Emotional Food Design

Triggering emotions through associations between different sensory plans

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Abstract: This paper is the result of a study based on theories and principles arising from Emotional Design and Food design. Its main objective is to analyse the connection between emotional triggers (shapes), flavours and emotions. We believe that the comprehension on user experience concerning the connection among the sight of a shape, a possible flavour and the emotion both senses invoke might aid designers to properly accomplish products that are innovative, emotionally powerful, able to establish bonds and create memorable experiences. Therefore, data collection was based upon a survey whose sample covered 250 Brazilians who were asked to firstly connect (if possible) shapes to flavours and then emotions to shapes under two nominal-visual scales. Chi-squared analyses have shown that there are significant associations between shapes and flavours since some of them are over-represented in comparison to the estimated expected frequency (positive residues). It has been concluded that researches in Emotional Design and Food Design can benefit from the data presented in this study as it would allow designers to better outline, prototype and accomplish more substantial, innovative and organized product-systems. We suggest continuing researches on the topic, focusing on the appreciation of specific emotions through manipulating visual triggers and their respective associated flavours.

Key words: food design, emotional design, experience design, gastronomy, emotional triggers.

1. Introduction

The Gastronomy research field faces a new dilemma: how does the food choice of consumption relate to the changes that users go through nowadays? The act of feeding oneself is no longer only based on someone's physiological needs – food, as we know it, has been developed into a series of complex variables, such as cultural identity, health issues, social status, environmental impact, emotional value and many other levels of experience.

Our research is based on a post-modern context of consumption, which, according to Lipovetsky [18] transforms society through the *here-now* hedonic culture. Such culture is also named by Pine and Gilmore [20] as *Experience Economy*. Said economy has evolved from the consumers' needs through changes in family structures and work environments. This economic moment values interaction, contact between users and products and, above all, consumption experience.

Since we needed to develop an understanding of our final user for the sake of our future designs, we have chosen to firstly work with the intangible aspects of an experience to deepen our efforts on the tangible and more concrete aspects of a certain product or service. Therefore we recurred to the Design area of knowledge in order to first:

   i. To study the relationship between Food and Design;

  ii. To define our innovation path by applying Emotional Design theories to our data collection;

 iii. To analyse how the association between different sensory plans could be applied to design food system products.

This research is aimed at measuring associations between shapes and emotions, and shapes and tastes. For achieving the such purpose, we have studied emotional values and its associations with *taste* and *sight*, while considering the effects of expectation on someone's perception. To define *expectation* and *perception*, we have chosen to apply the concept of *emotional triggers*. *Triggers* are responsible for activating emotions and can be defined as any stimuli that may cause emotional reaction on the user. In a gastronomic context, they can be perceived through lighting effects, cutlery design, smells, textures, tastes, images, sounds, among others. The data was obtained throughout a survey in favour of broadening the theory under the Design Emotion and the Food Design category.

2. Food Design

In order to discuss the relationship between food and design, it is vital to firstly contextualize the history of Gastronomy. Brillat-Savarin [6] narrates that the professionalization of cookery is relatively recent and defends that the development of establishments occurred during the early XIXs in France, spreading throughout the rest of Europe later on.

This expansion took several decades and it was composed of a few distinct cultural movements, such as:

  i) *Grand Cuisine*: with the popularization of the concept of restaurants in the late XIXs, agricultural technologies innovations, better food preparation and storage techniques were developed. Cooks like Talleyrand, Maistre Chiquart, Bartolomeo Scappi, Carême and Scoffier became icons of that generation. During this period of time, exquisite and fancy banquets were created, along with meticulously designed pastries and waiter services specializations - such as the Russian style: when the dish is finalized in front of the client;

  ii) *Nouvelle Cuisine*: during the 70s, chefs like Fernand Point, the Troisgros brothers, Alain Chapel, Paul Bocuse and Louis Outhier led a movement that prioritized the enlightenment of Gastronomy. In order to achieve their objectives, food preparations became simpler and yet more refined. The sauces were lighter, dishes were being served in individual portions and the aesthetics of the meal became even more important for that matter;

 iii) *Molecular or Technoemotional Gastronomy*: inspired by the enlightenment suggested by the French chefs during the Nouvelle Cuisine, cooks around the world started to further develop their techniques and perfect traditional recipes. Open-mindedness and innovation were the main topics of discussion during this period. One of the notable pioneers of this movement was chef Ferran Adria, who became the leader and an inspiration for many fellow cooks around the world. His style of designing new products was rather innovative, as he created a multidisciplinary environment in which chemists, food

engineers, sociologists and designers could collaborate to conceiving new ways of preparing and presenting food. This movement started at the same time that Pine and Gilmore [20] published their work regarding the Economy of Experience – not coincidentally, the experience of dining became as important as the dish itself hence driving chefs and other restaurateurs into researching and developing food in ways that were not considered so far;

iv) *Mass production*: alongside the high end cuisine movements, the fast-food business continued to grow and endure several economic crises to the extent that Interbrand [23] stated, in 1997, that Ronald McDonald, mascot of the famous fast-food chain, was more recognizable than Santa Claus. The fast-food canvas was a clear model of technification and all things related to daily life, such as shortage of time to have a proper meal in favour of our financial stability. Baudrillard [4] interprets the phenomenon of fast food as a result of an urban and industrial misery, in which everyone runs because they forgot the way to stop;

v) *Resistance movements*: as an alternative to the mainstream food business, a few trends gained strength during the past decades. The Locavores and the Slow Food association are some of the examples. The Locavore movement started in the United States of America and has been globally expanding through groups that preach about sustainability and green consciousness [5] The word *locavore*, created by Jessica Prentice [5], defines the movement as the consumption of food produced in a hundred mile range. The goal of said movement is to support local communities that maintain environment friendly produce (from gardens to small farms). Such production may cause users to avoid consumption of out of season products - that are usually carried from one location to another – and end up preserving local economy.

vi) *Slow Food*: it is an international movement founded by Carlo Petrini in 1986. It promotes cherishing traditions and regional cooking from the consumption of local ingredients. Firstly, it was a movement created as a way of resisting to the launching of a MacDonald's franchise next to the *Scalinata della Trinità dei Monti*, in Rome. Currently, the movement has over a hundred thousand members in 130 countries.

From the presented scenarios, Food Design and its approaches through design and and to the food industry will be now further discussed. According to ADI [1] Food Design is a field culturally more aware of product design, in which food and its tools work side by side. Therefore, the consumption of a product is driven by a mixture of tangible or intangible properties that comply with the users' conditions.

Food Design is a new area and more specific studies on the subject are noticed in the Design field only in the last decade. The first scientific congress took place in July 2012 in London. We could also mention Salone Internazionale del Mobile and the polytechnic institutes in Turin and Milan as essential disseminating and provoking agents for the generation academic knowledge in the area. The area bases its employment according to the groundwork of Arts, scientific knowledge towards food, Graphic Design, Product Design and multisensory research. It would ideally be an area dedicated to generating knowledge for the innovation of aesthetic expressions and increase aesthetic experience. In a manifesto, ADI [1] points out that, according to phenomenology, certain movements that were conceived from design culture – such as Show Food, Food Art,

Media Food, Concept Food, among others – are only ways of spectacularization of Food Design itself and should not be confused with the discipline.

Research on this new area is performed around themes such as ergonomics, contextualization, functionality, problem solving, productivity, innovation, user satisfaction, aesthetics and others. On the other hand, it is applied under three aspects [1]:

i) Design of places or tools to produce or consume food;

ii) Food design (development of products based on natural ingredients);

iii) Design capacity (development of tools or systems to manage food business).

Said movements and how Design is intertwined with them are better represented on the figure below:
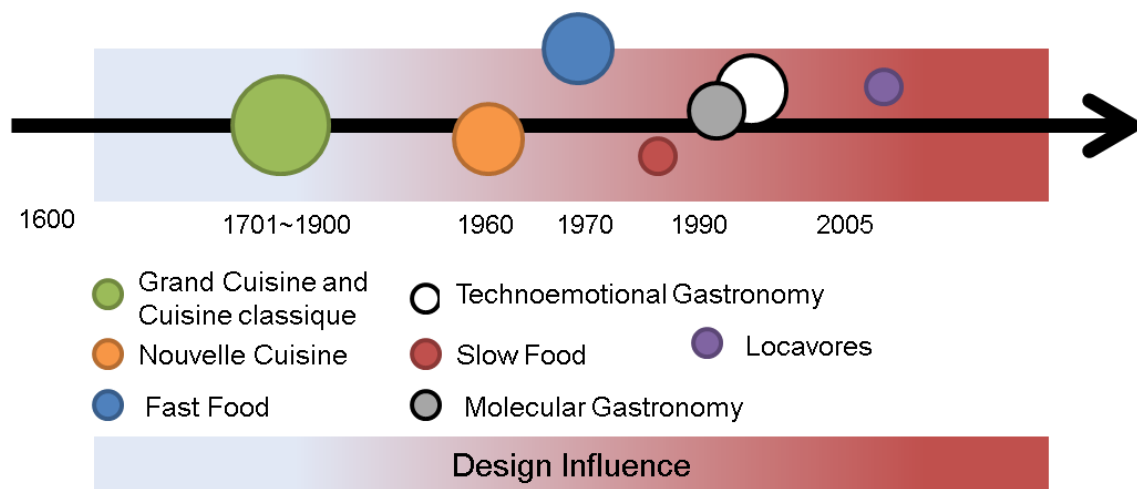

Figure 1. Timeline of the influence of Design in Gastronomy.

With our framework of Gastronomy and Food Design set, we can advance our discussion to where exactly this study lands and what we intend to accomplish in the end.

Based on our brief contextualization we understood how the trends in the Gastronomy history modified our daily routine and how restaurants, large fast-food chains and other movements emerged to fill, support or reclaim our needs and beliefs towards food. We also established that the relationship between Gastronomy and Design is still a work in progress. Food Design, as we currently know, will hopefully grow, evolving into a field that incorporates not only excellence in research and development but innovative strategies during the early stages of ideation and prototyping. In pursuance of this vision, our study focused on possible market differentiation through the stimulation of emotions by triggering them as a result of a carefully planned association between different sensory plans, in this case between sight and taste.

In the next chapter, we will investigate the field of Design Emotion and how expectations and perception play a crucial role during the appraisal process of resulting emotions.

3. Designing for emotion

To conceptualize Design Emotion, we will firstly turn to Norman [19]: human beings are complex animals and their structure is even more so. They are conscious about their role in the word and can reflect upon past experiences in order to keep on learning and be successful in the future. Design Emotion's main objective is to,

therefore, understand the role of emotions in such a complex reality and apply them to developing and improving products, processes, services and experiences. For that reason, it is necessary to design and idealize concepts for specific emotions, to apply methods and theories for trigger or avoid certain emotions. Desmet e Hekkert [12] describe how any design will end up evoking emotion through the designs themselves or because of their designers, even if the project does not have that intention. A design's interface may me planned to be neutral, but that does not mean that its effects would be so. Therefore, to study the user's emotional reactions might bring great benefits to designers. Understanding which the most effective variables when evaluating a product are through its interaction and experience furnish the designer with inputs so that innovative results are more frequently and successfully obtained.

The Design Emotion field of research is compounded by studies from two distinctive areas of expertise: Design and Psychology. For our research, we selected the origins of our emotions per se – how they are triggered and why our expectations and perceptions influence the outcome of the experience - from the Psychology field. From the Design field, we deepened our groundwork on how emotions could be taken into consideration when designing a new product or service while stimulating specific ranges of emotions. The figure below summarizes the authors used in our research and how the fields of Design and Psychology are implicated.
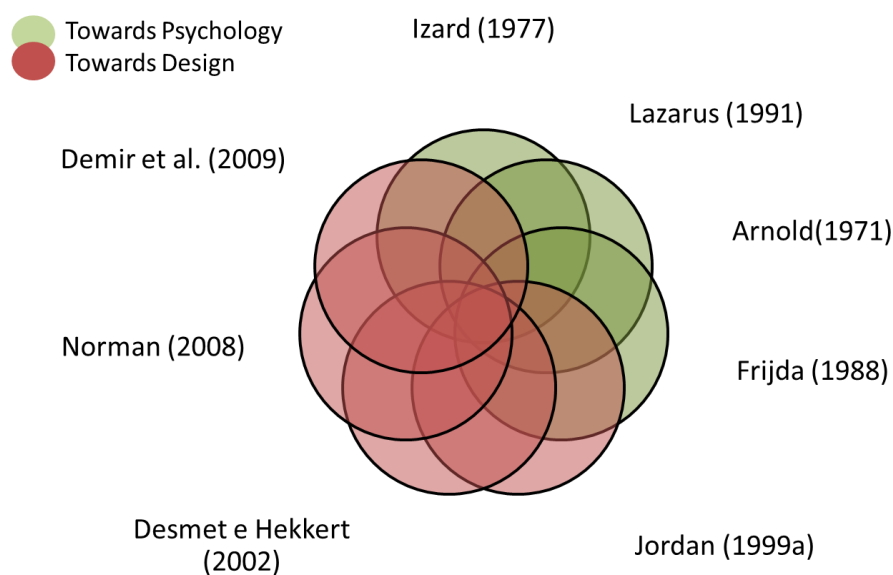

Figure 2. Psychology and Emotional Design authors.

The figure's main intention is to organize a mental model regarding the theoretical roots on emotions and Design. It is necessary to point out that representational items – such as colours – do not have a relevant order and do not rank the studied authors.

The Appraisal Model suggested by Desmet e Hekkert [12] aids designers to develop products that focus on possible resulting emotions. It means that it could be possible to successfully stimulate a x range of emotions and discourage y emotions (x being positive emotions and y negative ones). Figure 4 better explains the Appraisal Theory.
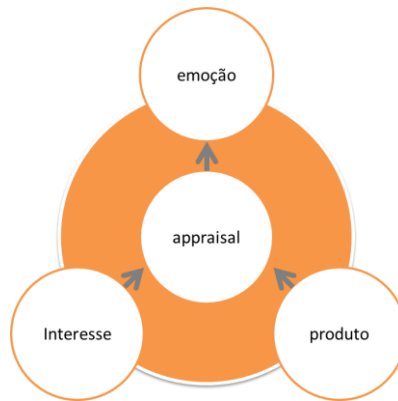
Figure 3. The Appraisal Theory [10].

The appraisal process described by Desmet and Hekkert [12] takes the influence of *expectations* and *perceptions* into account. While not show on the model above, both are embedded in the concern area and play a vital role during the decoding of any experience we might have. Expectations are described as subjective notions of things or situations that are still to come [2]. It is a kind of hypothesis formulated by any individual and it is evaluated by perception and judgement, which are defined to assess whether the hypothesis was right or wrong [2]. Perceptions, on the other hand, are described as mental impressions and are specific of an object, product or stimuli [7]. According to Anderson [2], perception has got four main characteristics: it is selective, it moves through meanings, it is set by personal reasons and it depends on stimuli.

Bruner and Postman [7] had already characterized stimuli. The authors state that a stimulus does not act on an indifferent organism and there is not *anoetic sentience* – in other words, thoughts that are not subject to consciousness. A perceptive organism is in either way in an expectancy state in relation to an environment and a context as "[…] the perceptual effect of a stimulus is necessarily dependent upon the set or expectancy of the organism" [7].

It is from this concept that the authors articulate that, for a subject to investigate perceptions, it is necessary to research the users' expectation. This way, the understanding of expectations and perceptions are essential for this research because of the following reasons:

i)   Food experiences can engage various meanings at the same time, which are triggered through the stimulation of our perception;

ii) Both expectation and perception are important factors to the development of an experience between user and product;

iii) Perception goes hand in hand with expectation, which on its turn walks side by side with experience or interaction performance. Therefore, the interpretation of said components may aid answering the general and specific goals of the investigation.

4. Data collection

In pursuance of answers regarding the triggering of emotions after the association between different sensory plans, we conducted a survey, which asked to our interviewee pair shapes to emotions and shapes to flavours. Below we have illustrations of the shapes and the list of emotions and taste available. After a non-statistical convenience sampling we had a total of 250 valid answers obtained through a qualtrics.com survey. All of the respondents were Brazilians and the results were compiled using SPSS.
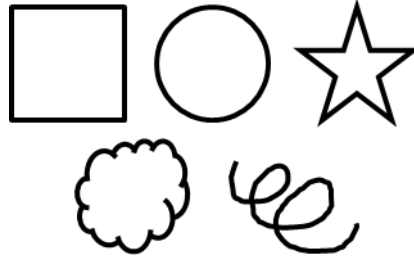
Figure 4. Shapes: square, circle, star, free circle and spiral.

Our survey sought for information on previously published studies in the area. Ramachandran and Hubbarb [21] obtained results that proposed the formulation of the hypothesis that the human brain is able to extract abstract properties of shapes and sounds. The shapes we have chosen for this survey were inspired by the experiment by Chou et al [8], in which researchers related the shapes of food packaging and their imagined flavors. The authors concluded that users can make associations between flavors and shapes, specially when the shape regarded the packaging itself – the user's first contact with the product. Spence [22] discloses general hypotheses for the associations between shapes and their consequent impacts on how food tastes. The author interprets the data through symbolic analyses and justifies our choices as representations of subliminal matter – such as what is pleasurable and advantageous to our emotional state. The researches have also used oral somatosensory system definitions to describe said association process, motivated by what is pleasurable. Accordingly, we have chosen basic geometrical shapes as a means to collaborate with such researches and to use the results for extending the research to 3D objects in the future.

Table 1. Sensory plans and emotions.

1st SENSORY PLAN	2nd SENSORY PLAN	
Sight	**Taste**	**Resulting emotions**
Square	Salty	Disgusted
Circle	Acid	Happy
Star	Sweet and sour	Aggressive
Free circle	Spicy	Bored
Spiral	Sweet	Worried
x	Bitter	Nostalgic
x	Sour	Interested
x	x	Safe
x	x	Free
x	x	Challenged
x	x	Calm

Five different shapes were randomly sorted and added to the survey along with five traditional flavours – except for umami, which still is not considered a known flavour to most people. The chosen types of chosen flavours and shapes are secondary when we consider the main objective of this paper, which is to verify the

correlations between shapes, flavours and emotions. We recommend that, in future researches, specific emotions should be chosen in order to check stimulation or discouragement for each of them.

5. Results

Based on the results exposed in Table 1 and the on chi-square analyses, it is possible to state that there is a series of meaningful associations between flavours and shapes. The chi-squared result indicates whether the associations between such elements. In the residual analysis, it is important to observe that the terms *overrepresentation* and *underrepresentation* are used when the results are compared to the expected average frequency. The residual analysis will reveal whether certain shapes were overrepresented in each flavour, indicating that they could not represent flavour while observing negative residues.

The association between *salty* and shapes is significant (χ^2=157,47, p<0,001), since *circle* is its most characteristic element as it was overrepresented. *Square*, *star*, *spiral* and *free circle* are underrepresented.

There is significant connection between *acid* and shapes (χ^2=71,25, p<0,001). *Square* and *star* are the most meaningful elements as they are overrepresented. *Circle*, *spiral* and *free circle*, on the other hand, are underrepresented.

Sweet and sour is significantly linked to forms (χ^2=21,07, p<0,001), since *star* and *spiral* are their most significant elements. *Circle*, *square* and *free circle* are underrepresented.

Spicy is significantly associated to shapes (χ^2=256,27, p<0,001). *Square* and *star* are the most significant elements towards this flavour, as they are shown to be overrepresented. *Circle*, *spiral* and *free circle* are underrepresented.

Sweet is significantly associated to shapes (χ^2=237,02, p<0,001), since spiral was its most representative element (turning out to be overrepresented). *Circle*, *square*, *star*, *spiral* and *free circle* are underrepresented.

Bitter is associated to shapes (χ^2=53,18, p<0,001) and *circle*, *star* and *free circle* are the most representative elements, interpreted as overrepresented. *Square* and *spiral* are underrepresented.

Sour is also significantly linked to shapes, since *square*, *star* and *free circle* are overrepresented (χ^2=37,12, p<0,001). *Circle* and *spiral* are underrepresented.

These results are better shown in the table below.

Table 2. Associations between flavours and shapes.

	Salty			Acid			Sweet and sour			Spicy			Sweet			Bitter			Sour		
	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual
Circle	99	34	65	20	42.6	-22.6	20	36.2	-16.2	17	44	-27	6	25.2	-19.2	77	41.8	35.2	36	42.6	-6.6
Square	24	34	-10	75	42.6	32.4	29	36.2	-7.2	135	44	91	14	25.2	-11.2	24	41.8	-17.8	45	42.6	2.4
Star	18	34	-16	70	42.6	27.4	48	36.2	11.8	47	44	3	8	25.2	-17.2	49	41.8	7.2	70	42.6	27.4
Spiral	12	34	-22	20	42.6	-22.6	53	36.2	16.8	8	44	-36	94	25.2	68.8	17	41.8	-24.8	15	42.6	-27.6
Free circle	17	34	-17	28	42.6	-14.6	31	36.2	-5.2	13	44	-31	4	25.2	-21.2	42	41.8	0.2	47	42.6	4.4
Total	170	-	-	213	-	-	181	-	-	220	-	-	126	-	-	209	-	-	213	-	-

According to the results exposed in Table 1 and the chi-square analysis, it is possible to state that there is a set of significant associations between emotions and shapes. As it was indicated previously, the chi-squared analysis express whether the association between emotions and shapes can be meaningful following the same parameters as in the previous analysis.

There was meaningful associations between *disgusted* and shapes (χ^2=195,19, p<0,001). *Star* and *free circle* were its most significant elements, as they were overrepresented. *Circle*, square and *spiral* were underrepresented.

The association between *happy* and shapes was meaningful as well (χ^2=228,13, p<0,001). *Square* and *spiral* were the most significant elements in this connection, as they were overrepresented. *Circle*, *star* and *free circle* were underrepresented.

Likewise, *aggressive* had a meaningful connection with shapes (χ^2=54,76, p<0,001). *Square*, *star* and *free circle* better configured the emotion as they were overrepresented, while *circle* and *spiral* were underrepresented.

There was a significant link between *bored* and the presented shapes (χ^2=144,78, p<0,001) and *circle* was its most meaningful element (overrepresented). On the other hand, *square*, *star*, *spiral* and *free circle* did not represent the emotion (underrepresented).

Worried was also meaningful to shapes (χ^2=42,91, p<0,001). *Circle* and *star* were its most significant elements and showed to be overrepresented, while *square*, *spiral* and *free circle* were underrepresented.

Nostalgic was significantly connected to shapes (χ^2=69,22, p<0,001). *Spiral* was its most meaningful element, as it was overrepresented. *Circle*, *square*, *star* and *free circle* were underrepresented.

The association between *interested* and shapes was meaningful as well (χ^2=63,27, p<0,001). *Square* and *free circle* were the most expressive elements towards the emotion, while *circle*, *star* and *spiral* were underrepresented.

Safe has shown to be significantly connected to shapes (χ^2=180,18, p<0,001). *Circle* was the most representative element as it was overrepresented. *Square*, *star*, *spiral* and *free circle*, on the other hand, were underrepresented.

Free is an emotion which was meaningfully associated to shapes (χ^2=85,70, p<0,001). *Star* and *spiral* were its most significant elements as they were overrepresented. *Circle*, *square* and *free circle* were underrepresented.

The link between *challenged* and shapes was significant (χ^2=51,62, p<0,001) and *square*, *star* and *free circle* were overrepresented. On the contrary, *circle* and *spiral* were underrepresented.

Calm was also strongly associated to shapes (χ^2=126,70, p<0,001). *Spiral* was its most meaningful element as it was overrepresented, while *circle*, *square*, *star* and *free circle* were underrepresented.

The following table shows such evidence.

Table 3. Associations between emotions and shapes.

	Disgusted			Happy			Aggressive			Bored			Worried			Nostalgic		
	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual
Circle	25	41.8	-16.8	7	33.6	-26.6	26	42.2	-16.2	95	34.6	60.4	68	40.2	27.8	19	36	-17
Square	8	41.8	-33.8	108	33.6	74.4	61	42.2	18.8	4	34.6	-30.6	19	40.2	-21.2	29	36	-7
Star	119	41.8	77.2	12	33.6	-21.6	69	42.2	26.8	33	34.6	-1.6	56	40.2	15.8	29	36	-7
Spiral	14	41.8	-27.8	38	33.6	4.4	11	42.2	-31.2	24	34.6	-10.6	28	40.2	-12.2	80	36	44
Free circle	43	41.8	1.2	3	33.6	-30.6	44	42.2	1.8	17	34.6	-17.6	30	40.2	-10.2	23	36	-13
Total	209	-	-	168	-	-	211	-	-	173	-	-	201	-	-	180	-	-

	Interested			Safe			Free			Challenged			Calm		
	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual	Observed	Expected	Residual
Circle	20	33	-13	78	22	56	7	37.4	-30.4	28	41.2	-13.2	19	22.8	-3.8
Square	72	33	39	11	22	-11	26	37.4	-11.4	63	41.2	21.8	9	22.8	-13.8
Star	20	33	-13	3	22	-19	68	37.4	30.6	62	41.2	20.8	5	22.8	-17.8
Spiral	18	33	-15	11	22	-11	67	37.4	29.6	9	41.2	-32.2	70	22.8	47.2
Free circle	35	33	2	7	22	-15	19	37.4	-18.4	44	41.2	2.8	11	22.8	-11.8
Total	165	-	-	110	-	-	187	-	-	206	-	-	114	-	-

In the final chapter, the conclusions for this research will be presented whereas possible ways to continue our research towards gastronomy, experiences and sensory plans are going to be discussed.

6. Conclusion

Considering our results, we can elaborate a few strategies in order to benefit both Food Design and Emotional Design projects. As seen earlier on, there are significant relationships between shapes, taste and emotions. With the data collected it is possible to suggest our fellow designers, chefs and other professionals to work around the expectations and resulting emotions involved in food experiences. For instance, it could be suggested that sweets shaped as spirals would reinforce the sweet attribute and deliver happiness as the resulting emotion.

The key of correctly using the acquired data stands on knowing what our user usually expects about a certain shape, its possible taste and how it would make them feel. There are a couple of ways to ideate a new product:

i. Picking a specific type of emotion that you would like to stimulate (such as *freedom*) and work with the associated shape in our projects. In this case, *star* and *spiral* shapes could be used on packaging, aesthetics of the product, and so on;

ii. Picking a specific type of taste (such as *spicy*) and work with the associated shapes. In this case we could also use *star* and *spiral* to reinforce the mentioned taste;

iii. We could also pick a specific type of shape, such as *square* and see what kind of taste and emotions it would trigger. In this case the possible emotion triggered would be *interested*, *challenged* and *angry*. On the other hand, the tastes would be *acid*, *sour* and *sweet and sour*. This process of ideation could be more efficient when deciding what type of ingredients and overall content of a certain recipe since we could dismiss the other types of taste.
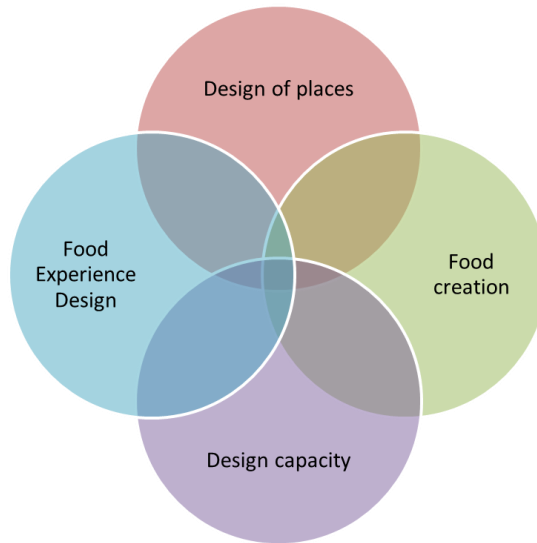
Figure 5. Food Design Realm.

While rethinking the three proposed aspects by ADI (Design of places, food design and design capacity), we are able to convey the inclusion of a research and development topic for Food Design (Figure 5). Such issue is already well-known to Design as a whole: Food Experience Design focusing on the expectations, perceptions and emotions that result from interactive processes among subjects, products, objects, places, product-systems and so on.

When deepening our studies towards experience, perceptions and emotions, we can get closer to the final user and design according to its needs and desires. Long and medium term experience innovation and positive memory building is then achieved through associating different sensory plans. This purpose is especially important when we dialogue with objects or services related to Gastronomy, since food stimulates many (or all of the) sensory channels: touch, smell, hearing, taste and sight. The association between such channels and their resulting intangible variables is not, however, a current topic of research.

We strongly believe that the possibilities on innovative projects related to the Gastronomy field should have, as a starting point, the development of empathy towards the user and further employment of the emerging knowledge in transdisciplinary environments.

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