price*	€2,45	€3,45	€2,19	€2,79	€2,65



*Price is suggested retail prices obtained fromwielervoeding.nl in March 2022

From this analysis, I chose to include five energy gels in this research: Bye! Isotonic, Maurten Gel100, PowerBar Original Gel, SiS Beta Fuel and Sponser Liquid Energy Pure. These gels were chosen based on their distinguishing type of packaging designs. Because of the collaboration with Maurten, it was obvious to include the Maurten GEL100, which comes in the traditional energy gel sachet which opens by tearing of the top. The Bye! and Sponser gels were selected due to their different type of packaging design and opening strategy. The PowerBar gel was chosen because of the well-known type of packaging (tear sachet) but with the added feature of an anti-litter chain. SiS was included in the research because of the same recognizable sachet packaging and, in terms of branding and graphic design, remarkable similar look to the Maurten GEL100. Tabel 3 show packaging characteristics of the selected gels. To motivate participants gel choices in the research to be based on packaging features, I tried to remain other properties (e.g. taste, kcal, caffeine content) as similar as possible.

3.3. Participant Recruitment

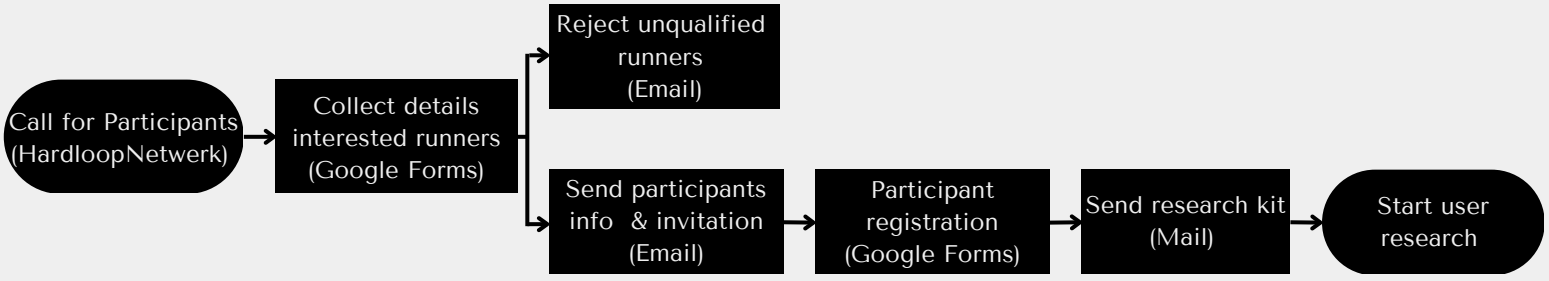
Energy gels are a widely used product in endurance sports, used by all types of athletes. To represent the user population and practical reasons, participants have to meet the following criteria:

- Has run at least one (half) marathon
- Experience consuming energy gels in (half) marathon
- Capable of running at least three times six kilometres in four weeks
- Resident in the Netherlands or Belgium
- 18 years or older

These criteria will ensure experienced participants to

represent the target group. The aim was to include a minimum of 20 participants. Participants are recruited by distributing a call for participants via the Dutch running blog Hardloopnetwerk. Runners who were interested in participating in the study, left their contact details to receive further information about the experiment after which they could decide to sign up. In total, I received 113 responses from runners interested to participate. Of these, eight were unqualified (four younger then eighteen, two unexperienced with energy gels), six were unexperienced in (half)marathon running). I sent an email to all runners who met the conditions to invite them to sign up for the research. 74 Runners signed up to participate in the study, 61 runners actually started the research. Figure 4 provides a schematic overview of the participant recruitment process and corresponding resources.

Figure 4: Schematic overview of the participant recruitment process



3.4. Data Collection Materials

Initially, participants were to provide research answers by filling the journal booklet, which should be returned when finished. However, due to the great interest, I decided to switch to a digital data collection tool in the form of a smartphone application. Conducting the research through a digital format enabled easier data processing as data could be exported by clicking a button, versus copying all responses manually. Although participants were encouraged to use the smartphone applications, they could still choose to use journal if preferred. The smartphone application was designed with the Twente Intervention and Interaction Machine (TIIM). TIIM is a research software provided by the Behavioural, Management and Social Science (BMS) Lab, part of the University of Twente.

3.4.1. Data Collection

For this study, experiences marathon runners were asked to use a set of different energy gels within their everyday training and reflect upon their experiences. All selected 74 participants received the research kit via post.

The research kit included five energy gels and the journal (Figure 5). The journal is printed in Dutch and functioned as a step by step guide. The journal consists of the following chapters, explaining the research steps, providing information on the energy gels and all questionnaires with space to provide answers.

- Deadlines
- Step by step guide
- Overview of the energy gels
- Questionnaire 1: Runner profile
- Questionnaire 2 : (Q. 2.1) Pre-run and (Q. 2.2) Run context and gel evaluation
- Questionnaire 3 to 6: Copy of Q.2
- Questionnair 7: Research evaluation and gel comparison

A digital printout of the journal can be found in Appendix 4.

At the start of the research participants provided background information like demographics, weekly running schedule, marathon experience and prior experience in energy gel consumptions (Q.1.). Next, the running experiment started. Participants were asked to choose one of the energy gels an use it in their training. Before the run, participants logged which gel they chose, the reasoning for this decision and their first impression on the gel (Q. 2.1.). After the run, participants were first asked about the context of the run. Next, they evaluated the use of the energy gel (Q.2.2.). This process of choosing, using and evaluating the energy gel is repeated for a minimum of three and maximum of five times (Q.3, Q.4, Q.5, Q.6). This flexible setup

Figure 5: Image of the Research Kit

enabled five energy gels to be included in the research, while also keeping it feasible to finish the experiment within the runtime of one month. The minimum of three runs makes the research accessible to a large group of runners. To conclude, participants compared and evaluated the energy gels the used gels and argued their opinion on important energy gel (packaging) properties (Q.7.). Figure 6 provides a schematic overview of the research process from the participants perspective.

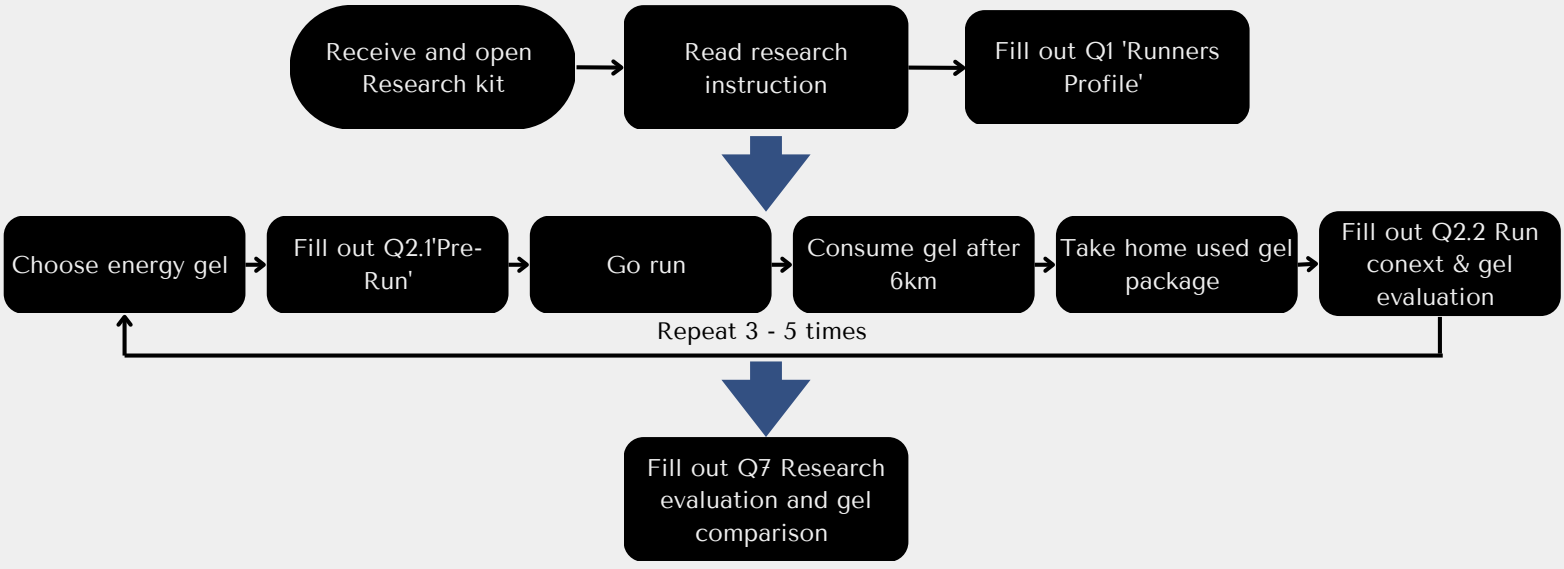
The research kits were sent to participants on 25-03-2022. Participants were asked to start the research (answer Q.1.) no later than 01-04-2022, this was later extended to 04-04-2022. The deadline for finishing the research (answer Q.7.) was initially 30-04-2022, but extended to 15-05-2022.

The runners completed the study anonymously, independently, and remotely. This way participants were able to test and compare multiple gels within a actual representable context. In addition, this research method removed demographic limitations enabling a broad set of users to participate. Furthermore, being anonymous, participants can freely answer questions, providing truthful results.

3.5. Data analysis

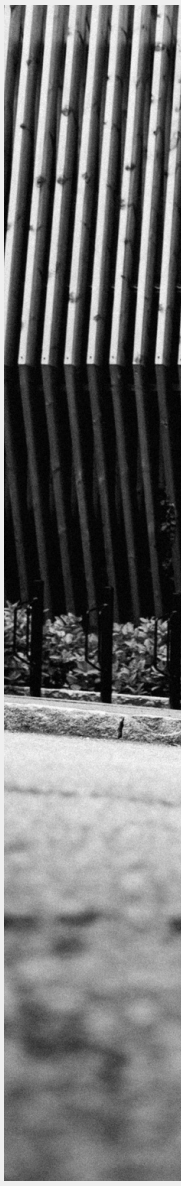
The research results from participants who used TIIM were downloaded as a CVS file. The software program Libre Office was used to import and transform the data after which it was copied and analysed in Microsoft Excel. Data from participants who used and returned the journal was manually added to the same Excel file. Participants who did not complete the research (ed. logged less than three runs) were excluded from results. Data was categorized in two ways: data per questionnaire (Run 1, Run 2, Run 3, etc.) and data per brands' energy gel. The data sorted per questionnaire was used to analyse participants reasoning of

Figure 6: schematic overview of the research process



choosing specific gels in certain order. To do so, I counted which gels were chosen in the first run as first choice, gels chosen in the second run as second choice and so on. Gel which were not chosen (because participants tested only three or four gels) were added to last chosen gel. Numerical data was used by comparing means (and corresponding standard deviations) to compare carrying-, opening-, consuming experiences, and packaging characteristics of the different energy gels. Descriptive data unites are analysed by defining answer categories and allocating answers into these categories. It should be noted that it is possible an answer is allocated into different categories. For example: a participant argues that the Maurten gel is the most user-friendly because it is easy to carry and pleasant consuming the gel. The answer can then be counted both the categories 'comfortable carrying' and 'easy consumption'. Quotes from participants were used to explain and confirm findings. Since the research was carried out in Dutch, comments have been translated into English where necessary.

Results



In this section, I will describe the results of the participant study explained in the previous chapter. Results will be addressed within the following sections.

4.1. Participant Profile
4.2. Experiences on User Packaging Interactions
4.3. Brand Comparison
4.4. Genaral Energy Gel Properties

4.1. Participants profile

Results of the participant profile are summarized in table 4. The research was finished by 33 participants (20 male, 13 female, Mean = 36, Min. = 20, Max. = 60). 94% Of the participants perform at least three runs per week, of which 15% either 5 to 6 runs and 18% more than six runs. 43 % Runs an average of 40 to 60 kilometres per week. All participants run at least 60 minutes or longer once a week. 40% Of participants perform a run longer then 120 minutes at least once a week. 91% Of participants carry their own energy gel in (marathon) races, remaining 9% did not consume energy gel in their race.

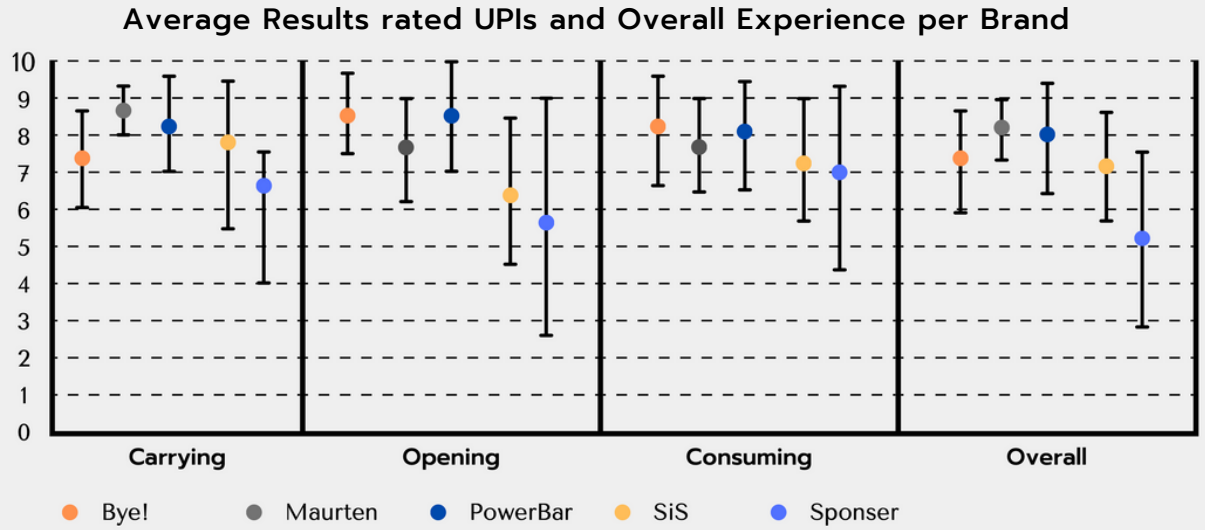
Tabel 4: participants profile data

PN	Age	Gender	Avg. runs per week	Avg. km's per week	Longest training of the week	Completed half marathons	Consumed energy gels	Completed marathons	Consumed energy gels
P1	20	Male	1	< 20 km	60 - 75 minutes	> 4	1	2	3
P2	27	Male	> 6	60 - 80 km	> 120 minutes	> 4	1	0	
P3	31	Female	3 – 4	40 - 60 km	90 - 105 minutes	> 4	3	> 4	6
P4	32	Female	3 – 4	40 - 60 km	> 120 minutes	> 4	1	0	
P5	49	Male	3 – 4	40 - 60 km	90 - 105 minutes	1	0	0	
P6	60	Male	5 - 6	60 - 80 km	> 120 minutes	2	1	2	5
P7	44	Male	3 – 4	20 - 40 km	75 - 90 minutes	> 4	2	> 4	6
P8	54	Male	3 – 4	40 - 60 km	105 - 120 minutes	> 4	2	> 4	5
P9	41	Female	3 – 4	40 - 60 km	> 120 minutes	> 4	1	> 4	
P10	30	Female	3 – 4	40 - 60 km	> 120 minutes	2	2	1	2
P11	26	Female	5 - 6	60 - 80 km	> 120 minutes	> 4	0	0	
P12	44	Female	3 – 4	40 - 60 km	> 120 minutes	> 4	2	1	5
P13	54	Male	3 – 4	20 - 40 km	90 - 105 minutes	> 4	1	> 4	4
P14	31	Male	3 – 4	40 - 60 km	> 120 minutes	> 4	1	3	5
P15	27	Male	> 6	> 100 km	105 - 120 minutes	> 4	1	0	
P16	45	Male	3 – 4	40 - 60 km	75 - 90 minutes	> 4	1	2	5
P17	25	Female	3 – 4	40 - 60 km	90 – 105 minutes	1	0	0	
P18	44	Male	3 – 4	20 - 40 km	105 - 120 minutes	> 4	2	0	
P19	35	Female	5 - 6	40 - 60 km	105 - 120 minutes	> 4	0	1	3
P20	34	Female	3 – 4	40 - 60 km	> 120 minutes	> 4	2	1	4
P21	40	Male	3 – 4	40 - 60 km	> 120 minutes	> 4	1	1	4
P22	26	Male	> 6	> 100 km	105 - 120 minutes	2	3	1	5
P23	30	Male	> 6	80 - 100 km	105 - 120 minutes	> 4	0	1	4
P24	31	Male	3 – 4	20 - 40 km	75 - 90 minutes	> 4	0	3	4
P25	22	Male	> 6	80 - 100 km	90 – 105 minutes	> 4	1	0	
P26	37	Male	1 - 2	20 - 40 km	60 – 75 minutes	1	0	0	
P27	43	Female	5 - 6	60 - 80 km	> 120 minutes	> 4	0	> 4	3
P28	29	Female	3 – 4	60 - 80 km	> 120 minutes	> 4	1	> 4	5
P29	37	Male	3 – 4	40 - 60 km	75 - 90 minutes	> 4	1	3	4
P30	44	Male	3 – 4	20 - 40 km	60 – 75 minutes	> 4	0	3	
P31	20	Male	5 - 6	60 - 80 km	75 - 90 minutes	1	1	0	
P32	32	Female	> 6	> 100 km	> 120 minutes	> 4	1	> 4	4
P33	36	Female	3 – 4	20 - 40 km	75 - 90 minutes	> 4	3	> 4	7

4.2. User Experiences on User-Packaging Interaction

Figure 7 provides a general overview of the outcomes of the UPIs carrying, opening and consuming, and the overall experience ratings (scale 1-10). The corresponding table with means and standard deviations (Tabel 7)is discussed in 4.3.3. The most outstanding finding from this figure is that Sponser received lowest rating on every topic. In the next sections I will discuss the results per topic in more detail.

Figure 7: Box and Whisker UPIs and Overal Experience Results



4.2.1 Carrying

Results show that the most preferred way to carry energy gels is in pocket of sportswear (44%). Alternatively, runners use a running belt (27%) or backpack/trailvest (23%). The remaining 6% answered to carry their otherwise (attached to bottle, handed by another person).

Results indicate that package size is important for the comfort of carrying. Smaller sized energy gels tend to receive positive feedback, participant mention these are easier to carry. When packaging is large, runners try fold or squeeze packaging to make it work for the desired carrying method.

For example, after deforming the packaging, P20 could fit the Maurten gel into running shorts pocket, making it more comfortable to carry: "Flexible and mailable, so it fits well in a pocket and you don't feel it while running" – P20

While P11 could not fit the odd shaped Bye! in clothing pocket:

"I found the packaging quite large/square. Awkward size, does not fit in pocket" -P11

And P16 argued a thick package, like SiS, did not fit into clothing pocket, which results in in requiring an alternative carrying method:
"Quite big, but mostly to thick. Other SiS gels were nice and flat, more convenient for a belt." – P16

On the other hand, a small, flat and narrow package, like PowerBars', easily fits in most pocket, belt or vest, according to P29:

"The thickness is perfect, so you won't notice it when you take it with you in either pocket, vest or belt." — P29

Sharp edges, rigid materials and hard components are uncomfortable to carry. Like mentioned by P10, who struggled to find a way the hard cap of the Bye! package did not press uncomfortably against her leg:

"A small gel, but with a hard cap. Luckily it was quite flexible so I could it tug it in my pocket the right way, otherwise the cap would push against my leg." - P10

4.2.2 Opening

Most packages (88%) were opened while running. The remaining packages were opened either while walking (3%) or standing still (9%). Handling opening of the packaging was mostly done two handed (72%). Alternatively, packaging was opened using teeth (25%) or one handed (3%).

Participants indicate the importance of clear and easy opening. Furthermore number of handling actions, required force to open package,. For example, P10 describes expected way of opening the Bye! package as a positive experience.

"There is a loose cap on it, which you easily unscrews as expected. Nice small opening for eating. However, end up with loose cap in your hand." - P10

The same applies for P2, who had a positive experience opening the PowerBar gel as it was clearly indicated how to do so by use of colour:

"Easy to open. Clear how to use, the "lid" has a slightly different colour and comes off easily"- P2

On the other hand, P20 struggled opening the SiS gel. He failed to open it in the first attempt and had to use his teeth due to rigid, sturdy material:

"Difficult to open due to sturdy material. After trying with hands succeeded with teeth after two times" — P20

When opening the Sponser gel, users must perform more than one handling action to open the package. The opening is secured with tamper evidence in the form of a plastic film. The plastic film can be removed before running to enable single action operating, allowing for easy opening.

"I still had to take off a piece of plastic that was on the cap. Luckily I had already seen it before the training. furthermore, the cap opens easily. Think you know this in advance during a match. otherwise very difficult" — P15

However, results show that many participants (42%) did not notice the tamper evidence. They had to remove it while running, which appeared to be difficult, as mentioned by P12:
"The plastic was very difficult to get off the cap. when I opened the cap the gel came out already"- P12

Four participants failed to take off the plastic and were forced to open the packaging in a different way. In these four cases, the cap was twisted off:
"I couldn't get the plastic off, so I opened the whole cap. luckily it didn't spill as I didn't use as intended." — P24

4.2.1 Consuming

Results show that participant have a positive consuming experience if they empty the energy gel quickly and easily, without spilling. In addition, possibility to reseal packaging influences the consuming experience. Nine participants mentioned the resealable packaging (Bye! and Sponsor) as a reason for choosing this specific gel.

P20 argued a pleasant consuming experience, due to the possibility to consume the gel partly and finish the residual gel later:
"It was quite a lot but luckily the packaging could also be closed again so I could take the rest later" — P20 on Sponser

P19 and P21 both make a connection between the width of the opening and the consuming experience. P19 emphasizes the correct opening width of the PowerBar gel which enabled a pleasant consumption experience without spilling. In contrast to P21, who criticizes the SiS gel because it comes out of the package too easily:
"Opening not too big and not too small. This allows for easy consumption, without spilling" — P19 on PowerBar
"My hands were a bit sticky after consumption as the gel spilled out of the package, did not happen with any of the other gels" — P21 on SiS

Rigid and angular packages can cause difficulties in emptying the gel content. P28 explains it was difficult to squeeze the gel out of the packaging due to these characteristics.
"Because part of the packaging is rigid and angular, I couldn't squeeze out all the gel" — P28 on Sponser

On the other hand, P17 emphasizes the benefits of flexible packaging material, which enabled to roll and squeeze the gel out of the package.
"Easy to squeeze and roll the packaging to get gel out, partly because of the flexible material" — P17 on PowerBar

4.3. Brand Comparison

4.3.1. Prior Usage of Energy Gels

SiS (26) is by far the most familiar brand to participants prior to this research. Furthermore participants are familiar with Maurten (14),

PowerBar (13) and IsoStar (8). SiS (13) and Maurten (7) are most often listed as favourite brand. Both brands are mostly liked for their taste/structure and seem to have little negative effect on the stomach. SiS appears to have a good price-quality ratio. People differ little in their energy gel choice and tend to be loyal to a familiar brand.

4.3.2. Gel Choices

Table 5 summarizes which gels are used in which run. Bye! is the most frequent used gel (27) in the experiment. The four other gels differ little when it comes to number of uses. Most participants seemed to be interested in the different packaging strategy of the Bye! gel, ten participants confirm their choice by mentioning the divergent packaging. Most given reasoning for choosing Maurten (9) and SiS (11) is familiarity with the brand. Sponser was mostly used (9) as for the larger, resealable packaging, being suitable for longer runs. PowerBar does not seem to be chosen for any specific reason.

Table 6 shows popularity based on first and last choice. Maurten (9) appears to be the most chosen and Sponser (3) least chosen product in the first run. Besides not being used within the first run, many participants did use the Sponser gel on their last run (10) or did not use it at all (14) making the product least chosen product.

4.3.3. Comparison of User-Packaging Interactions between Brands

Table 7 summarizes the results of the rating on the UPIs carrying, opening, consuming and the overall experience. These results describe the perceived differences on the user experience per brand. The next

Table 5: Gels used during the research

Brand	Run 1	Run 2	Run 3	Run 4	Run 5	Total uses
Bye!	7	7	10	3	0	27
Maurten	9	10	1	0	1	21
PowerBar	6	5	6	4	1	22
SiS	7	6	7	1	1	22
Sponser	3	4	8	2	2	19
Total runs	32	32	32	10	5	

Table 6: Gel popularity based on order of picking

First choice		Last choice		Not used		Not used/last choice	
Maurten	9	Sponser	10	Sponser	14	Sponser	24
Bye!	7	PowerBar	9	Maurten	12	PowerBar	20
SiS	7	SiS	6	PowerBar	11	SiS	17
PowerBar	6	Bye!	6	SiS	11	Maurten	13
Sponser	3	Maurten	11	Bye!	6	Bye!	12

sections will elaborate on these findings.

4.3.2.1. Sizing and Carrying Strategy

Figure 8 shows the results of the perceived sizing of the different brands. This figure shows Maurten gel is most often perceived to be either good or small in size, only 5% of participants refer to Maurten gel as being large. Respectively 22%, 36% and 42% perceive PowerBar's, SiS's and Bye!'s products to be large. Sponser stands out in a with 68% of participant perceiving the product to be large. Table 9 shows how participants have carried certain brands of energy gels. Bye!, Maurten, PowerBar and SiS are all carried in pocket by at least half of the participants. Sponser is less frequent carried in pocket compared to the other brands. This implies that a large gel, such as Sponsers', is does not fit in pocket and runners have to opt for alternative options. On the other hand smaller gels, such as Maurten and PowerBar, are mostly worn in the sports clothing pocket.

Table 7: Results UPI Experiences

Brand	Carrying		Opening		Consuming		Overall	
	Mean	StDev	Mean	StDev	Mean	StDev	Mean	StDev
Bye!	7.38	1.42	8.62	1.12	8.12	1.61	7.27	1.37
Maurten	8.71	0.7	7.57	1.47	7.67	1.32	8.10	0.83
PowerBar	8.36	1.36	8.64	1.65	8.00	1.57	7.95	1.50
SiS	8.05	1.53	6.45	2.06	7.27	1.67	7.09	1.44
Sponser	5.83	1.79	5.8	3.17	6.89	2.60	5.21	2.35

Figure 8: Pie Charts Perceived sizing per brand

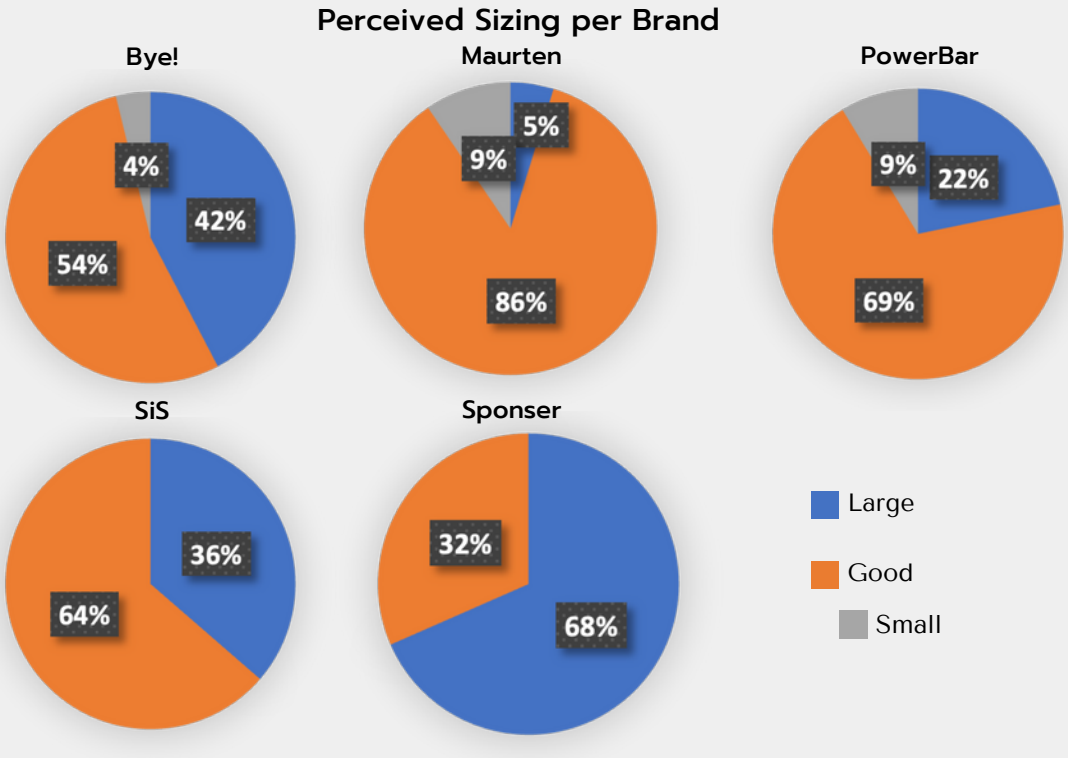
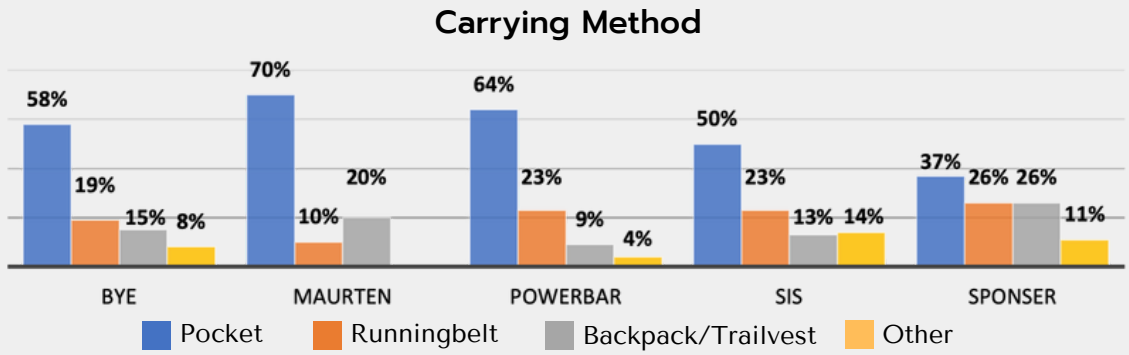


Figure 9: Bar Chart Carrying Methods per Brand



4.3.2.2. Material Characteristics

Descriptive results show that material properties play a role in carrying and consuming experience. Flexibility affects the way a gel fits into a pocket and how to squeeze or roll the gel out of the packaging. Softness of the material and sharp edges affect the comfort of wearing the energy gel. Figure 10 provides an overview of the results of the 5-point likert-scale participants used to rate the flexibility, softness and edge sharpness per brand. Accordingly, PowerBar is perceived to be the most flexible (Mean = 4.3, SD = 0.6) , has the softest material (Mean= 4.0 , SD = 0.7), and the smoothest edges (Mean = 3.4, SD = 0,9). On the other hand, Sponser scored lowest in terms of flexibility (Mean = 2.1, SD = 1.0), has the roughest material (Mean = 2.7, SD = 1.1) and sharpest edges (Mean = 1.7, SD = 0.7). Figure 10 visualizes the results on perceived material characteristics. The table with the results can be found in Appendix 5.

4.3.2.3. Opening Strategy

Figure 11 and 12 show how participants approached the opening of energy gel packages. Sponsor is the less frequently opened while running (74%) compared to any other brand. 21% of the participants stood still while opening the Sponsor gel which is more than twice as often as for any other brand. Of all energy gels used within the research, (71%) was opened with two hands. Sponser is the only gel which is opened one handed. Remarkably many participants used their teeth to open the SiS gel (50%). Also the Maurten and PowerBar gel are frequently opened with teeth which implies that these types of packaging (tear

Figure 10: Bar Chart Perceived Material Characteristics

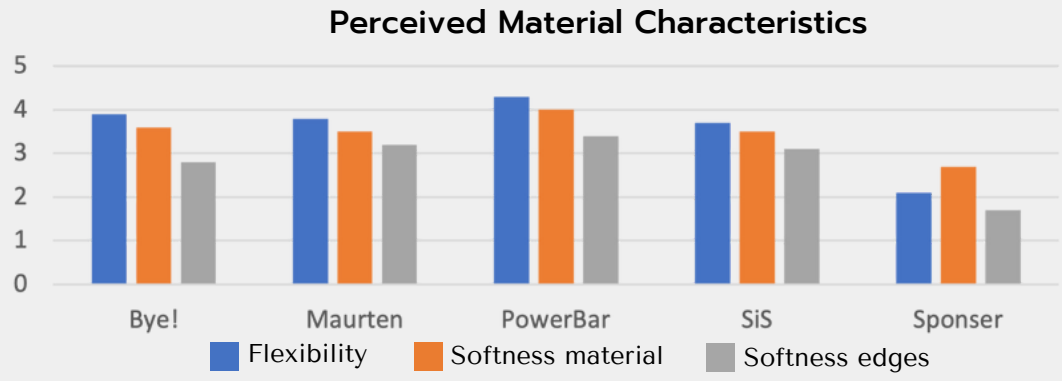


Figure 11: Bar Chart Action While Opening

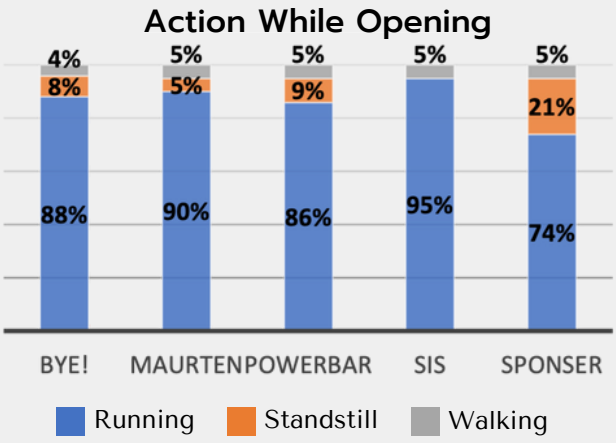


Figure 12: Bar Chart Opening Strategy

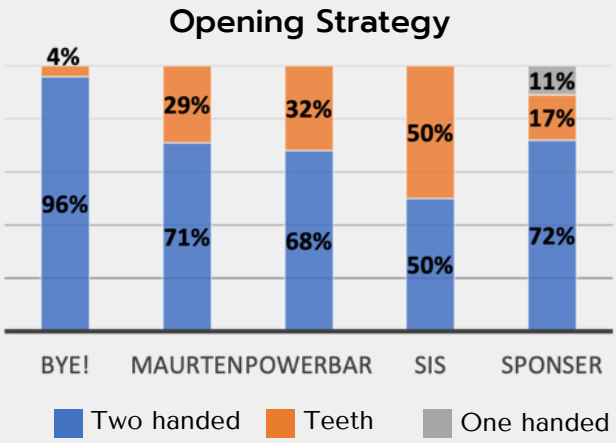


Figure 13: Bar Chart Number of Components

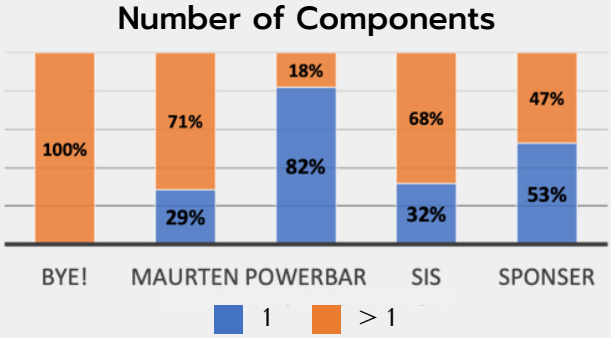
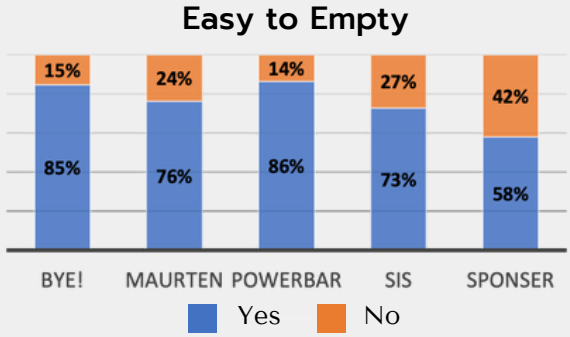


Figure 14: Bar Chart Easy to Empty



sachets) are opened with teeth more often than the packaging with a cap. Figure 13 shows the percentage of participants that ended up with either one or more than one components per brand. All users of the Bye! gel report two components after opening. PowerBar (82%) remains most often as one component, implying the anti-littering chain usually functions as expected. The other two type of tear sachets, Maurten and SiS, are clearly lacking this feature, as respectively 71% and 68% of opened packs consist of two components.

4.3.2.4. Consumption Strategy

Results do not provide remarkable differences within consumption strategies. Yet results show (Figure 14) that the Sponsor gel is most commonly not fully emptied (42%) . On the other hand, with PowerBar (14%) and Bye! (15%) it was usually possible to get all the gel out of the packaging.

4.3.3. Most and Least User-Friendly Energy Gel Packaging

Figure 15 and 16 show the results of which energy gels were perceived most- and least user friendly. PowerBar (40%) and Maurten (30%) turn out to be experienced as most user friendly by majority of the participants. Sponser (43%) and Bye! (30%) are most often classified as least user-friendly. Despite being labelled as least user-friendly, Bye! is also seen as most user friendly by a reasonable number of other participants (18%). The SiS gel is most (9%)- or least (9%) user

Figure 15: Pie Chart Most User-Friendly Gels

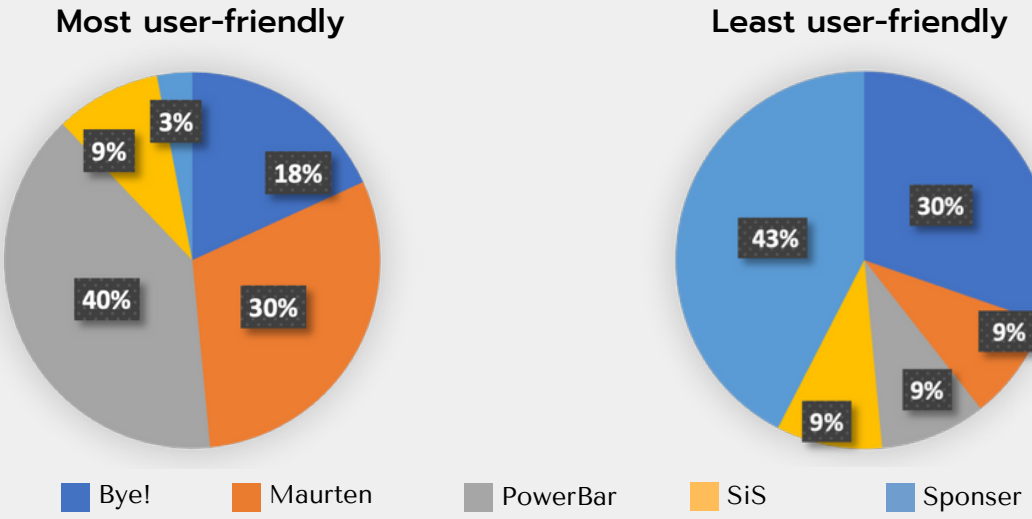
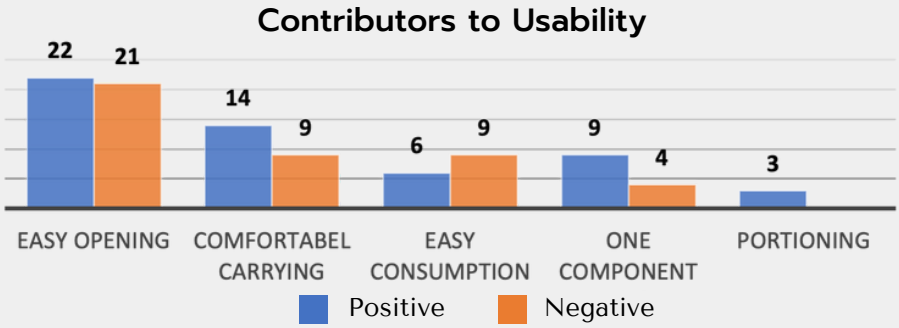


Figure 16:Pie Chart Least User-Friendly Gels

Figure 17: Bar Chart Most user-friendly



friendly for few participants. Participants mostly argued their opinion on this by having a positive or negative opening experience (n=43). Besides the other two UPIs carrying (n=23) and consuming (n=15) were mentioned to contribute to user friendliness. Furthermore, participants (n=13)mentionned only one component design to be the reason for being most or least user friendly. Additionally, participants (n=3) mentioned the ability of portioning as a result of a resealeable package to contribute to user friendliness. The disability of portioning, or not having a resealable package has not been mentioned to affect user friendliness in a negative way. Figure 17 summarizes participants reasoning for determining their most- and least favourite energy gel.

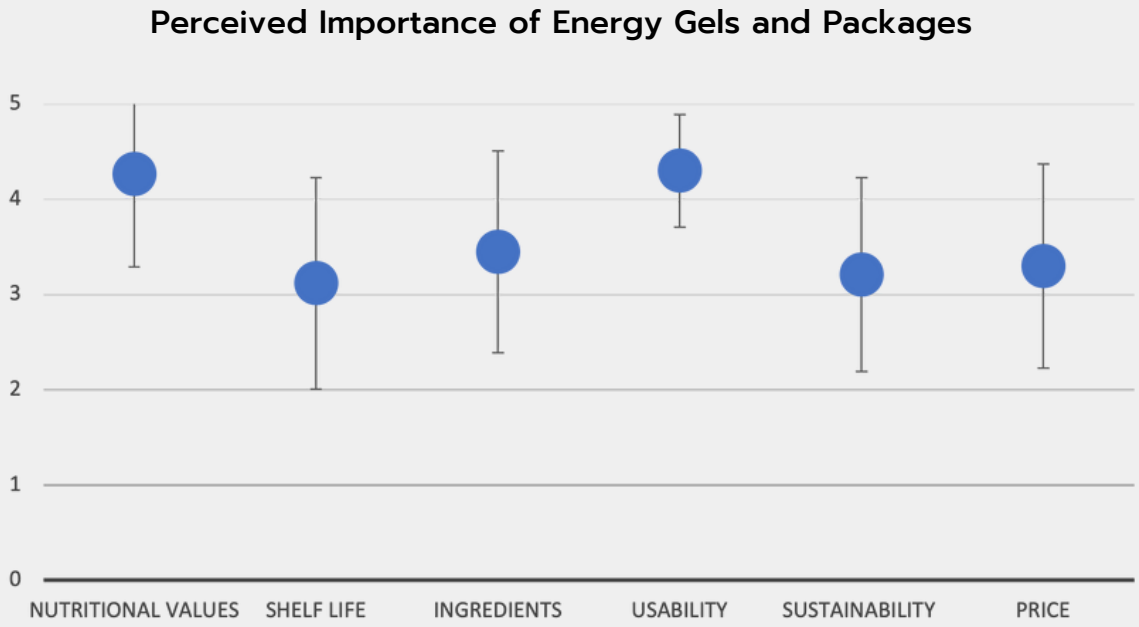
4.4. General Energy Gel Properties

Figure 18 provides a schematic overview of the rated importance (1 - not important, 5 - very important) of several energy gel properties. Table with results can be found in Appendix 6. Usability (Mean = 4.3, SD = 0.6) and nutritional values (Mean = 4.3, SD = 1.0) are considered to be most important. Additionally, participants (n=4) mentioned taste or consistency of the energy gel as an additional property of importance.

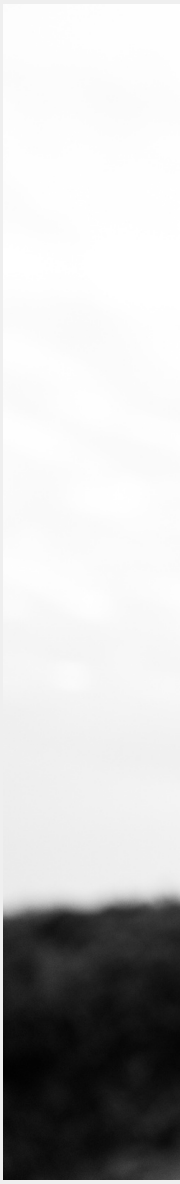
Most participants (58%) prefer an energy gel with a longer shelf life, the remaining participants (42%)

have no preference for either a longer or shorter shelf life. Likewise, 52% of participants purchases their energy gels about six months before use. Most others (45%) do so a month in advance, while few (3%) purchase the gel a week before use.

Figure 18: Box and Whisker Perceived Importance of Energy Gels and Packages



Discussion



Marathon running is performed by a wide range of people, differing in pace,ambition, capabilities and so on. As a result, the target group of energy gel users is large and varied and the opinion on user experiences diverse. Different types of runners have different and contrary needs in energy gel consumption. Therefore, there is no single answer to the question how design can address runners needs in energy gel consumption. Design certainly can enhance the user experience energy gel packaging. However, adaptation to the product and brand is key.

I will discuss the findings of this thesis in the following sections:

5.1. The Runners' Experiences of Energy Gel Packaging

5.2. Design Implications and Framework for Enhancing Use Experience of energy gel packaging

5.1. Runners' Experiences of Energy Gel Packaging

Literature showed the importance of user-packaging interaction (UPI) as a contributor in packaging experience. Achieving a positive experience depends on the match between users' capabilities, wishes and the required packaging interactions. In energy gel consumption, carrying, opening and consuming are vital and defining interactions. The user research provided valuable insights into the opinions and expectations of different types of runners regarding these interactions. The following paragraph will elaborate on the findings of these user-packaging interactions.

5.1.1. Carrying Experience

Results show that the carrying experience is determined by the comfort of carrying the energy gel. Whether the experience is perceived as comfortable depends on the relation between desired carrying strategy and size of the energy gel. Smaller sized gels are generally perceived as more comfortable as they fit in sportswear pockets. Flexibility of the packaging material can compensate for larger sized energy gel. Flexibility enables deformation of the packaging, making it easier to fit in sportswear pocket. Hence, the Bye! gel can carried in sportswear pocket (58%) despite being perceived as large (42%) due to flexibility of the material (3.9/5). On the other hand, the large (68%) and rigid (2.1/5) Sponser gel is carried alternatively (63%) as it does not fit in most pockets.

Results indicate that narrow, short and flat packages (e.g. Maurten and PowerBar) fit best in clothing pocket and running belts. Participants seem to prefer to carry gels in pocket, this method does set the strictest requirements for sizing of the packaging as portswear pockets are generally small. Runners carrying energy gels in running- belts or vest set less strict demands on dimensions. Furthermore, sharp and rigid packaging materials can cause negative carrying experience because they might caus irritation and pain. Packages with a lid (Bye! and Sponser) are often perceived to be uncomfortable to carry close to the body due to the hard components causing pressure sores.

5.1.2. Opening Experience

Number of handling actions and force required influence the users' opening experience. Comments on intuitive and quick opening strategies provoke positive opening experience. When packaging does not open as expected, participants must invest time and effort into finding out how to do so. Opening can be categorized into the more 'traditional' energy gel packaging formats, which have a tear opening (Maurten, PowerBar, SiS), and the spout-opening (Bye!, Sponser).

Guiding users by clear marking (e.g. use of colour) can provide the user

with sufficient information and therefor be beneficial for the opening experience. Bye!(8.6/10), PowerBar (8.6/10) and Maurten (7.6/10) clearly indicate where to open the packaging by use of colour. SiS (6.5/10) does so by the shape of its design. The Sponser gel fails in providing easy and intuitive opening. Although the flip cap opens intuitively, user must first remove a transparent plastic film (tamper evidence). Due to the transparent colour, the plastic was not noticed by many runners (42%), resulting in an unpleasant surprise as soon as they tried to open the flipcap. The tamper evidence is best removed before running, as it appears to be a difficult task while running. The Sponser gel was notably less often opened while running (76%) compared to other gels. In addition, opening the Sponser gel requires more than one handling action, increasing complexity of the task. All of the above contribute to Sponser having the worst opening experience (5.8/10).

Furthermore, participants confirmed the importance of preventing small loose components to emerge after opening packages. Loose components are likely to get lost and pollute nature. Design majorly, but not solely, influences whether packaging splits up. This is also dependent on the way the user handles the packaging. PowerBar received a high opening score (8.6/10), likely because of the added anti-littering chain feature. This system ensures the cap and bottom part are not separated after opening. Bye! scored equally good, while 100% of the participants indicate the packaging to consists of two parts after opening. However, the possibility to reseal the package ensures fixing the lid back onto packaging.

Finally, the different opening strategies provide interesting information. Bye! is opened with two hands by most users (96%). SiS, on the other hand, is only opened two handed by 50% of the users. Remaining 50% used their teeth to open the package. PowerBar (32%) and Maurten (29%) are also more often opened by teeth. Opening packages using teeth is not recommended due to the potential for damage to the teeth. So why do users choose to do so anyway? SiS, PowerBar and Maurten have one common denominator, all three packages are opened by tearing. Likely, particpants used two hands in their first attempt to open package, but when it fails to open (too little grip), users might switch to using teeth as this might prove more grip. When assuming the use of teeth is a last resort, the SiS gel must be more difficult to open than Maurten and PowerBar, which is in line with SiS's lower opening score (6.5/10).

5.1.3. Consuming Experience

Results show the consuming experience is mainly determined by the comfort of consuming and the ease of emptying the packing.

Design influences these points with the type of opening, shape of the design and material properties.

Packages in this research have two type of opening (tear or spout opening). The different types of openings may affect the user experience, but do not seem to do so in either a positive or negative way. The tear and spout opening provide a different 'mouth-feel', but participants do not show a strong preference in this regard. Furthermore, spout openings provide possibility to reseal a packaging. Resealable packages enables partial consumption, which might be preferred by some runners. Although the positive feedback on resealable packages, non-resealable gels do not seem to be less popular for not providing this feature.

Contrary to type of opening, the width of the opening is of great importance for consumption experience. Again, a wide opening does not seem to be preferred over a narrow one. However, required width is dependent on the structure of the gel. The opening should not be too big or too small. A thicker gel is more difficult to get out of the packaging and requires a wider opening to provide effortless gel consumption. On the other hand, a thinner gel can come out very easily, and therefore needs a smaller opening to prevent spillage.

The Sponser gel received the lowest score on consuming experience (6.9), being the only one rated below seven. This low score can be explained by the following points. A package that is angular in shape appears to be more difficult to empty, as the gel cannot 'find' its way to the opening. Furthermore, a sturdy material hinders the emptying because it is difficult to squeeze the gel out of the packaging.

5.1.4. Other Experience Influencing Factors

5.1.4.1. Individual User Preferences

The target group of energy gel users appears to be broad and varied, according to the results of the research. Participants regularly contradict each other with comments such as: "I like the Bye! twist cap, smooth opening and nice way to consume the gel" - P4 versus "I found the twist cap inconvenient, both for opening and carrying" – P3. Or when looking at perception of size, one might say the PowerBar package is large, while someone else argues the it is too small.. The same applies to opening: runners prefer resealable packages with cap while others prefer the ease of tear sachets. User preference mostly depends on ways of usage. For example, participants carrying energy gels in a pocket opt for smaller sized gel then those who carry a belt or trail vest. Runners who have time-related goals are most likely to be focused on efficiency. Those who aim to have fun running or perform exercise to stay healthy might be more focused

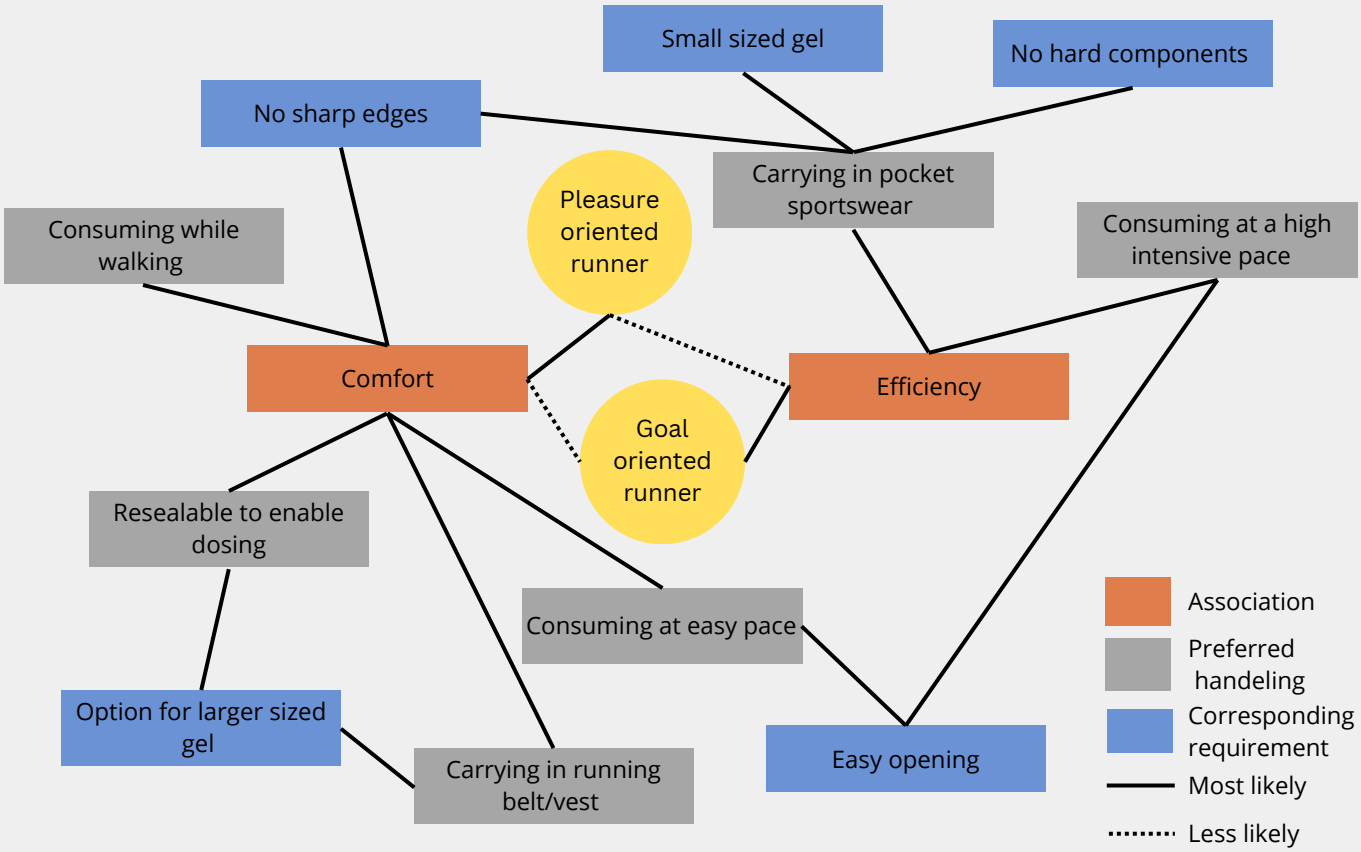
on comfort and ease of use. These different user goals result in different needs, wishes. Due to this diversity, one package cannot provide all runners with the ideal experience. Therefore, brands should choose a target group consisting of users who have similar needs and wishes. When brands apply a clear strategy and target the right users, they can enhance the user experience within this specific group.

5.1.4.2. Preferences Based on User Characteristics

Although the use preferences are quite diverse, results of the research show overlapping preferences within user types. User types could be differentiated by distinguishing between running goals and ambitions. Runners with high (competitive) ambitions and time-related goals are generally more focused on efficiency. On the other hand, runners who are less competitive, exercise to have fun or stay healthy have a greater need for comfort. Although this might not be the holy grail for classifying users, it can function as starting point to specify a target group.

To match the preferences of different user types, I have mapped some associations that emerged from the research, see figure 19. The associations concern runners' goals and ambitions, their need for efficiency versus comfort and corresponding preferences. In addition, I created some examples on brand personas derived from these associations (Appendix 7) . These could supply some background on typical users and can be used to approach a specific target group.

Figure 19: Association web runner types



5.1.4.3. Influence of Brand Image

Meanwhile, we know the user experience of energy gel packaging depends on the match between various factors such as the UPIs, user type (goal/pleasure oriented) and energy gel product characteristics (consistency, volume). Experience is also influenced by users' opinion on properties such as taste, ingredients and nutritional value. Unlike user characteristics and brand image, these properties are difficult to adjust according to user preferences. Runners' opinion on this is varied but also random making it difficult to group users accordingly. Therefor I would suggest remaining gel product characteristics as is, and try to improve the user experience through packaging design. The brands influence on user experience lies in designing a packaging matching user preferences, UPI's and gel characteristics.

5.2. Design Implications and Framework for Enhancing User Experience of Energy Gel Packages

With this thesis, I gained valuable insights on (marathon) runners energy gel consumption strategies and their preferences upon energy gel packaging. This information is can be used to enhance user experience of energy gel packaging. Despite the major differences between brands and user types, I aim to enhance the experience of different type of energy gel packages. Therefor, I have opted for a widely applicable approach. I did so by drawing up design generic implications, which needs to be specified within specific application. To support this approach, I also developed a framework which can be used to specify the implications. In the following sections I will introduce the implications, the framework and will elaborate on how to use these tools.

5.2.1. Generic Design Implications

Beside different user preferences, the literature, market and user research also identified overlapping user needs. I used these to define generic design implications to enhancing user experience of energy gel packages. The implications can be used to aid future design of any type of energy gel packaging. The implications I defined are:

1. Consider Target Users' Goals in using Energy Gel
2. Enable Comfortable Carrying
3. Design Easy and Intuitive Opening
4. Provide Convenient and Clean Gel Consumption.

In the following lines I will elaborate in the implications, explain their relevance and describe how the implication can be achieved in future design.

Consider Target Users' Goals in using Energy Gels

Different type of runners have different goals and ambitions, which makes they have different expectations of energy gel (packages). In order to facilitate a positive user experience, one should be aware of the targets users' goals so future design can address corresponding needs. These considerations are important to apply the following implications accordingly. Several considerations I would to keep in mind are:

- Consider the preferred carrying strategy
- Consider whether there is a need for partial consumption
- Consider users activity while using the energy gel
- Consider how fatigued the user may be when using the energy gel

Enable Comfortable Carrying

- Realize a design small enough to carry while running
- Flexibility of the material enables the user to fold the energy gel packaging in desired size and proportion
- Narrow elongated shapes seem to suit most sportswear pockets and running belts.
- Avoid shard edges and hard angular components to not cause irritation or pain

Runners options for carrying products are limited, options are to carry the gel on the body in sportswear pocket or running belt. Alternatively the runner carries a running vest to transport the energy gel.

Design Easy and Intuitive Opening

Energy gel packages are often opened while running, making is a secondary task. The design should provoke intuitive opening with a minimal effort.

- Provide design with clear user instructions
- Enable opening within one single operating action
- Ensure opening requires minimal force
- Enable opening task can be executed with two hands

Provide Convenient and Clean Gel Consumption

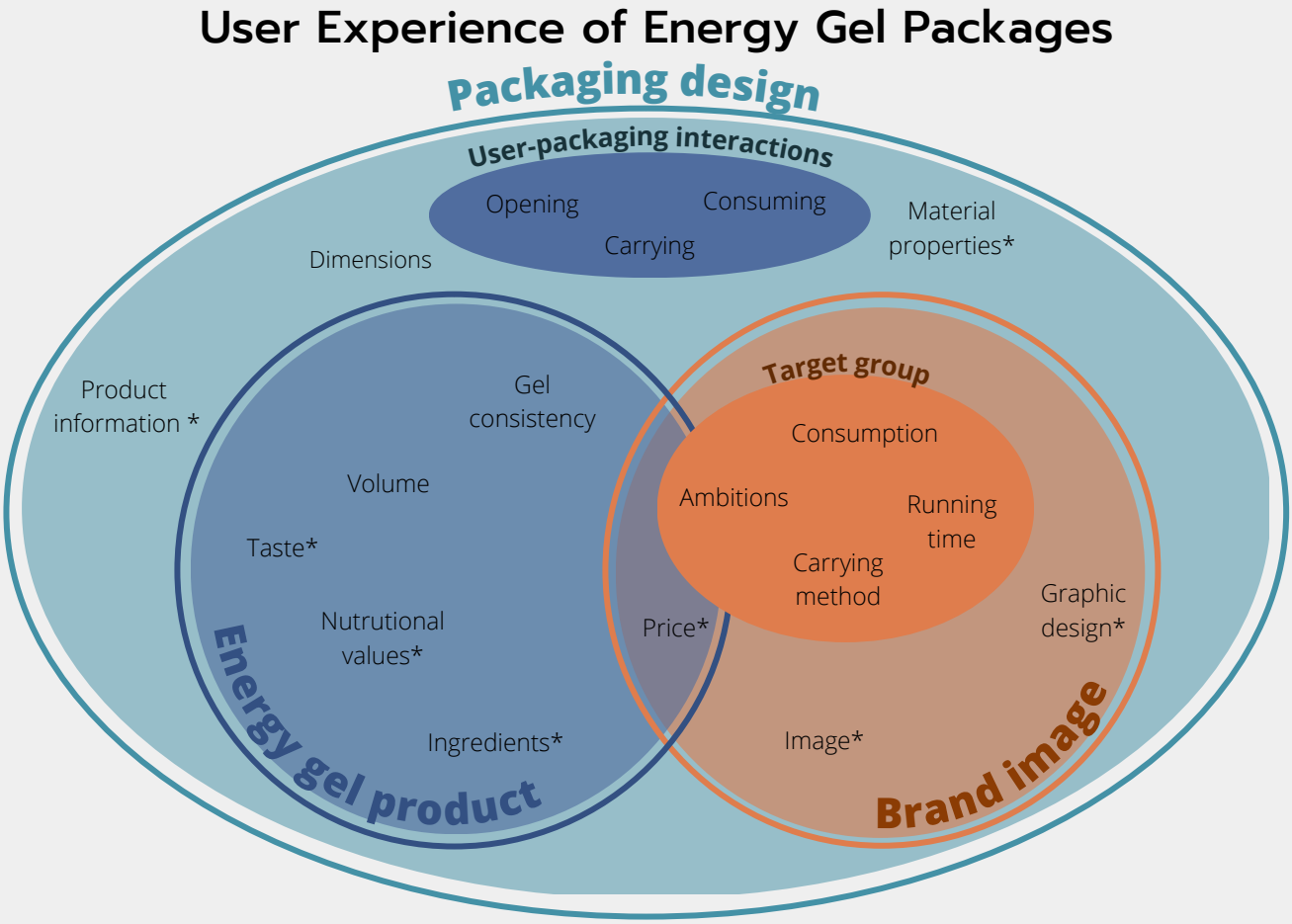
- Realize a design matching the characteristics of the energy gel (thicker gels require wider opening, thinner gels require smaller opening)
- Avoid nooks and crevices to enable entire content to come out of the package
- Flexibility of the material provides the user with control over the outflow of the energy gel by folding and rolling

Just as for opening of a gel package, consuming the energy gel is also often performed while running. Running increases respiration which may hinder consumption of any substances. The design should ensure smooth outflow of the energy gel product from the packaging without spilling the product.

5.2.2. Framework to Explain the User Experience of Energy Gel Packaging

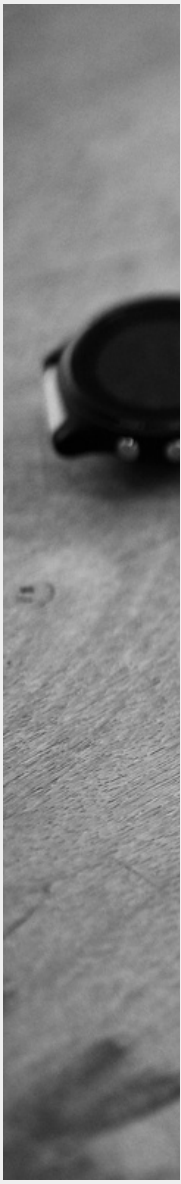
We know designing an energy gel package requires a sufficient amount information on the context of use. Two important variables which are known to determine this context are the user and the properties of the energy gel product. To better explain these variables and their relation to the user experience of energy gel packaging I have developed the following framework. Initially, figure 2 was used to explain the user experience of energy packages. In this figure I defined three dimensions (Energy Gel Product, Packaging Design, and Brand Image) to determine the energy gel packaging experience. Although this seems to be true, it is vital to distinguish the way the dimensions influence the user experience. Therefore, I revised and refined it into a new framework (figure 20). In this framework, Packaging Design is the overarching dimension, which is influenced by the other two dimensions, the Energy Gel Product and Brand image. The framework indicates which factors influence the user experience of energy gel packaging per dimension. These factors arose from this research. More factors may be added as research is conducted on this topic. The framework aims to provide structure when deciding on a strategy to improve the user experience of a specific packaging and support future designers with the implementation of the design implications.

Figure 20: Framework for User Experience of Energy Gel Packages



* Dimensions which do influence packaging design but are outside the scope of this assignment

Application of the tools to Maurten GEL 100



Now that I introduced the Design implications and the framework I will explain what these results mean in regard to the Maurten GEL100. In this section I aim to provide Maurten with a set of design recommendations on how to enhance the user experience of the Maurten GEL100 through packaging design. I will do so by describing the variables which apply to the Maurten GEL100. Next, I will apply the design implication come up with design recommendations. The framework is used to support this process.


Hydrogel Sports Fuel
GEL
100
INGREDIENTS: WATER, GLUCOSE, FRUCTOSE, CALCIUM CARBONATE, GLUCONIC ACID, SODIUM ALGINATE
40G
MAURTEN


US Nutrition Facts Servings: 1, Serv.size: 1 sachet (40g), Amount per serving: Calories 100, Total Fat 0g (0% DV), Sat. Fat 0g (0% DV), Trans Fat 0g, Cholest. 0mg (0% DV), Sodium 34mg (2% DV), Total Carb. 25g (9% DV), Fiber 0g (0% DV), Total Sugars 25g (incl. 25g Added Sugars, 50% DV), Protein 0g, Vit. D (0% DV), Calcium 21,6 mg (2% DV), Iron (0% DV), Potas. (0% DV).
UK/US: ENERGY GEL. INGREDIENTS: WATER, GLUCOSE, FRUCTOSE, CALCIUM CARBONATE, GLUCONIC ACID, SODIUM ALGINATE. PACKAGED IN A PROTECTIVE ATMOSPHERE.
SE: ENERGIGEL. INGREDIENSER: VATTEN, GLUKOS, FRUKTOS, KALCIUMKARBONAT, GLUKONSYRA, NATRIUMALGINAT. FÖRPACKAD I EN SKYDDANDE ATMOSFÄR.
DE: ENERGIEGEL. INHALTSSTOFFE: WASSER, GLUKOSE, FRUKTOSE, KALCIUMCARBONAT, GLUCONSÄURE, NATRIUMALGINAT. UNTER SCHUTZATMOSPHÄRE VERPACKT.
NL: ENERGIE GEL. INGREDIENTEN: WATER, GLUCOSE, FRUKTOSE, CALCIUMCARBONAAT, GLUCONZUUR, NATRIUM-ALGINAAT. VERPACKT ONDER BESCHERMENDE ATMOSFEER.
ES: GEL ENERGETICO. INGREDIENTES: AGUA, GLUCOSA, FRUCTOSA, CARBONATO DE CALSIO, ALGINATO DE SODIO. ENVASADO EN ATMOSFERA PROTECTORA.
UK / SE / DE / NL / ES
NET WEIGHT/NETTOVIKT/NETTOGEWICHT/PESONETTO: 40G
NUTRITIONAL VALUE/NÄRINGSVÄRDE PER/PER SERVING
NÄHRWERTANGABEN/VOEDINGSWAARDE
VALOR NUTRITIVO 100G 40 G
ENERGY/ENERGI/ENERGIE/ENERGIE 1063KJ 425KJ
ENERGIA 250KCAL 100KCAL
FAT/FETT/FETT/VET/GRASA 0G 0G
-OF WHICH SATURATES/VARAV MÄTTAT FETT/GESÄTTIGTE FETTSÄUREN/WAARVAN VERZADIGDVET/DE LAS CUALES SATURADAS 0G 0G
CARBOHYDRATES/KOLHYDRATER/ KOHLENHYDRATE/KOOLHYDRATEN/ CARBOHIDRATOS 62,5G 25G
-OF WHICH SUGAR/VARAV SOCKER/DAVON ZUCKER/WAARVAN SUIKERS/ DE LOS CUALES AZUCARES 62,5G 25G
PROTEIN/PROTEIN/PROTEIN/EIWEISS/PROTEINA 0G 0G
SALT/SALT/SALZ/ZOUT/SAL 212,5MG 85MG
7316 0717
MADE IN/PRODUCERAT I/PRODUZIERT IN/GEPRODUCEERD IN/ PRODUCIDO EN: DENMARK. MAURTEN AB WWW.MAURTEN.COM
BEST BEFORE/BAST FÖRE/MINDESTENS HALTBAR BIS/MINSTE HOUDBAART/CONSUMIR PREFERENTEMENTE ANTES DEL:

6.1. Brand Image

Maurten is an example of a brand that already has a clear brand identity. This is important, as setting a strong and distinctive brand identity will attracted a specific group of users who feel attracted to the brand and are likely to have the same values, expectations and needs. As Maurten has already clearly defined their strategy, it only needs to be applied to the model in an adequate way. To clearly communicate Maurten's brand values, I have represented them in the Kapferer Brand Identity Prims, which can be found in figure 21. The Identity Prism identifies a brand through six characteristics: physique, personality, relationship, culture, reflection and self-image (Pirvani & Farhana, 2009).

Figure 21: Brand Identity Prism Maurten

6.1.1. Target Group

Now that Maurten's brand identity is well defined, it can be used to select the target group. Maurten explicitly states to primarily focus on people who see themselves as athletes. These people always aim for the best results. From figure 19, we know that these users are mainly focussed on efficiency and have correspond needs.

6.2. Energy Gel Product

Maurten distinguish itself from competitors with the hydrogel, which is like a 'real' gel versus a carbohydrate rich syrup. The product characterizes itself by its thick consistency. To optimally support the athlete in his carbohydrate needs, Maurten prescribes consuming 100 kcal at a time, which equals 40 grams of GEL.

6.3. Design Implications for the Maurten GEL100

Input from the brand image dimension and energy gel product will now be used to specify the generic design implication so that they match the specifications of theMaurten GEL100. I specified the implication by converting the input from the framework into scenario-based thinking to consider target users goals in using the energy gel

Consider Target Users' Goals in using Energy Gels

The Maurten GEL100 user is an ambitious, goal-oriented runner. Therefore, the user will likely carry the gel in the pocket of his sportswear as this is the most efficient strategy which does not require extra (heavy) accessories. The runner will perform the opening and consumption task while running, possibly under (extreme) fatigue and with increased breathing. The user does not want to lose any time in opening the energy gel package.

- Enable carrying the gel in sportswear pocket
- Focus on efficiency
- Enable opening and consuming while running (at high intensity)

Enable Comfortable Carrying

When carrying packaging in sportswear, sizing is an important and crucial requirement. Moreover, it is vital to note that the package is worn close to the body. To provide users a comfortable carrying experience I would advise the following recommendations:

- Try to realize the smallest possible design, preferably narrow and elongated, to enable user to comfortably carry the gel in pocket of sportswear clothing
- Opt for a flexible material, to enable the user to deform the gel (packaging). This will increase the chance that the energy gel will fit into the desired pockets.
- Opt for a soft, smooth material with no sharp edges to ensure the packaging does not irritate the users' skin as he is likely to carry the gel package close to the body.
- Avoid hard components in the packaging to avoid irritant or cause pressure marks as the user is likely to carry the gel package close to the body. Therefore, I would advise not to use a twist or flip cap as these are known for their hard components.

Design Easy and Intuitive Opening

To enable the Maurten GEL100 user to open packaging under (extreme) fatigue, opening of the packaging should be quick, intuitive and effortless. To fulfil the users' needs I would suggest the following recommendations:

- Try to realize a design which the user knows how to open within a glance, leave no room for doubt. This can be achieved by visual cues such as colour use, clear mark indication or specific shaped design.
- Try to realize a design which can be opened within one single operating action, requiring minimal force to enable the runner to execute the task quickly under (extreme) fatigue. This can be achieved by packaging with a notch for the start of the tear line (if choosing a traditional energy gel packaging design and the choice of a material that is easy to manipulate.
- Try to realize a design which can be opened by using just hands to avoid the use of mouth and teeth. This can be achieved by a design with a firm grip and little required force to open. Opening packages with teeth causes risk of damaging the teeth. In addition, as the runner is likely to open the package under (extreme) fatigue, chances are (s)he will be out of breath. Opening the package by mouth may further interfere with breathing. As such, opening energy gels with the mouth should be avoided.

Provide Convenient and Clean Gel Consumption

When carrying packaging in sportswear is an important requirement, sizing of the product is crucial. Besides, it is vital to keep in mind the pack is worn close to the body. To provide the user with a comfortable carrying experience I would advise the next recommendations:

- Opt for a wider opening width to ensure minimal effort removing the gel from the packaging.
- Avoid a too large opening to prevent spillage.
- Opt for a flexible material to provides the user with control over the outflow of the energy gel by folding and rolling.
- Try to realize a design without nooks and crevices to allow the user to fully consume the content with no gel remaining in the packaging

Conclusions

This research looked into the needs and wishes of (marathon) runners regarding the use of energy gel packages. The aim was to provide implications on how to improve the user experience of these packages, specifically for Maurten.

7.1. Findings and Answers to the Research Questions

Before answering the research questions, I would like to emphasize the major finding of this thesis: there is no one-lined solution for the most user friendly energy gel packaging. This means there is also not a straightforward answer to the research question. Therefore, I will first briefly address the sub-questions.

1. Who are the user of energy gels and how do these users use energy gels?

The target group of energy gel users is large and broad. Running is an accessible sport and is practiced by many different types of people, who differ in many aspects like ambition, degree of physical training, duration of average (marathon) effort and so on. These differences result in different ways of using the product and divergent preferences in using energy gel packages. For example, there is a variety of ways to carry the gel (e.g. sportswear pocket, running belt/vest), the gel can be opened while running or while taking a break (walking/standstill), and can be consumed in one go or in portions. However, user preferences are not completely random but seem to overlap within different groups. I propose to distinguish groups between ambitious time-oriented runners, aiming for efficient energy gel usage, and runners who run for fun and to stay healthy, opting for more comfort.

2. What are the current energy gel options on the market?

Due to the variability in users, there is also a wide range of energy gel products available on the market. Energy gels differ in gel product characteristics (e.g. consistency, volume, kcal's), brand image (e.g. image, graphic design, pricing) and packaging design (e.g. shape, dimensions, materials).

3. How do the marathon runners experience current sports nutrition packages during running?

There are several ways of interacting which affect the experience of energy gel packages. This thesis showed the importance of comfortable carrying, easy and intuitive opening, and smooth consumption during running experience. The interpretation of these interactions and how they influence runners' experience is mainly dependent on users' capabilities, preferences and the energy gel product characteristics.

4. What are the pain and improvement points in current energy gel packages?

This thesis revealed several points which generally evoke negative experiences, and can therefore serve as a point of improvement: oversized packaging, sharp edges (despite the

softness of the gel itself), hard/sturdy materials, indistinctive/difficult opening, spillage of the gel and loose components after use.

5. How can the points of improvement be translated to design guidelines?

Due to the varying demands of users and properties of the energy gel products, strategies to improving these points may differs per brand. Therefore there is no one-lined solution for the perfect energy gel packaging. The priorly mentioned points for improvement have been incorporated into generic design implications which can be used to enhance user experience of energy gel packages. However, the following implication need to be specified to match specific users expectations and energy gel product characteristics:

1. Enable comfortable carrying will ensure users can transport the gel in the desired way without causing sores or pain.

2. Designing an easy and intuitive opening experience will enables the user to quickly open the gel so that he can keep running and does not have to waste time.

3. Convenient and clean gel consumption will provide an effortless supply of energy and enables the user to keep running without slowing down.

The answers to these questions collectively contribute to the answer of the research question:

How can design address (marathon) runners in needs for consuming energy gels?

Design can enhance the user experience of energy gel packages. When aiming to do so, one should consider various factors which may affect this experience. A selection of factors I found to influence this experience are carrying strategy, opening strategy, way of consumption, volume of the gel, graphic design and nutritional value. More factors can be found in the framework I propose, and I am also convinced that there are even more which I did not consider or find. I have divided the factors into three dimensions that influence the experience of the packaging, these formed the core of the "Framework for Explaining User Experience of Energy Gel Packages". In the framework, I proposed that packaging design is the overarching dimension, which is influenced and controlled by the energy gel product and the brand image dimension. By classifying users into target groups with similar preferences, a brand can respond by meeting the expectations and wishes of this group. The packaging design should focus on enabling desired carrying strategy, providing an easy and intuitive opening and smooth consumption of the content. This can be achieved by specifying design implications using the suggested framework.

7.2. Limitations and Future Research

This thesis has several limitations. For example, observations could have strengthened the findings on the use of energy gel packages. Observations are likely to provide additional, accurate information. Specially as participants may be not aware of certain inconveniences or forget to report information (ten Klooster et al., 2020). Additionally, results may be influenced by participants being biased as they might be familiar with, or prefer certain brands of energy gels. Finally, there may also be an information bias from the researcher side. As I am very familiar within the world of running, obtaining information is rather easy but not always structured. This familiarity can be perceived as bias by some researchers. However, this could also be an opportunity, as I am very familiar with runners' habits and ways of living. Together, these limitations should be taken into account while referring to the results of this thesis.

Future research can broaden the application of the framework and design implications. For example, as marathon running is not only a great physical effort, but also a mental challenge, it would be interesting to investigate the psychological effects of carbohydrate fuelling in marathon running. This may provide novel insights on how (packaging) design can support carbohydrate fuelling to enhance marathon experience and possibly performance.

In addition, there are a number of relevant packaging design topics that have not been considered for this study, but are relevant for future design. Given the current developments and social relevance, further research into sustainability is vital. Especially considering that energy gel packaging still a single use plastic products, which may be fully banned in the future (Dutch Government, n.d.). Moreover, it would be interesting to investigate runners' opinions and perceptions on sustainability of energy gel packaging. Perceived sustainability can be different from scientifically proven sustainability. For example, the trade-off between materials and protecting the gel product appears to be an interesting and challenging sustainability issue which might be perceived differently from a user and designer perspective. Future research could compare perceived sustainability with a life cycle analysis of an energy gel packages to learn more about this topic. Furthermore, relevant packaging topics such as manufacturability and logistics can be implemented to improve the overall packaging design.

7.3. Reflection

Writing a master thesis has been a long but rewarding process. I wrote the thesis during a period in which my life changed quite a bit. I would say I grew from being a master student Industrial Design Engineering who was running at sub-national level, to being an international athlete who was also writing an Industrial Design Engineering master thesis. This is something that strongly influenced the process and content of my master assignment. I am proud of how I have gone through this transition, happy to now finish this thesis, (hopefully) graduate and be able to call myself a professional athlete and Industrial Design Engineer. I learned a lot through writing this thesis, both in academic knowledge, as about myself. I would like to describe several points to reflect upon this thesis.

To start off, as I also mentioned in the limitations, my life as an athlete has had some influence on the content of the assignment. My involvement in the world of sports could be seen as biased by some researchers. I guess they are right to some extent. For example, it is easy to see my own interpretation of things as the truth, and because of the knowledge I have I might have made some assumptions others would not have made. Nevertheless, I believe that my experience also had its perks. I have a feeling for the sport, I know a lot of people in the running community and have a lot of experience. This made it easy for me to gather information and I was making continuous observations through what I saw happen around me. This provided me with a lot of information others might never have found. However, this natural way of 'data collection' also resulted in a slightly unstructured approach. Therefore, I can imagine that in some cases it can come across as random and unsubstantiated.

Secondly, starting this assignment in September 2021 I made a planning in which I would go to various research phases in about nine months time. Meanwhile, 14 months later, I am now (finally) writing the last sections of this thesis. I could justify this delay in many ways: altitude training in Kenya, competition in France, camp in Portugal, competition in London, qualification for the European championships and so on... Every time I came back from a trip, I found it difficult to shift my focus bakc from being an athlete to a student again. But the reason of delay doesn't matter that much. However, I do think it is important to evaluate the influence of this situation. The duration of this master assignment had advantages and disadvantages. An advantage was that I had the flexibility to set up the user research broad, I was on a training camp while the runners conducted the research, so I had the flexibility to give them plenty of time. However,

when I came back, the number of responses were slightly disappointing making me decide to extend the study for two weeks. On the other hand, it also had disadvantages. One of the personal traits resulting in my top sports career is perfectionism. Perfectionism is not necessarily a bad trait, but for this thesis I think it resulted in many hours of time spent, which in some cases might have been better to spent otherwise. If I had made a stricter planning, I would not have had time to do so and would have worked in a more efficient way. In addition, the result of the long process of working on this master assignment was that it became too large and complex in my head. It was only in the last few months of writing this thesis that I had a clear vision of where I wanted to go and how I wanted to go about it. I believe that if I had had these insights earlier, this could have positively influenced the result of the thesis. And yet, with all the time I have had, finishing always feels stressful in the end. For me, an assignment like this never feels finished, but it's time to wrap it up and move on!

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Appendix


Hydrogel Sports Fuel
GEL
100
MAURTEN

Appendix 1

Ethical Approval

UNIVERSITY OF TWENTE.

Mrs. S. Jonkman

FROM	DATE	PAGE
M.C. Kamp	15 December 2021	1 of 1
T 053-4892547	OUR REFERENCE	
m.c.kamp@utwente.nl	ET/A.28.19529	
SUBJECT	YOUR REFERENCE	
LETTER OF APPROVAL		

Dear Mrs. Jonkman,

The Natural Sciences and Engineering Sciences Ethics committee has reviewed your submission for "How can product design address pragmatic and hedonic needs of marathon runners in ergogenic aid consumption?" and based on the submitted material has formulated a positive advice for the dean.

On the basis of this advice I approve your application and leave the responsible execution of this project in your hands trusting that you will conduct this research in a manner worthy of the University of Twente.

The request has been registered under **reference number 2021.115**

I wish you good luck with your research.

Yours sincerely,

Prof.dr.ir. H.F.J.M. Koopman
Dean faculty of Engineering Technology
University of Twente

The approval given for your research project is valid, taken into account the restrictions that you have to comply with the current RESTRICTIONS ON SOCIAL AND PHYSICAL INTERACTION set by the government regarding the COVID19 outbreak. Your study intends to make use of methods requiring social and physical interaction. This poses risks for both participants and researchers, which have to be taken into account. This may imply that you have to find alternative ways to collect data or to delay the start of your study until the restrictions have been adjusted or lifted. If adjustments lead to substantive changes in the design of your study (excluded: digital/online means to get in contact with your participants), I advise you to send the changes to the Ethics Committee stating your reference number.
Please consult the standing guidelines of the UT and national authorities on research and educational activities www.utwente.nl/corona

P.O. Box 217, 7500 AE
Enschede
The Netherlands
www.utwente.nl

Appendix 2

Image Energy Gels for Gel Analysis

Appendix 3

Tabel Energy Gel and Packaging Properties Gel Analysis

Brand	Gel	Prijs	Volume	Weight	Dimensions (mm)	Depth (mm)	Kcal per serving	Kcal per 100 gr	Package shape	Way of opening	Reseal able	Anti littering	Look	Flexibility	Colour	Flavour	caffeine
3 Action	3 Action Energy Gel	€ 1,60		34 gr	130*35*10	1,00	100	294	Sachet	Tearing	2-way No	No	Shiny	Stiff	Yellow	Strawberry	No
Born	Super Liquid Gel	€ 2,25	55 ml		15*45*10	1,00	86	156	Sachet	Tearing	2-way No	No	Shiny	Stiff	Black	Mint/Lime	No
Bye!	Bye Sport Gel	€ 2,15	60 ml		160*45*10	1,00	88	146	Sachet	Tearing	2-way No	No	Shiny	Stiff	White	Mango Passionfruit	No
Bye!	Bye! Pro Isotonic Gel	€ 2,45	48 ml	60 gr	140*65*10	1,00	102	170	Standup -pouch	Twist cap	Yes	No	Shiny	Flexible	White	Forest fruits	No
Concap	Concap Carbo Gel +	€ 1,50	60 ml		170*45*5	0,50	92	153	Sachet	Tearing	2-way No	No	Shiny	Flexible	Black	Blackcurrant	Yes
Concap	Concap Energy Gel	€ 1,79		40 gr	125*65*2	0,20	104	260	Standup -pouch	Tearing	2-way No	No	Shiny	Flexible	Green	Not mentioned	No
Etixx	Etixx Energy Gel - Nutritional	€ 2,35		38 gr	140*35*10	1,00	96	253	Sachet	Tearing	2-way No	No	Shiny	Stiff	White	Cola	No
Etixx	Etixx Energy Gel - Ginseng & Guarana	€ 2,35		50 gr	160*45*10	1,00	120	241	Sachet	Tearing	2-way No	No	Shiny	Stiff	White	Maracuja	Yes
Gold Nutrition	Gold Nutrition Extreme Gel	€ 1,75		40 gr	125*75*20	0,20	100	250	Standup -pouch	Tearing	2-way No	No	Mat	Flexible	Red	Strawberry	No
Lightning Endurance	Ligtning Endurance Energy Gel Squeezed Fruit Juice	€ 1,09	60 ml		160*40*10	1,00	88	147	Sachet	Tearing	2-way No	No	Shiny	Stiff	Black/or ange	Orange	No
Maurten	Maurten Gel 100	€ 3,45		40 gr	130*40*10	1,00	100	250	Sachet	Tearing	1-way No	No	Mat	Semi-flexible	Black	Not mentioned	No
Maxim	Maxim Energy Gel Drink	€ 1,95	60 ml		160*40*10	1,00	110	184	Sachet	Tearing	1-way No	Yes	Semi - shiny	Semi-flexible	Blue	Citrus	No
Named Sport	Named Sport Sport Gel	€ 1,60	25 ml		130*55*5	0,50	69	278	Sachet	Tearing	2-way No	No	Mat	Semi-flexible	Orange	Tropical flavour	No
Named Sport	Named Sport Total Energy Gel	€ 2,30	40 ml	51 gr	135*65*15	1,50	119	298	Standup -pouch	Tearing	2-way No	No	Mat	Stiff	Orange	Lemon	Yes
PowerBar	PowerBar Fruit Gel	€ 2,19	67 ml	40 gr	185*50*5	0,50	102	153	Sachet	Tearing	1-way No	Yes	Semi-shiny	Flexible	Black	Orange	No
SiS	SiS Go Isotonic Gel	€ 1,99	60 ml		160*40*15	1,50	87	144	Sachet	Tearing	2-way No	No	Shiny	Stiff	Silver	Orange	No
Sis	SiS Beta Fuel	€ 2,79	60 ml		160*40*16	1,50	158	264	Sachet	Tearing	2-way No	No	Semi-shiny	Stiff	Black	Orange	No
Sponser	Sponser Liquid Energy Pure	€ 2,65	70 ml		140*45*25	25,00	200	284	Tube	Flip cap	Yes	Yes	Semi-shiny	Stiff	White	Not Mentioned	No
Squeezy	Squeezy Energy Gel	€ 1,20		33 gr	120*50*2	0,20	86	260	Sachet	Tearing	2-way No	No	Shiny	Stiff	Silver	Salty caramel	No
WCUP	WCUP Energy Gel	€ 1,85	40 ml		140*40*10	1,00	120	299	Sachet	Tearing	2-way No	No	Shiny	Stiff	Black	Cherries	No
Xendurance	Xendurance Energy Gel	€ 2,49		70 gr	170*40*10	1,00	83	118	Sachet	Tearing	1-way No	No	Shiny	Stiff	Silver	Citrus	No

Appendix 4

Runners Journal

GEBRUIKERS ONDERZOEK

LOGBOEK

INTERACTIE EN
GEBRUIKERSERVARING
BIJ ENERGIEGEL CONSUMPTIE

CONTACT:
s.jonkman@student.utwente.nl
06-21706553

INHOUDSOPGAVE

KLAAR VOOR DE START

Bedankt voor uw deelname aan dit onderzoek. In dit onderzoek willen wij proberen meer te weten te komen over de gewoontes en gebruiken van hardlopers die energiegels consumeren tijdens het hardlopen. De uitkomsten van dit onderzoek zijn bedoeld om bij te dragen aan de ontwikkeling van een nieuwe gebruiksvriendelijke en duurzame verpakking voor energiegels.
Dit boekje zal dienen als uw handleiding en logboek gedurende dit experiment, bewaar het dus goed.

U staat op het punt om aan de eerste fase van het onderzoek te beginnen. Voordat u de deur uit gaat voor uw eerste loop vult u uw lopersprofiel in, doe dit vóór **1 april**. Vervolgens kan u zelfstandig aan de slag met de ontvangen energiegels. Dit gaat als volgt: u kiest een van de vijf energiegels voor uw looptraining. Voor vertrek vult u het eerste deel van het logboek in, vervolgens doet u uw looptraining. We vragen u om de geopende verpakking te bewaren na gebruik. Bij thuiskomst vult u het tweede gedeelte van het logboek in. Dit doet u minimaal drie keer. De vierde en vijfde energiegels kan u testen mocht u daar de tijd en ruimte voor zien.

We bieden u twee opties voor het beantwoorden van de vragenlijsten in het logboek. Optie één is via de gebruiksvriendelijke, beveiligde smartphone applicatie TIIM van de Universiteit Twente. Voor optie twee vult u dit logboek in met pen of potlood en stuurt u het terug via de post aan het einde van het onderzoek. Als u in het bezit bent van een smartphone verzoeken wij u gebruik te maken van optie één.

Het onderzoek zal lopen tot **30 april**.

BELANGRIJKE DATA

UITERLIJK 1 APRIL 2022

Vul de module '*Lopersprofiel*' in via de TIIM applicatie.

of

Mail naar s.jonkman@student.utwente.nl in het geval dat u geen gebruik zal maken van de TIIM applicatie.

UITERLIJK 30 APRIL 2022

Vul de module '*Finish Strong*' in via de TIIM applicatie.

of

Retourneer het ingevulde logboek samen met de gebruikte energiegels.

STAP VOOR STAP

DIGITALE VERSIE

Hieronder vind u stap voor stap wat er van u verwacht wordt tijdens dit onderzoek.

1. Download de TIIM applicatie op uw telefoon.
2. Maak een account aan in de app.
3. Klik op het QR-icoon rechts boven in beeld. Scan de QR code of vul de voucher code in om de study toe te voegen aan uw account. Doe dit **vóór** 1 april.

   Voucher code: jL6Up QR code:
4. Uw aanmelding wordt gescreend, u ontvangt zo snel mogelijk bericht dat u van start kan gaan!
5. Vul de module '*lopersprofiel*' in.
6. Kies een gel voor uw training & vul de module '*pre-run 1*' in.
7. Doe uw training, gebruik de gel na 6km (of later), bewaar de verpakking en neem deze weer mee naar huis.
8. Bij thuiskomst, beantwoord de vragen in module '*run 1*' .
9. Herhaal stap twee t/m vijf minimaal drie keer met een nieuwe energiegel. De vierde en de vijfde energiegel zijn optioneel.
10. Na uw laatste training, vul de reflectie vragen in de module '*Finish Strong*' in. Doe dit vóór **30 april**.

STAP VOOR STAP

PAPIEREN VERSIE

Hieronder vind u stap voor stap wat er van u verwacht wordt als u het onderzoek niet digitaal doorloopt. Graag bendrukken we nogmaals dat de voorkeur uit gaat naar het digitaal invullen van de vragenlijsten. Mocht u er toch voor kiezen het onderzoek via dit logboek bij te houden, verzoekken wij u dit vóór **1 april** te laten weten door te mailen naar s.jonkman@student.utwente.nl.

1. Vul de het '*lopersprofiel*' in.
2. Kies een gel voor uw training & vul de eerste pagina van '*Run 1*' vragen in
3. Doe uw training, gebruik de gel na 6km (of later), bewaar de verpakking en neem deze weer mee naar huis.
4. Bij thuiskomst, beantwoord de rest van '*Run 1*' vragen.
5. Herhaal stap twee t/m vier minimaal drie keer. Gel nummer vier en vijf zijn optioneel.
6. Na uw laatste training, vul de reflectie vragen '*Finish Strong*' in.
7. Doe het logboek samen met de gebruikte gels terug in de doos. Plak het retour-label dat u heeft ontvangen op de doos en retourneer uiterlijk **30 april**.

DE GELS

U heeft vijf verschillende energiegels ontvangen. Hieronder vind u een overzicht van de gels met een aantal specificaties.

BYE! ISOTONIC GEL

Prijs:	€2,55*
Inhoud:	48 ml
Kcal per portie:	102 kcal
Kcal per 100g:	170 kcal
Cafeïne:	Ja

MAURTEN GEL 100

Prijs:	€3,46*
Inhoud:	40 ml
Kcal per portie:	100 kcal
Kcal per 100g:	250 kcal
Cafeïne:	Nee

* Alle prijzen zijn gebasseerd op adviesprijs
bij verkoop van een enkel product & inclusief 9% BTW.

SIS BETA FUEL

Prijs:	€ 2,79*
Inhoud:	60 ml
Kcal per portie:	158 kcal
Kcal per 100g:	264 kcal
Cafeïne:	Nee

POWERBAR FRUIT GEL

Prijs :	€ 2,09*
Inhoud:	67 ml
Kcal per portie:	102 kcal
Kcal per 100g:	153 kcal
Cafeïne:	Nee

SPONSER LIQUID ENERGY PURE

Prijs :	€ 2,65*
Inhoud:	70 ml
Kcal per portie:	200 kcal
Kcal per 100g:	284 kcal
Cafeïne:	Nee

* Alle prijzen zijn gebasseerd op adviesprijs
bij verkoop van een enkel product & inclusief 9% BTW.

	BYE! ISOTONIC GEL	MAURTEN GEL 100	SIS BETA FUEL	POWERBAR FRUIT GEL	SPONSER LIQUID ENERGY
Prijs	€2,55 *	€3,46 *	€2,79 *	€2,09 *	€2,65 *
Inhoud	48 ml	40 ml	60 ml	67 ml	70 ml
Kcal per portie	102 kcal	100 kcal	158 kcal	102 kcal	200 kcal
Kcal per 100 g	170 kcal	250 kcal	264 kcal	153 kcal	284 kcal
Cafeïne:	Ja	Nee	Nee	Nee	Nee

* Alle prijzen zijn gebasseerd op adviesprijs
bij verkoop van een enkel product & inclusief 9% BTW.

LOPERSPROFIEL

Om een beter beeld te krijgen van u als loper vragen wij u om het lopersprofiel in te vullen.

Wat is uw leeftijd?
..... Jaar

Wat is uw geslacht?
- ○ Man
- ○ Vrouw
- ○ Anders

Hoe vaak per week loopt u gemiddeld hard?
- ○ Minder dan 1 keer per week
- ○ 1 á 2 keer per week
- ○ 3 á 4 keer per week
- ○ 5 á 6 keer per week
- ○ 6 keer of meer per week

Hoeveel kilometer loopt u gemiddeld per week?
- ○ 20 km of minder per week
- ○ Tussen de 20 en 40 km per week
- ○ Tussen de 40 en 60 km per week
- ○ Tussen de 60 en 80 km per week
- ○ Tussen de 80 en 100 km per week
- ○ 100 km of meer per week

Hoe lang duurt uw langste training van de week ongeveer?
Ga hierbij uit van minuten die u daadwerkelijk hardloopt, dus geen oefeningen/loopscholing etc.
- ○ 30 minuten of korter
- ○ 30 a 45 minuten
- ○ 45 a 60 minuten
- ○ 60 a 75 minuten
- ○ 75 a 90 minunten
- ○ 90 a 105 minuten
- ○ 105 a 120 minuten
- ○ 120 minuten of meer

Hoeveel halve marathons heeft u gelopen?
- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4 of meer

Hoeveel marathons heeft u gelopen?
- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4 of meer

Welk jaar liep u uw laatste (halve)marathon?

Halve marathon:

In .....

Marathon:

In .....

Wat was uw finishtijd op uw laatste (halve)marathon?

Halve marathon:

..... uur, ... min., ... sec.

Marathon:

..... uur, ... min., ... sec.

Hoeveel energiegels nam u tijdens uw laatste (halve)marathon?

Halve marathon:
- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5 of meer

Marathon:
- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5 of meer

Wanneer u gels gebruikt heeft tijdens de race, heeft u deze zelf gedragen?
- ○ Ja, 1 of 2 gels
- ○ Ja, 3 of 4 gels
- ○ Ja, 5 of meer gels
- ○ Nee, ik draag niet mijn eigen gels tijdens de race

Hoe draagt u uw energiegels met u mee tijdens het lopen?
- ○ Zakje in sportbroek
- ○ Runningbelt
- ○ In ondergoed
- ○ In de hand
- ○ Anders, namelijk: .....

Van welk merk heeft u eerder energiegels gebruikt?

Meerdere antwoorden mogelijk

- ☐ Born
- ☐ Bye!
- ☐ Cliff
- ☐ Concap
- ☐ Etixx
- ☐ Gold Nutrition
- ☐ GÜ
- ☐ High5
- ☐ IsoStar
- ☐ Lightning Endurance
- ☐ Maurten
- ☐ Maxim
- ☐ Named Sport
- ☐ PowerBar
- ☐ SiS
- ☐ Sponser
- ☐ Squeezy
- ☐ Torq
- ☐ Vifit
- ☐ WCUP
- ☐ Xendurance
- ☐ 3 Action
- ☐ Anders: .....

Heeft u momenteel een favoriet merk voor energiegels?

Maximaal 3 antwoorden mogelijk

- ☐ Born
- ☐ Bye!
- ☐ Cliff
- ☐ Concap
- ☐ Etixx
- ☐ Gold Nutrition
- ☐ GÜ
- ☐ High5
- ☐ IsoStar
- ☐ Lightning Endurance
- ☐ Maurten
- ☐ Maxim
- ☐ Named Sport
- ☐ PowerBar
- ☐ SiS
- ☐ Sponser
- ☐ Squeezy
- ☐ Torq
- ☐ Vifit
- ☐ WCUP
- ☐ Xendurance
- ☐ 3 Action
- ☐ Nee, heb ik niet
- ☐ Anders: .....

Zo ja, waarom verkiest u dit merk over andere merken?

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.....

Wilt u verder nog iets kwijt over uzelf als hardloper?

.....

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RUN 1

Voordat u begint aan uw training, vul alstublieft het eerste deel van het logboek in.

FUEL UP WITH

Welke energiegel heeft u gekozen voor deze run?

Bye! / Maurten / SiS / PowerBar / Sponser

Waarom heeft u deze gel gekozen voor deze run?

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Omschrijf kort uw eerste indruk van de verpakking en uw verwachtingen bij het gebruik van deze gel

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TIJD OM TE GAAN LOPEN!

De rest van het logboek vult u in na uw training.

LEKKER GELOPEN?

Nu is het tijd om de rest van het logboek in te vullen.

THE RUN

Datum

...../...../ 2022

Tijdstip van vertrek

.....

Duur

..... minuten

..... kilometer

Weersomstandigheden:

.....°C

Droog/miezer/regen/zware regen

Windstil/weinig wind/veel wind/storm

Type training

Herstelloop/duurloop/ intervaltraining/race

Hoe zwaar was de training?

1 - heel gemakkelijk / 5 - heel zwaar

1 2 3 4 5

Wat geeft u deze training voor cijfer?

1 - niet goed / 10 - heel goed

1 2 3 4 5 6 7 8 9 10

Licht uw antwoord toe: .....

.....

.....

Hadden de omstandigheden van uw training effect op uw ervaring met consumeren van de energiegel?
- ○ Ja
- ○ Nee

Licht uw antwoord toe:.....

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THE GEL
USER EXPERIENCE

Hoe heeft u de gel meegenomen?
- ○ Zakje in sportbroek
- ○ Runningbelt
- ○ In ondergoed
- ○ In de hand
- ○ Anders, namelijk: .....

Wat heeft u gedaan met de verpakking na gebruik?
- ○ Weg gegooid, in een prullenbak
- ○ Weg gegooid, op de grond
- ○ Meegenomen, op dezelfde manier
- ○ Meegenomen, op andere manier, namelijk: .....
- ○ Anders, namelijk: .....

Omschrijf kort uw ervaring met het dragen van de gel
Wat viel op bij het dragen en lopen met de gel? Bleef de gel goed op zijn plek? Was dit comfortabel? Was het handig/onhandig dragen? Etc..

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Welk cijfer geeft u de gelverpakking voor het meeneem gemak?
1 - heel moeilijk meenemen / 10 - heel makkelijk meenemen

1 2 3 4 5 6 7 8 9 10

Was het duidelijk hoe de verpakking geopend moest worden?
- ○ Ja
- ○ Nee

Zo nee, hoe kan dit verbeterd worden?

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.....

Hoe heeft u de gel verpakking geopend?
- ○ Hardlopend, met twee handen
- ○ Hardlopend, met tanden
- ○ Stilstaand, met twee handen
- ○ Stilstaand, met tanden
- ○ Anders, namelijk: .....

Uit hoeveel delen bestond de verpakking na openen?
- ○ Nog steeds uit één onderdeel
- ○ Twee onderdelen
- ○ Meer dan twee onderdelen

Omschrijf kort uw ervaring met het openen van de gel
Wat viel op bij het openen van gel? Wist u de opening meteen te vinden? Opende de gel zoals u had verwacht? etc.

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Welk cijfer geeft u de gelverpakking voor het openen?
1 - heel moeilijk te openen / 10 - heel gemakkelijk te openen

1 2 3 4 5 6 7 8 9 10

Kon u de gelverpakking goed leeg krijgen tijdens het lopen?
- ○ Ja
- ○ Nee

Zo nee, hoe kan dit verbeterd worden?

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Omschrijf kort uw ervaring bij het innemen van de gel
Wat viel op bij het innemen van de gel? Had de verpakking invloed op uw ervaring met de gel? etc.

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Welk cijfer geeft u de gelverpakking voor het gemak van het innemen van de gel?
1 - heel moeilijk in te nemen / 10 - heel gemakkelijk in te nemen

1 2 3 4 5 6 7 8 9 10

LOOK AND FEEL

Wat vind u van het formaat van de energiegel verpakking?
- ○ Te klein
- ○ Te groot
- ○ Precies goed

Licht uw antwoord toe: .....
.....
.....

Kruis aan wat u het meest van toepassing vindt voor de verpakking van deze energiegel

Deze verpakking is:

○ ○ ○ ○ ○
Stug Flexibel

Deze verpakking voelt:

○ ○ ○ ○ ○
Ruw Zacht

De randen van deze verpakking voelen:

○ ○ ○ ○ ○
Scherp Zacht

Spreekt het uiterlijk/design van de verpakking u aan?
- ○ Ja
- ○ Nee
- ○ Anders, namelijk: .....

Licht uw antwoord toe: .....
.....
.....

Kon u de informatie die u wilde weten gemakkelijk vinden op de verpakking?
- ○ Ja
- ○ Nee, ik moest goed zoeken
- ○ Nee de informatie staat er niet op
- ○ Ik heb geen informatie opgezocht

Welke informatie was u naar opzoek? .....
.....

CONCLUSIE GEL 1

Hoe heeft u het gebruik van de gel verpakking over het algemeen ervaren?
Wat waren positieve punten?

.....
.....

Wat waren negatieve punten?

.....
.....

Zou u deze gel kopen?
- ○ Ja
- ○ Nee
- ○ Misschien

Licht uw antwoord toe: .....
.....
.....

Zou u deze gel gebruiken tijdens uw volgende race?
- ○ Ja
- ○ Nee
- ○ Misschien

Licht uw antwoord toe: .....
.....
.....

Welk cijfer zou u deze energiegel verpakking geven?
1 - Slecht / 10 - Fantastisch

1 2 3 4 5 6 7 8 9 10

Page 14 - 19 repeated 4 times

Run 1	(p14 - p19)
Run 2	(p20 - p25)
Run 3	(p26 - p31)
Run 4	(p32 - p37)
Run 5	(p38 - p43)

FINISH STRONG

U bent aangekomen bij het einde van dit gebruikersonderzoek. Als het goed is heeft u minimaal drie, maar misschien ook wel vier of vijf van de energiegels kunnen testen. Nu u verschillende producten heeft gebruikt heeft u misschien een voorkeur voor een specifiek verpakkings concept. Daarnaast zijn er mogelijk punten opgevallen waarvan u zegt: "dit is echt fantastisch", of juist helemaal niet. In dit laatste gedeelte van het logboek stellen we u enkele algemene vragen en zullen de verschillende energiegels met elkaar vergeleken worden.

Beoordeel hoe belangrijk de volgende eigenschappen van een energiegel voor u zijn

Voedingswaarde

Niet belangrijk — *Heel belangrijk*

Houdbaarheidsdatum

Niet belangrijk — *Heel belangrijk*

Ingrediënten

Niet belangrijk — *Heel belangrijk*

Gebruiksgemak

Niet belangrijk — *Heel belangrijk*

Duurzaamheid

Niet belangrijk — *Heel belangrijk*

Prijs

Niet belangrijk — *Heel belangrijk*

Zijn er andere eigenschappen die belangrijk voor u zijn?

.....

.....

Gaat uw voorkeur naar een product met lange- of korte houdbaarheidsdatum?

- ○ Kort
- ○ Lang
- ○ Geen voorkeur

Hoe ver van te voren schaft u uw energiegel gemiddeld aan?

- ○ 1 week
- ○ 1 maand
- ○ 6 maand
- ○ 12 maand of meer

Hoeveel gels heeft u getest voor dit onderzoek?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5

Welke energiegel verpakking vond u het meest gebruiksvriendelijk?

- ○ Bye!
- ○ Maurten
- ○ PowerBar
- ○ SiS
- ○ Sponser

Licht uw antwoord toe: .....

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Welke energiegel verpakking vond u het minst gebruiksvriendelijk?

- ○ Bye!
- ○ Maurten
- ○ PowerBar
- ○ SiS
- ○ Sponser

Licht uw antwoord toe: .....

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Welke energiegel(s) zou u opnieuw kopen?
(Meerdere antwoorden mogelijk)

- ○ Bye!
- ○ Maurten
- ○ PowerBar
- ○ SiS
- ○ Sponser
- ○ Geen van allen

Licht uw antwoord toe: .....

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Van alle energiegel verpakkingen die u heeft gebruikt, over welke eigenschappen was u het meest positief?

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.....

CONTACT:
s.jonkman@student.utwente.nl
06-21706553

Van alle energiegel verpakkingen die u heeft gebruikt, over welke eigenschappen was u het meest negatief? Wat frustreerde u?

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Heeft u verder nog opmerkingen?

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DANKUWEL!

Dankuwel voor uw deelname aan dit onderzoek. Dit was fase één waarin u zelfstandig de energiegels kon testen. In fase twee zullen we met een aantal deelnemers samen komen in een discussie/brainstorm sessie. Hier zullen we uw bevindingen nogmaals bespreken en gaat u in gesprek met andere deelnemers over hun mening en ervaringen. Daarnaast is er ruimte om na te denken over dé ideale energiegel verpakking. Welke eigenschappen moet absoluut behouden worden? Welke kunnen verbeterd worden?

Meer informatie over de discussiesessie zal volgen via de mail. Voor vragen of opmerkingen kan u altijd mailen naar s.jonkman@student.utwente.nl

Appendix 5

Tabel Material Characteristics per Brand Results

	Flexibility		Softness material		Sharpness edges	
	Mean	StDev	Mean	StDev	Mean	StDev
Bye!	3,9	0,9	3,6	1,1	2,8	1,1
Maurten	3,8	0,7	3,5	0,9	3,2	0,9
PowerBar	4,3	0,6	4	0,7	3,4	0,9
SiS	3,7	1,1	3,5	1	3,1	1,1
Sponser	2,1	1	2,7	1,1	1,7	0,7

Appendix 6

Tabel Importance of Energy Gel (Packaging) Properties Results

	Mean	StDev
Nutritional values	4,27	0,98
Shelf life	3,12	1,11
Ingredients	3,45	1,06
Usability	4,3	0,59
Sustainability	3,21	1,02
Price	3,3	1,07

Appendix 7

Brand Persona's

Joice
40 years old
Runs around 40 km per week
Will make marathon debut at Amsterdam Marathon and is in need for a right way to fuel her runs

	Before use	During uses	After use	Next time use
Actions	Tried several sorts of energy gels but does not like to use them Discovers the Bye! Isotonic gel	Compares Bye! Isotonic gel with other brands	Takes the energy gel in the pocket of running shorts on her next long run Twist of cap while she takes a quick break from running Consumes half of the energy gel and closes the product to finish it later	Uses a running belt to carry the gel for more comfortable carrying experience Recommends the gel within her running club
Thought & Emotions	There should be something out there that works for me	It looks like the fruit pouches I gave to my little boys when they were younger The gel has less intimidating look than some other professional gels	Opening the gel was a bit hard while running but I don't mind taking a quick break. This gel is much more like a drink, making it easier to consume it.	I don't mind using the belt People from my recreational running group might also appreciate this 'friendly' gel
Desires & Needs		Ability to close and reopen the product for later consumption		
Painpoints & Oppertunities	Has a hard time swallowing thick energy gels		The cap does not feel comfortable in pocket running shorts. This energy gel has a twist cap allowing it to be closed and reopened	

David
28 years old
Runs around 120 km per week

Will run his 5th marathon and is aiming for a time sub 2.5 hours.

	Before use	During use	After use	Next time use
Actions	Is looking for an energy gel that can optimally support him in his next marathon where he is aiming to run sub 2 hours and 30 minutes. Has seen many pro athletes use Maurten products	Takes the gel in his running short his next interval training to use it at marathon pace Pulls open the top of the gel pack with teeth and loses the top part Quickly sucks up the gel in two sips	Ask some fellow athletes about their experience with the Maurten Gel 100	Uses Maurten Gel 100 in his marathon Recommends Maurten Gel 100 to his marathon running group.
Thoughts & Emotions	I need the best product on the market, no matter what	No time to go back and get the top part I just lost This gel is so thick, it will give me lots of energy to run quicker!	If all pro athletes use this, I have to use this as well This gel looks very professional	Energy fueling will no longer be an excuse for not making my target time as I use the best product on the market
Desires & Needs	Running the marathon as quick as possible	Losing no time consuming the gel Carrying energy gels without additional props		
Painpoints & Oppertunities	Had some stomach stuggles in his prior marathons	Losing the plastic top-is not environmental pollution Compact size	This gel is quite expensive	

James
32 years old
Runs around 50 km per week

Will participate in the Berlin marathon with friends from his running team

	Awareness	Consideration	Experience	Conclusion
Actions	One of James running friends tells him about the PowerBar energie gel he tested		Takes 3 gels in the pocket of his running shorts Easily opens the gel with two hand on his long run	Purchase the energy gel to use during the Berlin Marathon Recommends to his fellow Berlin Marathon runners
Thoughts & Emotions		If my friend likes this gel I might too This gel looks quite professional	Very nice that I can't lose the top part This gel has a nice consistency	This gel will get me thru the marathon!
Desires & Needs	Find an easy, affordable and user friendly way to fuel during his marathon	A gel which can easily be carried in the pocket of his running shorts	Carrying the gels without props	
Painpoints & Oppertunities		The anti-littering chain ensures the lid to stay connected to the packaging	The flat design allows multiple gels to be stackedin his running shorts	No need to wear a running belt as this gel fits perfectly in the pocket of running shorts.

Laura
30 years old
Runs around 50 km per week

Will participate in the Enschede marathon and aims to improve her personal best

	Awareness	Consideration	Experience	Conclusion
Actions	Want to order her regular SiS energy from te website and noticed a new type energy gel		Takes the gel in her sports bra on a long run to test before she decides to use it her marathon Opens the gel just like she is used to do	Purchase the energy gel to use during the Marathon
Thoughts & Emotions		Look like the well known Maurten Gel but from thebrand I am familiar with. This gel looks 'faster' then my regular SiS gel	This gel is like my old SiS gel, but has a more professional feel to it	
Desires & Needs	Get the right energy gel which enables to run faster then last time		Feel fast	
Painpoints & Oppertunities	Likes to stick to what she knows	The anti-littering chain ensures the lid to stay connected to the packaging	-	

Phillip
37 years old
Runs around 75 km per week

Will participate in a trail marathon across the Veluwe

Awareness	Consideration	Experience	Conclusion
Is in the store to find gels to use during his long runs or marathon and sees a striking packaging		Takes the gel in his trailvest Consumes the gel in three sets	Purchase the energy gel to use during the trail running
This is different then other gels I have used inthe past		Amazing, now I can decide for myself how much energy I need at the moment	
	Consuming desired amound instead of fixed content		
	The reclosable lid allows for consumoption in desired amount. Wears trailvest during his runs	-