A flair of Greece: a case for a semi-automatic machine designed for the preparation of Greek coffee

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I hereby declare that the work submitted is mine and that where I have made use of another’s work, I have attributed the source(s) according to the Regulations set in the Student’s Handbook.

March 2017
Thessaloniki – Greece
«σαν τον καφέ είναι ο έρωτας
άλλοι τον προτιμούν βαρύγλυκο
άλλοι τον θέλουν με ολίγη
οι πιο πολλοί τον πίνουν μέτριο
κι όλοι το ίδιο τον πληρώνουν»

Ντίνος Χριστιανόπουλος,
ποιητής

“love is like coffee,
some prefer it bittersweet,
others with a pinch of sugar,
most drink it normal

and everybody pays equally”
First and foremost, I would like to thank Mr. Athanasios Babalis for his continuous help and assistance in this extraordinary journey.

Also, I want to thank

her
him
him

and her...

They know who they are.
Abstract

This dissertation was written as part of the MSc in Strategic Product Design at the International Hellenic University.

The primary focus is to create a product which reminds Greece. This was implemented in two phases. First, a thorough research took place aiming to identify how can someone create a remembrance of a country. These concepts were applied in the case of Greece and ultimately a product which carries part of the heritage of Greece was chosen. A product which prepares Greek coffee.

In the second phase, a brief history is explored in favor of design needs. A market research takes place to identify the current market competition. The final Design Brief was compiled and the creative process started. An existing product is deconstructed and analyzed to understand the way it functions. The morphology of the existing brewing pots is analyzed to understand the visual stimuli which lead to Greek coffee pot.

Four different archetypes were considered and one was picked for further development. Several different morphologies were created based on the picked archetype. Each feature of the product was studied separately (pot, base, handle) and solutions are given in every feature. A final model created and the technical aspects are also explored in term of materials and production techniques. Attention is given to the heat source and solutions are provided in terms of functional ergonomics and button mapping. In the end, the possible improvements of this project are provided and proposals for future steps are given.

Dimitris Kandylakis
31/3/2017
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Introduction

A great many nations suffer from the lack of products which embody the real identity of the country. Greece has enormous cultural heritage and has been blessed with some of the most astonishing landscapes in the world. In addition, the Greek cuisine is renowned and counts a few very recognizable brands, such as feta cheese and Greek olive oil. These products directly create a link between the user’s mind and the country.

However, these are foods and not products. One area which is weak is the existence of products which create direct resembles with the country. A lot of memorabilia are badly designed and most of the time they are arguably ugly. The point is not directed towards entire sectors which form an international reputation for a country, for example the auto industry for Germany. But for distinctive product, which either by function or by morphology create a direct mental link between the user and the country of reference. An excellent example is the classical Italian espresso pot. A direct link is generated with Italy both by morphology (Hexagonal hour-glass shape) and function (prepares espresso).

The creation of such a product is the main objective of this dissertation. Summarized in the following sort initial design concept.

Design a product which generates to the user the notion and a feeling of Greece
Country Branding

The initial briefing was simple and clear. Design a product which reminds Greece. It was therefore deemed necessary to explore how a product, or an idea for that matter, brings to a person the notion of a country. The principals of country branding are explored. That is when the principals of promoting a brand or a product are applied to promote a place or even a nation.

Brand and Country Brand

When we describe the term brand, many definitions can be found. Some focus upon the visual manifestations of a brand and are mainly applicable in product-centered brands. Other definitions go beyond the visual aspects of a brand and attempt to capture the essence of brand. This is more applicable to our case since a country does far more than producing a single product and its equity is mostly found in non-material aspects. Furthermore, it does not belong to any brand manager or corporation, instead one may say that a nation belongs to its entire citizenry. According to Macrare, Parkinson and Sheerman, “a brand represents a unique combination of characteristics and added values, both functional and non-functional, which have taken on a relevant meaning that is inseparably linked to the brand, awareness of which might be conscious or intuitive” (Dinnie, 2015). In his book, Keith Dinnie defines a nation brand to be “the unique, multi-dimensional blend of elements that provide the nation with culturally grounded differentiation and relevance for all its target audiences” (Dinnie, 2015). These unique elements must be identified and utilized to effectively promote a country.

Country Identity and Image

The identity and the image of a product (or a brand) are two very important concepts which concern anyone who is involved in the development of a product or a brand. Therefore, it is important to differentiate them. There are numerous definitions in various dictionaries, but a concise explanation is the following. The identity refers to what someone or something truly is, how he/she or it perceive itself. Whereas, image refers to how something is perceived by others. This notion is important because a great many nations suffer from this identity-image gap and struggle to be perceived by other nations for what they truly are. For the others to see the identity and move beyond the image. Stereotypes and clichés sometimes dominate the perception of a
nation. For example, because of the recent financial crisis, Greeks are often considered to work fewer hours-per-week compared to other European countries; in fact, they work the most in EU\(^1\).

National Brand Equity

We define national brand equity as “the tangible and intangible, internal and external assets (or liabilities of the nation)” (Dinnie, 2015). The assets each nation holds are the strengths upon which it builds its equity. The internal assets are depicted conceptually as innate or nurtured. Respectively, the external assets are depicted as vicarious or disseminated. In the diagram below one can see visualize his concept.

![National Brand Equity model](https://www.weforum.org/agenda/2016/06/which-european-countries-work-the-longest-hours/)

A simple explanation of the model is that the internal assets are derived from the nation itself and projected to the world. The external assets are the opposite. From the others to the nation.

To be more specific the internal innate assets are enduring elements of the national identity. For example, the cultural aspects which the nation has inherited throughout its history or the physical landscape. In the case of Greece, it would clearly be the rich ancient culture of the antiquity and the landscape of the Greek islands. Modern Greece did not create any of these assets, they were inherited. The internal nurtured assets are shaped by conscious efforts to create and sustain these assets. For example, supporting of the arts or constantly maintaining the quality of life in a city. Germany is a prime example of a nation which constantly tries to maintain a high quality of

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\(^1\) [https://www.weforum.org/agenda/2016/06/which-european-countries-work-the-longest-hours/](https://www.weforum.org/agenda/2016/06/which-european-countries-work-the-longest-hours/)
life. It has achieved to be among the best places to live. In 2017, three of its cities were among the top ten best places to live in the world².

On the other hand, the external assets can be visualized vicarious (indirect) or disseminated (spread). Indirect are the second-hand perceptions which other nations and their citizens have created based on popular imagery and depiction of the nation. For example, imagery created via popular culture such as films and literature. A classic example is the film “Zobra the Greek”. This famous film has created a certain imagery regarding how Greek people have fun and dance; a depiction which is rather far from the modern Greek reality. Disseminated assets are very easy to understand. They are the means by which a nation uses human resources to promote itself. For example, brand ambassadors and branded exports. Sir Sean Connery is an example of a high visibility ambassador for Scotland, as well as the David Beckham is for England. At the same time in terms of tangible products example, Sony is a great example for Japan as well as the entire auto-industry (VW, Audi, BMW, Mercedes, etc.) is for Germany.

Similarly, with the country identity, it is very important for a country to know its assets because this way can identify areas of strengths and weakness. The assets are used by the country to promote its national identity.

**Conceptual model of nation brand identity and image**

In his book, Keith Dinnie presents a model which shows how nation-brand image is derived because nation brand identity is communicated through means such as cultural artefacts, the diaspora, brand ambassadors, marketing etc.

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The hexagon of country branding

So far, we have covered the country’s identity and image. We have also established the need for a country to create an image which accurately and honestly reflects its identity. In his study Anholt presents the six aspects by which a country can communicate its identity to create the desirable image. The following hexagon visually illustrates these six principals. (Anholt, 2005)

It is worthwhile to explore each term individually since these areas are going to be used to visually depict Greece. After connections are established, a product which represents Greece will be chosen and can act as a product ambassador.

Tourism

This can potentially be a flagship for the promotion of a nation since it is the most visible aspect of place branding. It is also the biggest spender and the most competent marketing force. Greece is especially fortunate to inherit unique geographical locations which always is a good potential for tourism.

Export brands

Branded exports are in today’s world one of the most effective ways of building and sustaining national image. A strong, unique, broad-based and attractive national brand is one of the best gifts a nation can offer to its homemade products and its exporters. The concept of COO\(^3\) is particularly important here. Once a certain status is achieved it gives an incredible boost into the product category. One can simply consider the importance of made in Germany when we talk

\[^3\] The COO effect refers to the effect that a product or service’s origin has on consumer attitudes and behavior towards that product or service.
about engineering products or alternatively the elegance of “made in Italy” when we talk about fashion. Greece has strong COO effect when we talk about olive oil or food in general.

People
The ordinary, everyday people are perhaps the best ambassadors for their home country. They are one of the most efficient channels of communication the values (positive or negative) of a country. Here we do not only talk about local people who encounter tourists but for expats who live abroad. They also carry the values and habit of their native culture. Greeks around the world are known to spread the feeling of hospitality. A value which is heavily linked with Greek culture.

Foreign and domestic policy
Key part in the formation of an image play the government and the policies they follow. When the domestic policies create synergies, and promote open foreign policies this naturally has a positive impact. In addition, the nation’s government combines with diplomats are the official representative of a nation in the rest of the world. Certainly, their behavior matters.

Culture and heritage
Countries which emphasize only in the economic growth are in danger of developing a two-dimensional brand image which is of interest only to investors, tax exiles and currency speculator. Culture, heritage and sport create an important third dimension providing with the country richness, trust and respect broad. Luckily Greece has inherited one of the most important cultural heritage worldwide. The ancient Greek achievements in areas ranging from philosophy to sportsmanship (Olympic spirit) provide modern Greece a default mode of respect in these areas. However, the modern Greeks very often misuse or overestimate these gifts.

Investments and immigration
The influx of foreign investment and human resources has always been a powerful tool to improve a nation’s image. A positive attitude in these policies lead into more talent, capital and business ventures and this translates into rapid growth. Unfortunately for the case of Greece this is a major weakness the past years. The financial crisis and the inability of the past and current governments to solve this issue has given a crucial hit in the county’s image.

It is important for our product to choose the principals which Greece is strong and promote a positive image.
Semiotics theory applied in country branding

Semiotics is the science which studies the use of signs and sign language. Mistakably, someone might assume it is mostly concerned with the signage system. However, this is only a fraction of the field which semiotics cover. Semiotics deals with philosophy, linguistics, cultural studies and a range of philosophical, biological and sociological phenomena which occur in understanding signs (form of design). A sign in general is something physical and perceivable which signifies something to someone in some context (Kahane, 2015).

One of the benefits of adopting a semiotics approach while branding a product is the emphasis given in the context. In terms of the COO effect there is a great deal of to make creative use of signs. Askegaard and Ger advocate that a rich set of connotation should be used in when images of product and places of origin are analyzed. Taking their approach, a four-dimensional conceptual model of contextualized PCI\(^4\) is proposed. It consists of these elements: place, product, market context and usage context.

Context in the semiotics theory describes the meaning which is described from signs and symbols entrenched in their cultural space and time. Therefore, while building the visual manifestation of a brand one should give credit to visual elements which provide coded references to cultural and national identity.

Once a product has been chosen the design brief will be build using the aforementioned theory of applied semiotics to create a product as targeted and efficient as possible.

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\(^{4}\) PCI = Product-Country Image. It is a product which is strongly related with a country. Similar concept with the COO but for specific brand. For example, the shape of the traditional espresso pot is directly linked with Italy.
Mind Mapping Greece

A visual depiction of the brand Greece is attempted based on the principles of the Place Branding Hexagon. It should be noted that the branch of culture and heritage along with the Tourism branch are the strongest assets and had to be split in more than one branch.
Design conclusion: Country Branding

To summarize, a county which wants to apply effective nation branding and promote itself must first find its identity. Use its assets and communicate them effectively to rest of the world. To do that the country branding hexagon is utilized. The six aspect must be evaluated, promote the strengths and try to improve the weaknesses.

An attempt was made to visually depict the six aspect of Greece, to create connections and decide on a product which has the potential to act as a country ambassador. This visual depiction represents only a fraction of the aspect a country like Greece possesses.

As expected the two strongest internal assets of Greece are its landscapes and its cultural heritage. The latter spreads from philosophy and architectural monuments, till the Mediterranean diet. Food and beverages also hold prime position in the heritage branch of this nation. Therefore, is desired to lean towards a product which mixes food and culture.

Much too many objects exist which can be created to serve this purpose. However, it was the writers love for coffee which tilted the product search towards the Greek coffee.

The pillars upon which the product is going to be based in order to serve the initial concept is via Aesthetics and Function. Aesthetics contain the morphology, materials and colors of the product and the preparation of Greek coffee is the function. A lot of attention will be given to the traditional aspects and rituals as part of the function.

If we apply the semiotics theory in the case of Greek coffee we can see that the place is Greece which has a strong connection with this type of coffee, the usage context is the daily habit of drinking coffee and the market context are signs which are read by the people who drink Greek coffee. Therefore, the product which is used in the preparation of Greek coffee is an excellent candidate, as long as it is connected with Greece.

Arguably, one could suggest that Greek coffee has its origins in east. However, as it will be illustrated later in the project, this this type of coffee has been deeply imbedded in the history of Greece and has become part of Greek reality. Part of the modern Greek identity.
A case for Greek coffee and a SWOT analysis

The Greek coffee is a daily habit of modern Greeks. It has very interesting historic tights with the Greek culture, but these will be explored further down.

The product itself is interesting and serves our purpose in terms of a function. It is important to see its viability in the Greek market. Therefore, a quick SWOT analysis was implemented and the results a visually depicted in the diagram below.

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>• Strong connection with daily rituals and Greek heritage</td>
<td>• Considered “old fashioned”</td>
</tr>
<tr>
<td>• 45.5% of coffee drinkers consume it in Greece</td>
<td>• Takes more time to prepare than espresso</td>
</tr>
<tr>
<td>• Simple to prepare (no training required)</td>
<td>• Served only warm (seasonal use)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Few options for automated machines</td>
<td>• Upward trends of espresso drinking habits</td>
</tr>
<tr>
<td>• Small competition in the market</td>
<td>• Gradual aging of primary users</td>
</tr>
<tr>
<td>• Ordinary shapes and complete lack of “character” in the existing options</td>
<td>• Gradual abolishment of the Greek coffee from coffee places in favor of espresso (faster, more popular)</td>
</tr>
</tbody>
</table>

**Figure 6 SWOT analysis for Greek coffee in the Greek market**

The Greek coffee stands strong among the preferences of Greeks, more than 45% consume it as their main coffee preference (ICAP Group, 2016). It is simple to make and strongly connected with the daily breakfast. However, it is considered old fashion and its consumption is declining among the young generations mainly due to the rise of espresso coffee. Nevertheless, espresso only takes of 24.8% of this market (ICAP Group, 2016), almost half of the market share. The lack of automated machine is a good market opportunity since there is very little competition. Later we will see that the more automated these products are, the more expensive can be. Perhaps one of main threats, is the drop of use in the cafes. The primary reason is the time it requires to make a properly made cup of coffee.

This gap is worthy to be explored as a product. Emphasis should be given in the quality while making the preparation easier.
A brief history of Greek coffee

There are no solid references to place coffee drinking as beverage in Ancient Greek, Roman or middle eastern cultures. Surviving document can place the drinking of coffee no earlier than the middle of the 15th century in the Sufi monasteries in Yemen in southern Arabia (Bennett A. Weinberg, 2001). Although, references of coffee use in ancient Greek and Hebrew cultures do exist, they present it primarily as a drug and prize its significance it terms of its curative and mood altering properties.

The Greek coffee is essentially boiled coffee. Nowadays, there are four ways of brewing coffee. Boiling, infusion (French press), gravitational feed (filter brewing), and pressurized percolation (espresso). Boiling was the universal method of brewing coffee until the 1930’s and is still used in some places, notably Middle Eastern countries. The ritual is in the pouring technique. The ground coffee is purposely not separated from the water and remain in the drinking cup (Kahane, 2015).

This method, commonly known to the rest of the world as “Turkish coffee”, uses a kettle called “ibrik” that was heated over a stove. Turkish coffee and has been accredited to Turkey as Intangible Cultural Heritage of Humanity by UNESCO in 2013. One may find this type of coffee in different countries but with different name. Greek, Cypriot, Bulgarian coffee are a few examples.

Greek coffee and the society

Significant attention is given in the cultural aspect of tradition. It was therefore deemed necessary to research the course of Greek coffee through the Greek society and how it got incorporated into the culture.

Turkish Coffee, as a habit, was introduced to Greeks via Ottoman Empire. At the begging of the 18th century, slowly, it started to emerge in the life of everyday people as an informal daily habit. Gradually it became one the most valuable house treats (Petropoulos, 1979).

It should be noted that the term “Greek” coffee has been used for the past 50 to 60 years. Previously, the term Turkish coffee has readily used in Greece. Political tensions between the two countries led to the abandonment of the “Turkish” pronoun and its replacement by the “Greek” pronoun.

The coffee is treated in the traditional coffee houses, which at the time were a common place of meeting. The conversations ranged from politics and sports till everyday gossip. The most loyal

customers are called theriaklis, a person who passionately loves something, almost obsessed with it. A term used for the coffee aficionados who visited the coffee place very frequently. They drink their coffee in a thick porcelain cup, without any sugar. Like the traditional Ottomans. This serves two functions, initially the coffee remains warm and at the same time protects the user from getting burned. An interesting habit which has been lost through time is that the theriaklis traditionally eat the coffee sediments (Petropoulos, 1979).

Greek coffee was the main drink to be served, along with traditional side treats, such as loukoumi or spoon sweets. An interesting fact is that traditionally the coffee was prepared by men and served by young boys (rarely adults). As a process required high craftsmanship and the person who prepared it was considered highly skilled and respected. The art of preparing the Greek coffee was known to women as well. However, their entrance in the coffee houses was unofficially forbidden by man-centered societal structure and allowed them to prepare the coffee mainly at home.

The preparation of the coffee, regardless of the location, was considered a ritual. A well taken-care coffee can take up to 20 minutes. Therefore, host must invest time to make a cup of coffee and was consider a great honor to be invited for one. Future brides were judged by their ability to make good Greek coffee. In many significant moments, the coffee serving retained an important position. For example, after a funeral ceremony it was almost obligatory to serve Greek coffee. A custom which is still alive in modern Greece and even carries its own name, “Consolation Coffee” (in greek, “Kafes tis Parogorias”).

The latter “ritual” coffee was served with water which was initially boiled in cinnamon. However, a great many variations can be made for Greek coffee. Especially at professional level. For

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6 https://www.sakketosaggelos.gr/Article/1662/
example, traditional Ismir coffee makers where using Tachini\(^7\), while the monks in Agion Oros\(^8\) are using Ouzo.

Grounded coffee and sugar in the preferred proportion was added in the coffee pot and stirred. Once the mix starts to expand and form bubbles at the pot was removed from the fire. It rested for a slight amount of time and then was reintroduced in the heat. Until it reached again near boiling temperatures and then it was removed again and the whole process was repeated. The vagueness in the process is part of the art of making this kind of coffee. Each manufacturer had his own process and despite that the principals were the same other would re-boil the coffee up to five times. Other would stir the coffee more often and others almost not at all.

**Design Conclusions: History and social aspects**

- Albeit this type of coffee is originated from the Ottomans and not from Ancient Greece, it can be considered part of modern Greek culture since it has been in the life of Greeks for more than 200 years.
- The ritual is in the pouring method. Therefore, the boiling pot is visible to the final user, therefore attention in the aesthetics must be given.
- There are practically many combinations of water, coffee and sugar. Therefore, automated serving method for sugar and coffee are very hard to implement
- The traditional brewing method requires high level of training and skill.
- The traditional brewing time can reach up to 20 min. Therefore, to retain the traditional aspect, long brewing time with low temperature settings much be considered.
- The level of the coffee should be monitored.
- The water temperature should not bring the mix in boil. The pot is immediately removed from the heat source once the mix is brewed.
- Stirring the coffee is part of the technique and should be considered.
- Coffee was traditionally served with side treat. Considerations for accommodating space for the side treats should be made.

\(^7\) Tahini is a condiment commonly used in the kitchens of Eastern Mediterranean region, made from toasted ground hulled sesame seeds. ([https://en.wikipedia.org/wiki/Tahini](https://en.wikipedia.org/wiki/Tahini))

\(^8\) Agion Oros is a geographical area in the Northern Greece which includes a series of Christian Orthodox monasteries
Market research & Analysis

A market research regarding the exiting competition took place during the phase.

While the market has many choices for the traditional and modern coffee pots, the options are decreasing as we increase the automation level.

If we study the entire market, we can divide it into two main categories.

The first uses a coffee pot. The user inserts the ingredients in the pot and uses a heat source to brew the coffee. Then fills the cup manually by pouring the mix from the pot. It should be noted that unless the user stirs the mix himself, then none of the manual or semiautomatic machines does any stirring.

The second category uses a brewing chamber. Coffee and sugar are manually inserted in the brewing chamber. Water is automatically poured into the mix. Once brewing is completed the latter is served directly in a cup.

A subcategory which has only recently been developed, uses capsules to make the Greek coffee. The user inserts the capsule in the designated place and everything else is automatic. Albeit less demanding, this method has the least connection to tradition and could easily be confused with other coffee machines, such as an espresso capsule.

Brewing in a pot, then serve in a cup

Here one can easily observe that most of the products are completely manual in their use and the differences are in the heat source. The more traditional versions use ethanol as a burning fuel which takes longer but adds to the traditional quality of the coffee.

The more modern version which is also among the most popular methods use gas (usually butane) which is very easy to use, they are also cheap to buy. However, there is always the inherent danger which comes with gas.

The latter two methods are independent of electricity and therefore can be easily used outdoors.

Another common alternative heat source is to use the kitchen stoves.
In recent years, a common type uses an electric resistant which is attached to the bottom of the coffee pot and heats the mix using electricity. These types of products resemble a lot the modern kettles. They too carry a boiling safety.

A mix between traditional methods and modern technology is by heating sand and brewing the coffee in the sand. This resembles a lot the traditional method used in the old coffee houses, however instead of heating the sand by using charcoals, the modern versions use either gas or electricity to heat the sand.

Finally, the more advanced versions of this category have the same principals of operation (manual water/coffee/sugar intake) but use a designated coffee pot which can only be used by this machine, for the preparation of Greek coffee and has sensors to prevent over spilling of the coffee. The Beko BKK 2113P is the only product which has a brewing pot and automated water feed.

Brew in a special compartment, serve directly into cup

There are very few options in this category in market. Generally speaking, not only the Greek market. They are all Turkish made and are all significantly more expensive.

As discussed earlier, in all three of them, coffee and sugar are feed manually in the coffee chamber, but water is poured automatically from the machine.

Finally, as a subcategory here, one may find the coffee is inserted in specially designed capsules. This give the unique opportunity to add coffee with different infused flavors.
Market Analysis

In the summarizing table below the main competitors are compared in following 13 areas:

1. Use: whether they are aimed to home use, professional or both.
2. Automation level: how many stages of the preparation are taken cared by the product.
   a. 1 = none
   b. 2 = avoids boiling
   c. 3 = machine stops the process automatically
   d. 4 = water is added automatically
   a. 5 = all steps are automated
3. Time per portion: the time it takes for a user to prepare a portion of coffee using this product
4. Coffee variation: the different types of coffee a user can make us
5. Efficiency: how many coffee can a user make in one attempt
6. Cost: the product cost in the Greek market
7. Attention: how much attention is required from the user to prepare one coffee
8. Expertise: the level of skills required to prepared one portion
9. Heat source: how is the coffee mix heated
10. Slow brewing option: whether the user prepare one portion in different times
11. Safety level: how safe is the user when operating this product.
12. Steering option: whether the user has the option to steer the coffee during its preparation
13. Water tank: whether the product has a water tank.

Visual comparison

While performing the market analysis, it was evident that the automation of the models affected the morphology of the product. Therefore, an image chart was created which visualizes the differences more effectively.

It is interesting to point out that after Level 2 the traditional horizontal handle is dropped in favor of a more compact design. After level 3 the brewing pot is also dropped out and it is very hard to distinguish these machines from other type of coffee machines.

<table>
<thead>
<tr>
<th>Use</th>
<th>Automation Level</th>
<th>Time per portion</th>
<th>Coffee variation</th>
<th>Efficiency</th>
<th>Cost (€)</th>
<th>Attention</th>
<th>Expertise</th>
<th>Heat source</th>
<th>Slow brewing option</th>
<th>Safety level</th>
<th>Steering option</th>
<th>Water tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camping Gas Theophilos</td>
<td>home</td>
<td>1</td>
<td>not fixed</td>
<td>all</td>
<td>depends on pot</td>
<td>20-30</td>
<td>high</td>
<td>high</td>
<td>burning gas</td>
<td>yes</td>
<td>low</td>
<td>yes</td>
</tr>
<tr>
<td>Ethanol gas</td>
<td>home</td>
<td>1</td>
<td>not fixed</td>
<td>all</td>
<td>depends on pot</td>
<td>50</td>
<td>high</td>
<td>high</td>
<td>burning gas</td>
<td>yes</td>
<td>low</td>
<td>yes</td>
</tr>
<tr>
<td>Kitchen stove</td>
<td>home</td>
<td>1</td>
<td>not fixed</td>
<td>all</td>
<td>depends on pot</td>
<td>variable</td>
<td>high</td>
<td>high</td>
<td>electric resistance</td>
<td>yes</td>
<td>low</td>
<td>yes</td>
</tr>
<tr>
<td>Singer Meraki 2</td>
<td>home/professional</td>
<td>2</td>
<td>1 min</td>
<td>all</td>
<td>1-4 cups</td>
<td>20</td>
<td>high</td>
<td>high</td>
<td>electric resistance</td>
<td>no</td>
<td>medium</td>
<td>yes</td>
</tr>
<tr>
<td>Chovoli E2008</td>
<td>professional</td>
<td>1</td>
<td>not fixed</td>
<td>all</td>
<td>depends on pot</td>
<td>200</td>
<td>high</td>
<td>high</td>
<td>gas/electricity</td>
<td>yes</td>
<td>medium</td>
<td>yes</td>
</tr>
<tr>
<td>Beko BKK 2113M</td>
<td>home/professional</td>
<td>3</td>
<td>1.5 min</td>
<td>all</td>
<td>1-3 cups</td>
<td>50</td>
<td>low</td>
<td>low</td>
<td>electric resistance</td>
<td>no</td>
<td>high</td>
<td>no</td>
</tr>
<tr>
<td>Beko BKK 2113P</td>
<td>professional</td>
<td>4</td>
<td>1.5 min</td>
<td>fixed water amount</td>
<td>1-6 cups</td>
<td>150</td>
<td>low</td>
<td>low</td>
<td>electric resistance</td>
<td>non</td>
<td>high</td>
<td>no</td>
</tr>
<tr>
<td>Arzum Okka</td>
<td>home/professional</td>
<td>4</td>
<td>1-2 min</td>
<td>fixed water amount</td>
<td>1-2 cups</td>
<td>200</td>
<td>low</td>
<td>low</td>
<td>electric resistance</td>
<td>yes</td>
<td>high</td>
<td>yes</td>
</tr>
<tr>
<td>Arçelik Selamlique</td>
<td>home/professional</td>
<td>5</td>
<td>2 min</td>
<td>predefined</td>
<td>1 cup</td>
<td>300</td>
<td>low</td>
<td>low</td>
<td>electric resistance</td>
<td>no</td>
<td>high</td>
<td>no</td>
</tr>
</tbody>
</table>
Discussion

It is easy to point out the duality of the offered solutions. It is also clear and predictable that a more automated solution offers less of the Greek coffee experience. If we consider the most automated machine with the capsules, one can easily see that the process for the end user is the same as for any other kind of coffees, like espresso per say. The only difference, is the variety of coffee in the capsule. The user still inserts a capsule in the machine and receives his final product directly into his cup, identical with the espresso capsule machines.

On the other hand, if we take the least automated process, which keeps a lot of the traditional aspect, one can easily identify the drawbacks and the reasons why these methods are gradually becoming obsolete. It takes more time, it is more dangerous and the user must be in constant alertness to avoid over cooking or spilling the mix. This makes it a more demanding process.

Perhaps a finer balance can be found in the models which keeps the manual filling of the coffee pot and the manual serving in the cup but remove from the user the hustle of constantly paying attention in the coffee mix.

The products which use gas or ethanol are more versatile in terms electricity demand, the electric models are much safer and do not need any refill of the gas tank/ethanol. Also, the sensors require electricity to run.

An element which should be kept in favor of tradition, is the straight handle. All modern versions use a curved handle. A strait one is different than the existing trend and much closer to the traditional coffee pots.

How to make Greek Coffee

An important aspect (arguably the most important) of product, is to perform the function it was designed for. In our case, the primary objective is to make good Greek coffee.

Therefore, one must firstly understand the process by which Greek coffee is prepared.

Different methods of preparation can be found across different nations. Most methods are affected by the tradition each country follows regarding the coffee ritual. In his book, Elias Petropoulos remarks that in the traditional Greek coffee houses the loyal customer, who were acting a bit macho, had the tendency to ask for impossible mixes in order to make fun of the usually young waiters.
There are numerous ways to prepare Greek coffee. The combinations between the water, coffee and sugar make it hard to fully standardize the process. Nevertheless, the core steps remain the same regardless of the nation.

Briefly explained, the steps are the following:

1. The user activates the heating source
2. The right amount of water (usually measured in cups) is added in the brewing area (typically a coffee pot).
3. Sugar, if requested, is added first to do dissolve easier.
4. Coffee is added next, but the mix is not stirred yet.
5. When coffee is immersed in the water, the mix is stirred
6. The mix reaches at a near boiling temperature, the water level rises and bubble start forming on the froth.
7. The pot is removed from the heat source and rests for a few seconds.
8. It is placed it back on the heat source until a second “boil” is achieved.
9. The mix is served traditionally.

Regarding the process the following remarks should be made with regards to the traditional Greek way of brewing this coffee.

- The starting temperature of the water should be at least at room temperature and perhaps a bit higher. Helps the coffee to dissolve easier.
- The brewer does not stir the mix until the coffee is fully dissolved in the water.
- The longer it takes to brew the mix the better the flavor and the thicker the froth.

Design Conclusions: How to make Greek Coffee

- The quality of the beverage’s taste depends on the quality of the coffee beans and the brewing time. The method (automated or manual) to mix the ingredients is independent of the taste. Therefore, these two can be separated because a tasty coffee does not require manual feeding.
- Reaching the mix in boiling temperature destroys the taste.
- Different combinations of coffee make it hard to fully automate the process.
- The manual feed of the drink’s ingredients is part of the ritual and strongly connected to the tradition. Therefore, the further away one goes from the manual process the further away he moves from the traditional brewing method.
There are three phases in which tradition is observed.
  - First, the manual feeding of ingredients in the brewing pot.
  - Secondly, the brewing time.
  - Finally, the serving.

**Getting everything together: The Design Brief.**

So far, we explored the Greek assets and created connections. We identified that a product for the preparation of Greek coffee is a good candidate, we established the connection of that coffee with the national identity of Greeks and we showed evidence that the product would have viable financial prospects at least in the Greek territory.

Then we conducted a market research. Attention was given to the aspect of automation of each product. Hence, it was recognized that the more automated a product is the further it moves from tradition and the “ritual” of Greek coffee. A ritual which is kept by both the person who prepares it and the person who drinks it.

Finally, we analyzed how one can prepare Greek coffee in the most commonly accepted process.

In conclusion, to create a product which balances between tradition and functionality the most appropriate method is to create a semi-automated product which keeps the traditional ritual in two out of the three preparation phases. The ritual of manually filling the brewing pot with coffee ingredients and the ritual of the serving are kept. The middle phase which is the most demanding is going to be automated.

Since this is a master thesis, it is beyond the scope of the project to fully analyze and perhaps innovate in terms of the electronics inside the product. Therefore, the existing technology will be taken as an assumption and be used as a base for the electronics.

First, the potential user is defined, then the primary, secondary and tertiary markets are recognized. Finally, a description of how is the product going to meet the users’ needs is presented in hierarchical order starting from the most important.
Initial Concept

“Design a product which brings to the user the memory and a feeling of Greece.”

This is to be achieved either by the morphology, aesthetics or by function and preferably by a combination of these.

Design Brief

The product

Design a semi-automated coffee machine for preparation of “Greek” Coffee

User (who)

- Coffee drinker
- Appreciates Greek culture
- Of any marital status
- Mid-range financial status
- Of any gender
- Right or left handed
- Adult (20yr and up)
- Local or foreigner

Market (where)

- Primary
  - Home (in the kitchen area)
  - Office
- Secondary
  - Traditional coffee houses
  - Small modern café
- Tertiary
  - Hospitals
  - Funeral reception services

Product (How) – Hierarchical order

- Prepares “Greek Coffee”
- Aesthetically pleasing (left on the kitchen counter and not hide it after use)
- Reminds of Greece (form, materials, colours)
- Accommodates traditional elements
- Can be placed on standard kitchen counter
- Operated by one hand
- Can deliver four portions of coffee in one use (two doubles, two singles, one double or one single)
- Semi – automated process
- Easy to use
- Easy to clean
- Can be carried by a single person
Deconstructing Competition

Analyzing the existing models of the market and try to understand how they operate is a common practice in the product design industry. It is important to fully understand the competition and its innovations.

Therefore, an existing model was purchased and deconstructed to understand how it functions and analyze its technology.

An effort will be made to accommodate the electronics of the BEKO into the morphology of this project. However, if this facilitation works against the desired morphology, this effort will be abandoned.

In terms of the economics behind this specific model, it should be mentioned that BEKO, a Turkish white appliances manufacturer, is the just the branding name. The company which manufactures the electronics and has filed for all the patents is Arçelik S.A.; a Turkish electronics conglomerate9 which owns multiple brands such as Arçelik, Beko, Grundig and many more. This is to show that serious investment took place in the R&D department to solve many of the potential problems which arise in complex products such as a coffee machine.

9 https://en.wikipedia.org/wiki/Ar%C3%A7elik
Machine operation

The operating parts of this machine are used as base for our coffee machine, therefore it is necessary to understand how it operates and prepares the coffee. Perhaps most importantly one should understand why the machine operates in the way it does and how certain details and innovations contribute into making a good cup of coffee.

The machine is very easy to operate and no real training is required from the user. The semi-automated process simply requires from the user to put the ingredients in the coffee pot. Once the ingredients are in, one simply places the pot in the machine and pushes the only button at the top. Thereafter, it operates automatically. Practically, it spares the user from watching the pot while the coffee is brewed and takes care overboiling using an infrared sensor sensors. This innovation is patented by Arçelik.

It should be noted that the is no on/off switch. The device is activated when it is turned on and turns into a hibernating mode if it is inactive for some time. However, there is a hidden trigger which is activated when the user removes the pot

One cycle of operation

After the user has filled the cup with the desired coffee, the small piston at the bottom pushes the coffee pot upwards, locks it in place and starts to heat the water. Once the water reaches the appropriate temperature the piston hits the bottom of the pot twice to imitate the traditional banging of the coffee pot on the table. Then continuous to brew the coffee for a few seconds and finally notifies the user that the process is finished using a sound and a blinking light.

A very important role of the piston is that after the coffee mix has reached the desired temperature and the piston is pulled down, the heat source which provides is removed as well. This acts as a safety mechanism and prevents the mix from over-heating due to residual heat left at the heating pan.

Thereafter, the user must manually use the pot and serve the coffee into the cup.
Design Conclusions: Deconstructing competition

- The current model consists of four structural parts.
  - Base: carries the main electronics board and the piston
  - Front part: carries the sensors at the top and houses the pot chamber
  - Façade: houses the button and the brand graphics
  - Top part: creates the outer cell of the machine
- To accommodate the current electronics, there must be enough space for the main electronic board, enough for the piston to move freely and enough at the top to accommodate the sensor.
- Placing the operation button at the top is not necessary, but it is more visible and easier to push.
- The pot has more volume than the number of cups to accommodate for expected rise in the level or accidental over boiling. Total volume is 390ml, effective is 210ml (up to max water line)
- There is an internal protrusion to indicate the maximum water level.
- There is a ventilation tube, d=1.4cm. However, it is a passive system since there is no fan to suck the air. Therefore, one must accommodate for ventilation.
- The total size of the machine is not big, however there seems to be a lot of unused space.
- The coffee pot and handle are made of plastic. Only the bottom part of the pot is metal to transmit the heat. Interestingly, the pot does not look plastic at all. Therefore, a combination between plastic and metal is possible.
- The electronics board appears to be rather simple and could potentially reduce its size.
- There are two incisions which guarantees that the pot is placed appropriately in the cavity. This protects the users from potentially starting the process with the pot wrongly placed.
- The piston acts as the heat source. When the brewing cycle is complete it is pulled back to prevent over-heating.
- The operation button has both haptic feeling (bumps) and optic signals (led light)
- After one operating cycle is complete, the machine notifies the user using sound and optic signals.
- The main electronic board has gross dimensions of 12cm x 10.4cm x 2.6cm
- The operating button is on the same board with the level sensor. The latter has gross dimensions of 6.5cm x 2.7cm x 1.8cm
- The piston requires at least 6cm to operate
- There is a hidden trigger in the cavity which is activated when the user removes the pot.
- Part of the internal space is used to house the electric cable
Morphology and function of traditional and modern brewing pots

The brewing pots have not evolved too much over the course of the years.

This happened for two reasons. First, people gradually started to prepare the coffee in their own kitchen and there was no need for the aesthetics. Secondly the existing models worked just fine so more weight was given in the functionality rather in aesthetics.

Morphologically all the coffee pots share some common characteristics.

- They have a larger base which convex going upwards.
- They have a log strait handle which is either horizontal or it points upwards. This occurs for two reasons.
  - First it provides better handling
  - Secondly it keeps the hand of the user away from the heat source and the pot itself which at the end of the brewing process it is very hot.
- There is a clear nozzle from which the liquid is poured and it is always perpendicular to the handle. It is never on the same axis with the handle like teapots and kettles. This aids with the serving of the coffee. It gives better control over the pouring of the coffee.
- It is very rare to see a pot which can be utilized by left handers. The nozzle is on the left of the handle in order to be operated by the right hand.
- Modern pots tend to be less conical.
- Materials are a key distinction
  - Traditional old pots are usual made out bronze or copper and carry a wooden or metallic grip handle.
  - Moderns pots are almost guaranteed to be made by stainless steel. The automated and semi-automated versions which are made of plastic with a metallic base to transmit the heat or the entire core is stainless steel.
- In both modern and traditional coffee pots, the handle is attached at the top.

![Figure 19 Set of traditional pots](image1)

![Figure 18 Set of modern pots](image2)
It is very important to point out one key feature here. There is no pot which restricts the use only to coffee preparation. They can be used to heat water or tea. So, these may be pots for preparing coffee but their functions can be altered.

Also, most pots can be used with different heating methods. Gas, electric stove and sand heat can all be used with copper and steel pots. Restrictions arise with the pots which are plastic and designed to work only with the semi-automated machines.

Finally, perhaps one of the most characteristic elements of the traditional coffee pot is the unusually long handle. Of course, this served one very important purpose in the past. To protect the user from the heat of the coils. A secondary reason, in the coffeehouses, was to allow the user to place the pot further away from him to be able to handle many pot at the same time.

**Morphology of semi-automatic machines**

A special case are the semi-automated coffee machines. They have some differentiations regarding the morphological elements and the material.

- The morphology of the pot is relatively free from the traditional convex shape. The overall shape has very few visual ques to lead the user that this is a Greek coffee machine
- The handle is short and vertical.
- Plastic is the primary choice of material. There is a metallic base which is attached to the main body to transmit heat.

![Figure 20: Examples of existing semi-automatic coffee machines morphology](image)

**Design Conclusions: Pot Morphology**

- Using a heat resistant material leads to a product which can be used for multiple functions. Not only coffee preparation but water heating and tea preparation as well.
- Using copper and wood in the design can provide visual stimulants which lead to a more traditional feeling.
- the principal visual que for the traditional coffee pot is the convex shape and the straight handle. At least one of these two elements should be used to evoke the feeling that this is a Greek coffee machine and not another kind of machine.
Concept Generation

The functional aspect of the product has been thoroughly justified. The other aspect is the aesthetic. As discussed earlier, one of the strongest assets of Greece is its landscapes and cultural heritage. Therefore, it was decided to draw inspiration from these two areas.
The Cycladic architecture

One of the most scenic images of Greece are taken in the Greek Aegean islands. The traditional architecture of Greek churches with the white walls and the blue domes is one of the more recognizable images of modern Greece.

The Cycladic idol

The human form idols created by the Cycladic civilization around 2800-2300 BC\(^\text{10}\). Their forms and lines are smooth and the lack of detailed features establish them among the best example of minimalist design of the antiquity.

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\(^{10}\) https://en.wikipedia.org/wiki/Cycladic_art
The classic ancient Greek column

One of the more recognizable shapes of ancient Greek architecture. The archetype of a Greek column can be found from ancient Greek temple and renascence paintings till the White house and even as archetypical sign in maps to indicate ancient monuments.

The owl of Athena

The final element which was explored during the stage was the owl of the ancient Greek goddess Athena. Per Greek mythology, an owl was constantly following the Greek goddess and it is a symbol of knowledge and wisdom. The little bird can be found anywhere from ancient coins till amphorae.

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The final archetype

Out of the four morphological approaches, the ancient Greek column was found to be the most effective for the purposes of this project. It is very recognizable archetype, it is interesting morphologically and it is directly linked with one of the strongest assets of Greece, the antiquity.

The architectural archetype, had two reasons which got it rejected. First, relating the product with any religious symbols is not effective because it might cause rejection from potential users of different religion. After all, most of the countries in which this coffee thrives are Muslim nations. The second reason is that it perpetuates the stereotype of Greek island. This is not by definition a negative aspect; however, Greece has many more islands to show and magnificent mainland as well. Therefore, since the objective is to create a representative product of Greece a more unifying archetype is desired.

The Cycladic idol and owl of Athena archetypes, albeit excellent choices, were rejected simply because the column is a much more recognizable image. Also, the owl could result in a very descriptive object and this was not a desired outcome.

Column concept generation

The archetypical morphology is established. The next step is to start the creative process for each individual component of the product.

Three main elements of the product were explored. The morphology of the brewing pot, the main body and the handle.

From the first steps of the design it was decided to create a product which has a monolithic logic. Meaning to create a product which has a unity and each piece is part of a bigger piece. When all the pieces are united then the product looks complete. The Greek column also has a monolithic logic since it always has a continuity which makes it seem as it was carved from a single piece.

Important part in this monolithic logic plays the base. It need to "hug" the pot in such a way which a single piece is created. In addition, there is the restriction that it need to enclose the pot from the top in order to house the sensors.

A lot of attention has been given the tradition. As it was illustrated in the earlier steps in which the morphology of the pots was analyzed. The pots have very distinctive shapes. Also since the ritualistic aspect of serving the coffee is retained, the aesthetics element of the pot should be studied.
Form inspiration

Before experimenting with the product’s initial form, a research on cylindrical vases with and without handles took place. This acted as an inspiration board in all key elements of the product. The main brewing pot, the base and the handle.
Hand Sketches

A series of hand-drawn sketches were implemented to start forming a basis for the first 3D models. All the elements were investigated. In some cases, the coffee pot, the handle and the body were visualized as one. In other cases, they were studied individually. However, the emphasis is given to the pot first and the base will be explored afterwards.
Product semantics

From the start of this project the main emphasis is to connect the product with the idea of Greece and semantics play a major role.

Semantics were defined as an inquiry into the symbolic qualities of objects and as a design tool to enhance these cultural qualities (Kahane, 2015).

In our case, cultural and symbolic semantics are utilized to convey the desired meaning.

The prime feature which is borrowed from the classic column aesthetics is the vertical flute which runs longitudinally throughout the entire height of the column. This feature is such a strong visual cue which had to be simplified to avoid any obvious results. The classical columns are divided in three categories. The Doric, the Ionic and the Corinthian order. Among other differences, which have to do with the column capitals, the latter two orders come with 24 flutes in their shaft while the Doric comes with 20. It was decided that to simplify the base drawing, 12 sides are going to be used instead of 24 sides. However, during the brainstorming process solutions with more than 12 sides were explored.

Another subtler element of the ancient Greek architecture, which has always been present, but is never directly obvious, is the existence of fixed proportions using the number “φ”. That is the ratio of two lengths to be equal to 1.618. This is going to be used while creating the geometry of the coffee pot.

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12 https://en.wikipedia.org/wiki/Classical_order
The coffee pot

For practical reason the coffee pot has a restriction between its dimensions. Morphologically the height must be at least equal, if not larger than the diameter. Traditionally, it has circular cross section, however this is not necessarily a restriction. Therefore, the basic volumetric shape which to be used is cylindrical.

In the design brief, it was specified that the product must be able to serve four portions of coffee. Two doubles or four singles. Therefore, this requirement governed the pot dimensions.

Traditionally, the volume of water is measured per small cup for Greek coffee. Various arithmetic values were found online ranging from 50ml\(^{14}\) to 85ml\(^{15}\). Two different cups were measured and their volume was found to be more in the range of 65ml to 75ml. It was decided to take as a measuring unit per cup the 70ml. Therefore, the coffee pot needed to hold a volume of at least 280ml, to cover the 4 portions of coffee.

In the deconstruction of the competition is was identified that the an extra 4cm were added from the maximum water line to account for extra water which might be added by mistake and the rise in the height of the mix when its temperature is rising.

The final requirement, set by the cultural semantics mentioned previously, was proportionality of the dimensions. The ratio of height to diameter to be equal to 1,618.

The minimum dimensions which satisfy all three requirements was a cylinder with 7,5cm diameter and 12.1cm height. This adds up to a total 540ml volume. At first, this volume appeared to be very high, it was more than twice of the necessary volume. However, it is not very far from the standard large coffee pots which are around 480ml. Also, the additional volume would be beneficial in two ways. First different morphologies can be tried without the need to recalculate the volume. Secondly, the user could easily use it for other drinks which require larger volume, such as the preparation of a tea beverage.

Three approaches were attempted. In each approach two different versions were created. The cylindrical volume has been twisted, curved and transformed to create the novel geometries.

\(^{15}\) https://en.wikipedia.org/wiki/Turkish_coffee
The Base

The base must fulfill two requirements. To carry the electronics of the product and create a monolithic aesthetic.

With regards to the electronics, as it was identified earlier, the top part must cover the top of the pot to measure accurately the level of the mix and avoid over boiling.

The dimensions of the base are in accordance with the overall dimensions of the pot. This was the basis upon which the base was build. As it was stated, the base is only there to assist by eliminating the need for constant alertness of the user. Therefore, it is the base which must serve the morphology of brewing pot and not the other way.

Multiple attempts were made to create a base which will be able to satisfy the requirement. This included two stages. First, models were created and this lead to a general morphology. Then, three additional models were created with more detailed design to conclude into one final design.

**CA-B1**
Vertical morphology with polygonal base. The base and top part are equal. Combined with either CA1.1 or CA1.2.

**CA-B2**
Conical shape with top part to be thinner than the base part. Combined with either CA2.1 or CA2.2.

**CA-B3**
Inverted conical shape which has thinner base and can be combined with every pot morphology.
Final pot design

From the three categories, CA2.1 was decided to be evolved.

The conical shape provides more visual cues to the traditional pot than the vertical CA1 solutions which looks more modernized. The third proposal on the other hand seems too close to the traditional shape due to the convex curvature.

An interesting detail which can be seen in the CA1.2 and CA2.2 is the diagonal cut in the top part of the pot. The concept is to assist the flow when coffee is poured. This functional feature is kept. It was suggested to be further amplified to be more precise. However, that would result in the creating discontinuity in the model main lines and was rejected for the time being.

The design brief dictated that it should be used by both left and right handed people. Therefore, the pouring feature was added in both directions.

To connect the pot with the handle a groove is created so a ring can be placed. Fillets were added both internally and externally in the sharp edges to eliminate stress concentration points. The pot is not going to carry any significant load. However thermal stress can be created due to rapid temperature changes. In the design brief the easiness to clean is a requirement. Therefore, the pot should be capable of being washed immediately and there should not be a need to wait until it cools off.
The ring starts at 2 cm from the top and has a height of 2 cm. The bottom of the ring is located 4 cm from the top. This created natural line for the maximum water height inside the pot. Therefore the user can visually see the level without any the need for any extra connotations.

The final dimensions of the pot are 12.1 cm in height and 7.5 cm is the diameter of inscribed circle in the base polygon. There is a 3° inwards inclination as you move from the base upwards. The total volume finally comes down to 429 ml and the volume up to the max water line (4 cm from top edge) is 307 ml. This is more than adequate for four portions. For reference, the Beko pot has 210 ml (three portions) up to the max water line and a total volume of 390 ml. Beko also considers a cup to be 70 ml. Finally, the walls have a thickness of 1 mm.

**Connecting ring**

A ring is going to be used in order to connect the pot with the handle. The ring will have circular cross section to break the simplicity and the line of the pot angular flutes and will be manufactured from different material.

The ring is will be made out of a single piece and it will be split on one side in order to be placed around the pot.

The edges of the pot protrude outwards and the ring is going to be obstructed by these. This is the main locking mechanism.

The final design of the ring will be decided once the handle morphology is settled.
Final base design

Since the pot morphology is finalized the morphology of the base is to be decided. The CA-B2 provides a much better aesthetic balance. Creating a monolithic view which was the desired outcome.

One of the main assumptions which were made was that existing technology should be used. Therefore, the dimensions of the sensors in the Beko model were used. The top part which houses these sensors had to become thicker to be able to accommodate them comfortably.

Another aspect which was considered was that of ventilation. In the Beko model the piston at the bottom pushes the coffee pot at the top and shuts it almost airtight. Thus, the resulting steam must find a way escape. In this design, no piston is used and thus the steam is free to escape. Since no ventilation tube is required only the height of the sensor is considered. With the piston method gone space can be saved at the bottom part as well. The heat source which replaces the heated piston is discussed later.

Monolithic continuity

Combining the pot and the base a monolithic continuity was the desired outcome. Looking at the models below shows that this has been achieved.
The Handle

In the morphological study, which was performed earlier, it was identified that the handle plays a very crucial role. The traditional handles tended to be disproportionally long, horizontal and always straight. Primarily for practical reasons. More modern versions are shorter but still horizontal and straight. In the semiautomatic product, these attributes are abandoned and therefore the shape of the handle offers no visual cues to the user that this is a Greek coffee pot.

The aim is to create a product which is a blend between modern versions and traditional pots. Therefore, two different approaches were considered. In the first, the horizontal elements were abandoned and in the second experimentations were made regarding the length and diameter. From these two categories three additional models we created, in order to select one.

**H1**
A more ergonomic approach which helps the user have a better grip. The part which connects the pot and the handle is designed to fit between the index and middle finger.

**H2**
A shorter but thicker approach, provides a good grip. The hexagon cross-section creates a visual connection with the main pot morphology.

**H3**
A more classical approach with longer handle and circular cross-section.

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Figure 38 Hand drawn sketches of different handles

Inclined Handle Morphology

Straight Handle Morphology
Final handle design

It was decided to proceed with the H3 approach.

The H3 has two major advantages over the other two suggestions. The long, straight and horizontal handle, is a clear visual cue of a Greek coffee pot. In addition, the market research indicated that there is no existing semi-automatic Greek coffee machine which features a straight handle. Therefore, it is arguably a unique characteristic among the other brands.

The H1 suggestion, is very ergonomic, but it will be much harder to manufacture and has clear resemblance with existing models. In addition, it breaks the monolithic principle which has been followed throughout the project. Also, the material for the handle is aimed to be wood. The detail connecting the ring with the handle could be hard to manufacture and a potential future weakness. The second suggestion, H2, is very distinctive and different than the existing models but questions regarding its ergonomics were raised.

The final dimensions were adjusted to increase functionality and were settled at 12.1 cm length, an outer diameter of 3.5 cm on one end and 2.5 cm on the other end.

The handle has a socket to plug the connecting ring. The ring is going to be held firmly in place and restrained from moving out via a pin.
Final ring design

Since all the main elements are finally designed it is time to complete the ring details.

The rings thickness is 1.4mm and therefore ribs are added in the horizontal plane to structurally reinforce the member under bending in this direction or torsional loading. In the vertical axis, there is no need for reinforcement because the member is 1.5cm deep. One of the corners in the edge which is inserted in the handle is removed and the edges are sharpened to assist during the assembly process.

Base assembly

The base must look monolithic but for practical reason it cannot physically be on part. There must be a way for someone to open it and access the electronics.

The parts were split in edges to minimize the aesthetic impact of the splits.

Two more aspects were considered during this process. First, the manufacturing aspect which is explored in later chapters and second the easiness to clean. It was decided to move potential splits away from the steam to avoid having coffee particle stuck in the split line.
Heating source: Induction

From the early stages of this project it was identified that electricity is going to be used to heat the pot. Typically, the heating element is a resistance which heats the water up to a boiling temperature. Bimetallic heat strip thermostat is commonly used as a safety mechanism to avoid over-heating\(^{16}\). Moreover, most standard models have no control over the temperature, which is usually fixed at near boiling temperature.

The deconstructed Beko model has the same resistant heating mechanism. However, there is an important difference here with the traditional kettles. There is no bimetallic heat strip. Instead the heat source is mechanically pulled away. This helps to protect overboiling the coffee due to residual heat still left is the coil. The Greek coffee, in the final brewing phase, expands and is very sensitive of being over-boiled, hence it must be immediately removed from the heat. This action is imitated by the piston.

This method, albeit clever, has one major drawback. It requires a lot of space. In addition, the Beko model had no temperature regulator.

The solution which is proposed is to replace the resistance with an induction plate. Induction heating is a very fast and energy efficient way to heat the pot. In its essence, this method heats directly the pot instead of heating the resistance and via heat transfer the pot. Induction occurs by using a coil to create an oscillating magnetic field which creates eddy current in the pot and thus it is heated\(^{17}\). One important requirement is the pot to be made of a ferrous metal with high iron concentration.

The method has some design benefits and a few drawbacks which must be considered.

1. The ceramic plate, which is usually used on top, retains very low temperature since it is not heated in the first place. The only heat it receives is from the pot. Hence, the need to manually remove the pot when brewing is over is eliminated.
2. The low temperature of the plate reduces dramatically the safety levels of the product since it eliminates any accidents

3. It is easy to control the temperature via simply changing the frequency in which the coil operates. This is a great opportunity to provide the user with an option for a “traditional” coffee experience which uses much lower brewing temperature.

4. The required overall depth is much less that the piston version Beko uses.

The negative sides are the following.

1. A small fan is required to cool down the coil and some noise may follow after each use.
2. The cost is significantly higher than the resistance method. However, since this technology is spreading rapidly the costs is continuously decreasing.

The benefits outweigh the negatives and therefore this solution is adopted. From the design point of view, it should be noted that openings must be used for the air to escape. These opening should not be at the bottom of the product because it is going to be placed on the kitchen counter and liquids may be spilled.

Functional ergonomics and button mapping

The design brief dictated that the product should be left on the kitchen counter constantly. Therefore, the need for an on/off switch is eradicated. If the user keeps the product plugged in, it is constantly on. If the user keeps it unplugged, then he must plug it in, so he can operate it. Therefore, it will turn on automatically. Both visual and audio feedback will be provided.

Visual Stimuli

A visual signifier exists to communicate the product status. A led light will be used with the follow indications:

- White → hibernation mode
- Blue → ready to be used
- Flashing blue → preparing the coffee
- Red → an error has occurred
  - user tries to operate the product without the pot in place
  - the pot is empty

If the product is plugged in but not in use for 10 minutes, it will enter a hibernation mode. A blue led light will be on for the first 10 minutes indicating the product is ready to be used. After 10 minutes and for the next 30 min a white light is on to indicate hibernation state. Thereafter, the machine will remain in hibernation mode but the light indicator is turned off.

The induction heating method guarantees that no preparation stage is required because there is no need to preheat any resistance.
In hibernation mode, the induction coil is active and operates under very low frequency. Once the steel pot is removed and the magnetic field is disrupted, it will fully activate the machine. Same principal is applied if the user leaves the pot out of the machine for more than 10 minutes. Once the pot is placed back, the magnetic field which is generated will activate the machine.

We can see that the mechanical trigger of the Beko machine is eliminated with the use of the induction heater.

**Sound Stimuli**

Sound stimuli will be provided when the machine begins the brewing process and most importantly when the brewing is completed. No sound que is required when the user plugs the machine in power or “awakes” it from hibernating state, because all these actions must take place consciously and the visual stimuli is adequate.

**Button mapping**

The machine is automatic in terms of starting and stopping the brewing process. However, since it is desired to incorporate traditional elements an option of low heat and long brewing is added.

The temperature is automatically adjusted using the level sensors. Therefore, the brewing time exist as a variable. The user has the following two operating modes.

![Diagram of operating modes](image-url)

*Figure 47 The possible two modes of operating the machine*

The second mode of operation eliminates one step and protects the user from accidentally forgetting to turn the dial (if a dial is used) in the new position.

A designated button for the traditional slow brewing must exist since this is a different brewing option and should not be done accidentally.
The user must be able to stop the brewing process manually at any time. This could happen by pushing the main button while the brewing process is on or by simply removing the pot from the stove. The magnetic field is immediately disrupted and the coil is turned off.

To operate the machine the user must take the pot out of its place, therefore there is no need for a wake button, this can be embedded in the sensor and be activated when the pot is removed. The Beko machine operates with a similar manner.

**Button configuration and haptics**

The two buttons are configured vertically with the standard brewing option facing front since it is the most common. To differentiate the two buttons the normal mode button is larger in diameter and concaves upwards. The traditional mode concaves downwards. Also, different embroider patterns used (not modeled). The normal mode will have three concentric circle texture and the traditional mode will have one circle.

The different haptics of the buttons will also assist the visually impaired.

**Materials and manufacturing techniques**

The materials of a product are always a very delicate matter. They can convey a message, create a status and give a sense of luxury. Primarily, they must also serve the purpose of the product. There is no use to have a nice-looking plastic if it is not food graded. Also, the properties of the material play an important role. A solid and heavy material like marble would be an excellent choice, especially for a project focused on Greek antiquity, however its weight (and cost) make it very impractical. In our design brief it was specified that the product should be carried by a single person. Therefore, weight is important.

Also, the material directly affects the production method. The product is designed to be produced in large quantities and this should be considered when choosing a material.
Base

For the base, plastic is the best material. Lightweight, cheap and suitable for mass production. It is not going to come directly in contact with any liquid, however since it is in the kitchen area it should me food graded.

With regards to manufacturing, the best method for our case is injection molding. Our geometry is relatively complex so thermoforming is not a suitable alternative. This method has very high tooling cost and is only suitable for mass production. The cost can be decreased if the geometry is simplified in such a way which single split molds can be used (Thompson, 2015). The base is split in three parts and this guideline was taken under consideration. Two out of three parts can be formed without the need for a retractable core.

Coffee pot

The pot is the main element of this design and therefore multiple criteria must be met. First, the material must be heat resistant, because it will be in contact with the heat source. Therefore, plastics are eliminated. It must also be resistant to corrosion, since it will constantly be in contact with water. It must be able to be produced in mass production. Finally, it must have high concentration of iron to be used with the inductive heating stove. So, aluminum and copper alloys are rejected as materials, and so is glass. Thus, the best material for is stainless steel.
The standardized method to manufacture cylindrical cross-section would be deep drawing. However, in our scenario the top diameter is smaller than the bottom and therefore this is not an option. Injection molding is also rejected because there is no way to remove the retractable core once the pot is casted (Thompson, 2015). The solution is a production technique known as Hydrobuckling. It is similar to glass blow molding but applied to metals. There are two stages in this process. First, using typical deep drawing, a metal tube is created from a plate. In the next stage a hydraulic pump flattens the metal inside the mold and load is applied form the final shape (Lascoe, 1988). A similar technique using compressed gas is used to form aluminum parts because it has lower malleable temperature. These methods create very good surface finish and reduce the cost of secondary processes.

**Connection ring**

The ring is made of copper. The guiding decision here was the connection with the traditional coffee pot which were made of the same material. However, pure copper cannot be used because it oxidizes, a copper-tin alloy is traditionally used in these situations (Thompson, 2015). The single piece of copper can be easily produced using sheet metal cutting and bending techniques. In fact, the transitional point from the circular part to the part which leads to the handle was designed specifically with this in mind.

**Handle**

The handle will be made of wood and specifically olive tree wood. The connotation here is clear. Greece has worldwide reputation for its olive oil and the olive tree had renowned place in the Ancient Greece. It will be a single block of wood to comply with the monolithic logic of the base and will be formed using milling.
Final product description

A semi-automatic machine for the preparation of Greek coffee.

The monolithic aesthetics creates a direct link with ancient Greece and makes use of the classic Greek column archetype. Traditional elements are accommodated via the morphology of the pot (conic pot shape, pouring nozzles, long straight handle), the materials (copper ring and olive tree handle) and the certain function of slow brewing option operation. A unique feature in this type of machines and a very rare in general.

Small dimensions mean that it can be easily placed on the kitchen counter. With a very simplified and direct button mapping it does not require simultaneous hand use. Requires one push of a button to start the brewing process. With visual, audio feedback and different haptic in each button, it communicates easily the machine status. The stainless-steel pot is easy to clean and has adequate volume to serve four portions of 70ml cup. The induction heating stove prepares the coffee quickly, does not hold any residual heat, can act as an activation/deactivation trigger and can be turned off very quickly.

Three different color options are presented based on the initial mind map which was created during the visual manifestation of Greece.

Cycladic White | Aegean Blue | Olive Green

The details design sketches of the final solution are attached in the appendix.
Future steps

Regarding the further improvement of the product a few steps are suggested.

Product development

Prototypes should be created to see a physical model of the product. Due to reasonably small dimensions the product could be 3d printed in 1:1 scale using PLA at a reasonable cost. This process is especially important for the handle. Since ergonomics come into play, real models are essential to create a good handle. Perhaps all three handle suggestions could be printed to have a better comparison.

A thermal analysis is advised for the pot to see the effect of heat expansion relative to the ring. This problem was studied during the project and was identified that copper and certain stainless steel alloys have very similar thermal expansion coefficients. Nevertheless, it should still be studied.

A sustainability analysis could be conducted to identify the product’s carbon footprint.

Further explore the electronic part and how to accommodate them in the design. Unfortunately, this part was omitted in the thesis. An important assumption for this thesis, upon which many automations were based, is the possibility to accommodate an induction heater. This should be verified.

Stirring the mix was one problem which was never solved in this project. It is worthy of exploring.

Product marketing

A few ideas for the future of the product once a final version is deployed in the market are the following.

- Create a model which aims towards the professional market. With two brewing pots and a water tank. It should have the ability to brew simultaneously in the traditional brewing time and normal time in order to be more functional.
- Introduce seasonal and special editions with different color versions.
- Consider a premium version with an aluminum base body.
- Launch a combination of coffee cups, plates and a tray to accompany the product. Sell them as a set and independently.
- Further develop the existing product to have designated space for spoon sweets and side coffee treats
Conclusions

The theoretical research in nation branding identified that if designers aspire to design a product ambassador or at least create a product which conveys the true identity of the country, visual elements that provide coded references to cultural and national and identity must be considered.

In this master thesis, this position was defended using two elements of design. The **aesthetics** and the **function**. Regarding aesthetics, the product borrowed form elements from the ancient Greek heritage, materials from traditional pots and colors from the Greek landscape. Regarding function, the daily habit of Greek coffee was exploited and modern technologies were used to develop a competitive and in many aspects unique product.

Overall, the semi-automatic coffee machine which is proposed fully satisfies the design brief. The aesthetic values of ancient Greek architecture are effectively communicated and the product’s final design answers to a series of questions.

Bibliography


Appendix

Detailed technical drawings of the final solution
A flair of Greece