

POLITECNICO DI TORINO

Corso di Laurea Magistrale
in Ingegneria Gestionale

Tesi di Laurea Magistrale

Digital affordance: analysis in the case of food delivery



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Anno Accademico 2020/2021

Abstract

The notion of affordance was introduced by Gibson (1977), according to whom it is the users' perception of the relationship between them and an object. Despite the growing interest in promoting an affordance-based approach to the design of artefacts, the literature on the subject is still scarce and presents various ambiguity elements. Moreover, research on affordance in digital contexts is still poor. Finally, previous affordance models and theories do not include the users and how the characteristics of the environment are captured.

A joint research by Politecnico di Torino and Politecnico di Milano (2020) attempted to provide a contribution to previous research. Hence, the study proposed an operational protocol on which to build the analysis of digital affordances and conceived digital affordance as composed by sensory and experiential perceptions.

As part of this study, a questionnaire was administered with the objective of testing the precedent conceptualization of digital affordances being either related to senses or to experiences. The test was conducted on the use-case of food delivery. The result was not satisfying enough to confirm the categorization of sensory and experiential affordances. Consequently, after having detailed the previous study, a new categorization into Navigation, Information, and Interactivity affordances was proposed, following the results of (Shao et al., 2020).

In parallel to this, the literature was revised in the attempt of reconstructing a theoretical basis for the development of a user-discovery map. The depicting of a picture of the user was completed through a semantic analysis of multiple reports from Glovo, one of the main European players in Food Delivery. As a result, three moments of interaction (pre, during and post) were linked to Behaviour Intention (BI), Use Behaviour (UB) and Satisfaction with Use (SU). Hence, by adjusting the UTAUT2 theory (Venkatesh et al., 2012), a model for linking behaviour predicting factors to BI, UB and SU was proposed. Subsequently, this model was tested through two focus groups and sixteen interviews. The model aims to empathise the role of the user in affordance-based evaluations of digital systems.

Finally, with the objective of providing indications to the engineering design, the results of this research were synthesized and critically analysed. More precisely, insights on the prioritization and identification of the affordances are offered.

This work aims to improve and enrich the research works related to the affordance applied to digital artefacts. It thus details the notion of digital affordance and suggests an approach for the identification of the role of the user.

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1 Introduction

The problem

An Affordance is the relationships established between a user and an object within an environment (J. Gibson, 1977). For D. Norman (1998), by studying the affordances that an object could transmit to an actor, it is possible to define a system architecture that allows the user to interact with an artefact. Consequently, the study of the affordances of a digital artefact could offer an analytical basis for hypothetical proposals for improving the quality of the digital system on which designers can reflect.

The theoretical basis of the concept of affordance seems to have the potential to effectively support the design process, even in case of new digital artefacts and the digital systems they enable (Litern, 2010). Thus, the conceptualization of affordance can be used as an instrument to evaluate and guide the product development process, through a continuous process of testing-feedback-corrections. However, despite the nascent line of research that attempts to promote an innovative approach to the design of digital artefacts, it has not found any critical analysis to highlight and formalize the link between affordance and digital artefacts' design. Moreover, despite the growing interest, the literature on the subject is still scarce and presents various ambiguity elements. Finally, several studies state that it is not possible to generalize the problem of designing digital artefacts and, specifically, not with the use of the concept of affordance.

Furthermore, as Sengers and Gaver (2005) noted, historically in HCI systems and their features are designed mainly to convey the designers' meanings and interpretations to the users. The designers would decide what possibilities and opportunities should be offered to the end-users. From the cognitivist viewpoint, this means that the authoritative viewpoint of the designers determines the system affordances. Only in the last few years, approaches such as usability engineering, participatory design, ethnography, etc. have been the driving force for designing systems with more user focus. The concept of affordance, however, has faced only minor changes through some activity-centred perspectives (Baerentsen, Trettvik 2002) and the authoritative view of designers has remained unchanged. Information elicited from users could be used to identify affordances as well as create user models. The overall approach introduced by (Maier and Fadel 2003) provides a starting point for the creation of a bridge between methods for user needs capturing and affordance. However, several shortcomings of this study inhibit the capturing of user needs with an affordance-based approach. First, it is unclear who the users are and what affordances they want the artefact to have. This information can be captured with a list (Maier and Fadel 2009), but a complete model structure would inherently contain it. Additionally, it has remained unexplored how the operating environment and user characteristics can be captured, either within the model or in a separate construct (Cormier et al., 2014). Finally, none of these studies focuses on digital artefacts.

Thus, a work conducted in the context of a joint research by Politecnico di Torino and Politecnico di Milano (2020) aimed at formalizing an approach to the design of digital artefacts by exploiting the analysis of perceptions arising from the interaction between a user and an artefact within a digital system. To achieve this objective, a conceptualization of digital affordance was proposed, which is derived from the intersection of the properties of digital artefacts with the notion of affordance in the HCI literature. The definition wanted to offer a modern point of view on how digital objects present themselves, emphasizing the role of both sensory perceptions and perceptions related to experience. In addition, the work proposed an operational protocol on which to build the entire analysis of digital affordances (from their identification to a qualitative or quantitative evaluation). Nevertheless, the conceptualization of digital affordance was derived by previous literature referring to affordance associated with physical artefacts, which are different from digital ones by nature. In addition, the notion of digital affordance and the analytical approach proposed for the analysis of the affordance was tested considering the perceptions of a single user. Since affordance is a subject that evaluates perceptions, which are subjective, it has emerged the necessity to expand the sample of respondents to support the relevance and validity of the findings.

The aim of this work

The goal of this work is to support research that introduces a modern point of view to support the development process of digital artefacts, based on the notion of affordance. To achieve this, we first aim at challenging the notion of digital affordance proposed in a previous study conducted in conjunction between Politecnico di Torino and Politecnico di Milano. The goal is to verify whether it adequately describes the set of relationships that exist between an actor and a digital artefact within a digital system. Then, we intend to capture who the users are and what affordances they want the artefact to have. Finally, we aim to contribute to the formalization of an affordance-based method for the design of digital artefacts.

This implied:

- Conducting on-field research to obtain an empirical analysis that can support the validity of the notion of digital affordance by the previous study and provide objective evidence of the results.
- Proposing a user-discovery map on which to build the evaluation of the interactions between the user and the digital artefact.
- Critically analysing the results of the study and thus proposing some indications for the engineering design.

The study wants to represent a new starting point within "Perception Design", with the challenge of trying to define a theoretical basis for further studies. Moreover, it is proposed to include users (what they want from the artefact, how the external environment influences the relationship, which factors influence their behaviours) in the Affordance-based models and Engineering Design theories. The

results (if any) could lead to the exploitation of the acquired knowledge to build elaborate service based on the use of Affordance.

The methodology

The approach to the problem was based on both the analysis of literature and empirical research. In order to reach the goal of the study, the use-case of the online-food-delivery (OFD) service was considered.

For the aim of this study, the work by (Vyas et al. 2006) has been of fundamental. They proposed an interaction-centred viewpoint of affordance, which is called Affordance in Interaction. This means that the affordances of an artefact are not the properties of the artefact but a relationship that is socially and culturally constructed between the users and the artefact in the lived world. Thus, in this study interaction with the system was decomposed in three moments (which correspond to different timings of interaction): Prior (ex-ante); During (simultaneous to); Post (ex-post) Interaction. Subsequently, these “moments” were linked respectively to behaviour intentions (BI), use behaviour (UB) and satisfaction with use (SU). This passage served to connect the notion of affordance to the discovery of the user.

An extensive review of existing literature was conducted to uniquely identify behaviour and satisfaction predictors. This eventually led to the definition of a model which could track the main predictor factors for the considered service. Subsequently, the model was integrated by conducting multiple rounds of primary research (interviews, semantic research, focus groups, etc.). The adjustment and validation of the underlying hypotheses followed.

Additionally, this work focuses on verifying the notion of digital affordances proposed in a joint research by Politecnico di Torino and Politecnico di Milano (2020). Thus, though the administration of a questionnaire and subsequent studies on the results, the operational protocol on which to build the entire analysis of digital affordance was tested.

Structure of this document

The document consists of five chapters, excluding the introduction and the conclusion.

The first chapter is for the contextualization of the problem and the introduction of the notion of affordance. Indeed, a roundup of various definitions of affordance is provided. The chapter opens with the presentation of the concept of affordance, in its most traditional version; it continues by presenting the concept of “affordance in interaction” and the notion of “goal-orientation”; subsequently, it describes affordance in the context of HCI. Then, a section is dedicated to the description of digital affordance and the relative evaluation method, as proposed in the precedent study. Finally, it focuses on the problems of adopting the conceptualization of affordance to engineering design and on the user’s role.

The second chapter is devoted entirely to the literature review, which is divided into four parts. The first part is dedicated to the definition of BI, UB and SU. The second part presents a collection of behaviour predicting factors (namely convenience, hedonic motivations, external influence, trust and facilitating conditions). In the third section, the UTAUT2 model is presented, which served as a basis to represent the critical factors and contingencies related to the prediction of behaviour and satisfaction. Finally, an overview of the main predictor discovered and covered by prior literature in the field of online food delivery services is given.

The third chapter describes the theoretical basis and hypotheses for the user-discovery map developed in this study, which is furthermore described in its initial version (V0).

The fourth chapter focuses on the presentation of the considered use-case. It provides various definitions of food delivery services and represents insights on key trends, with a specific focus on Italy. Then, it describes the various rounds of on-field research which were conducted in this study. Finally, it focuses on some architectural details of the service.

Finally, the fifth chapter is the presentation of the main findings of this research. The chapter is divided into three phases, which reflect the three research questions of this study. In the first phase, by studying the results from the questionnaire and the interviews, the method for analysing the digital affordances proposed in the previous research is tested and detailed. In the second phase, following a progressive approach, the developed user-discovery map is adjusted, so that to integrate feedbacks from the users, and the underlying hypotheses are tested. Finally, in the last part, the main findings of the various on-field-research rounds have been summarized, to deliver some indications and notes for the designer.

The conclusion consists of a summary of the main aspects of the work. Finally, the limitations of this work are presented, on which future research should focus to provide greater validity to the findings.

2 Definition of Affordance

2.1 Conceptualization of affordance

The term Affordance was coined in 1977 by J. Gibson to explain how animals were able to grasp the intrinsic meaning of an object using simply sensory perception, without resorting to any kind of reasoning. The definition emphasizes the complementary relationship existing between the substance and the animal, a relationship that is totally independent of the effect that is generated, and which is enabled through the use of the senses. The animal perceives the affordances, which are enabled by some physical features (size, surface, material, etc.) and which must be perceptible to the animal (Gibson, 1977). In this sense, Gibson theorized affordance as the perception, originated by the senses, that users have of the established relationship between them and an object within an environment

This idea was later used by D. Norman (1988) in the field of Engineering Design. Norman understood that by studying the perceptions that an object transmits to an actor it is possible to define a product architecture that is intuitive and usable. Norman then reformulated the concept of affordance as follows: "It is the result of an interpretation of an object, built on the experience and knowledge that we apply to its perception".

Gibson explains that affordances are independent of perception; in other words, they exist whether they are perceived or not and whether we pay attention to them or not. They are intrinsic to the key properties required for perception (Gibson, 1986: 143). For Norman (1999), affordances are of little value if they are not visible to users. Moreover, if we look closely at user behaviour, we find that it is influenced by perceived affordances rather than by actual affordances (Pols, 2012).

These two authors are viewed as the fathers of the modern conceptualization of affordance. However, further studies and definitions have been developed in the subsequent 40 years. Most importantly, multiple authors have thought of multiple definitions and declinations of "affordance".

The purpose of these declensions is to describe in an exhaustive way the users' perception and to limit the growing ambiguity of applying this concept. Norman himself felt the need to propose his own declinations (Norman D., 1999).

2.2 Affordance in interaction

As technology becomes a part of our work, home and leisure environments, the limited and reductive notions of affordances (Norman 1988; Gaver 1991) need to be reconsidered.

In this sense, we can consider the definition of affordances by (Vyas et al. 2006), which they define as the possibilities (for both: thinking and doing) that are signified by the users during their interaction

with the artefact. Thus, they proposed an interaction-centred viewpoint of affordance, which is called Affordance in Interaction. This means that the affordances of an artefact are not the properties of the artefact but a relationship that is socially and culturally constructed between the users and the artefact in the lived world. This view strongly suggests that affordance emerges in the process of interacting with the artefacts. The users continuously and progressively interpret, engage with, and learn from the consequences of this interaction (Vyas et al. 2006).

From here, they coined two distinguished notions of affordance, taking an “interaction-centric” view

- **Affordance in Information** is the ability of users to understand the technology (indeed, the author refers to this as the “what” of the technology), based on their syntactic and semantic interpretations. These affordances could undergo some changes, as users gain more familiarity and knowledge about technology.
- **Affordance in Articulation** is the interpretations on the use and manipulation of the technology and is thus referred to as the “how to” of the technology. Even this type of affordance can be reconstructed over time, but this time it will depend on the context of technology use.

Notably, these notions both refer to the users’ own interpretations about the technology itself and its use. There is a strong connection between these two affordances, which may affect each other over time, and the contextual aspect, which might change. This leads to conclude that affordances are not “static”, but instead evolve together with the user and the context.

This is in line with what (Bærentsen & Trettvik, 2002) suggested: even if designers can premeditatedly decide what affordances (which is here interpreted as a possibility for action) of a system should be offered to users, the latter will however actively participate in the interaction and thus may interpret and understand their “possibilities for action” in an original way, which the designers might never have imagined about. This characteristic is particularly important in the case of digital artefacts, which are interactive in nature.

More importantly, the goals of interactive system design are shifting from the mere functionality, usability, productivity and effectiveness to enjoyment, pleasure, fun, and curiosity to other experiential aspects. Hence, what these systems offer and how users signify and use the systems is also changing.

In order to strengthen the relationship between interaction and affordances, interaction has been decomposed in three moments (which correspond to different timings of interaction)

- Prior to interaction: Affordances result from the mental interpretations of things, based on our past knowledge and experience applied to our perception of things (Norman, 1988).
- During interaction: Action is stimulated by the “right” affordances, which thus need to be thought of as goal-oriented (Scarantino, 2003; Brown, 2005; Pucillo et al. Cascini, 2014) and given in the proper information context (Gaver, 1991; Hartson, 2003).
- Post interaction: Experiences generate perceptions of which a trace remains within the user and which will guide the user's future actions: these are learning affordances (Kaptelinin, 2012)

Note the total set of interactions and relationships between user and artefact is larger than the subset of affordances. Indeed, artefact–user affordances refer to the potential usefulness of the artefact to a user (which means, the artefact is providing a use to the user). Hence, as Gibson pointed-out, only to the extent that the properties of an artefact are useful in some way to the user does an affordance exist. Thus, we can define an artefact–user affordance as an interaction between artefact and user in which properties of the artefact offer a potential use to the user. The artefact is then said to afford those uses to the user (Vyas et al. 2006).

Once the interaction has occurred, this will cause a learning experience. Indeed, this interaction is not an end in itself, but instead generates perceptions and memories of which a trace remains within the user. The affordability associated with the interaction will guide the user's future (Kaptelinin, 2012), not only in case of re-interacting with the same artefact, but also in the interaction with others, which the user perceives as similar.

Another distinct but related set of interactions between artefact and user occurs when the user actually uses the artefact (the “during interaction” moment). The main difference with the other “moments of interaction” is that, whereas the others refer to affordance, this is more related to behaviour than affordances (Vyas et al. 2006). For example, the affordance of drivability of an automobile is one type of interaction, while the act of a person actually driving is a different type of interaction, but the two are related because the automobile must first afford driving (an affordance) before it can ever actually be driven (a behaviour).

Behaviours are nevertheless fundamental to our evaluation. Indeed, the interaction (a certain behaviour) will be guided by the “correct” stimulus, which means that action is driven by the users' response to the multiple affordances available. This action will be dictated by the goal that the user has when deciding to interface with the artefact. All this implies that the affordance must also include the user's idea of goal, there is a need for the affordance to be thought of as goal oriented (Scarantino, 2003; Brown, 2005; Pucillo et Cascini, 2014).

2.3 Goal orientation

As explained 2.2, the user will have to manage different perceptual stimuli, which can therefore be divided into “prior to interaction” and “after interaction” perceptions. However, before the interaction to occur, the user will have the opportunity to feel multiple ex-ante stimuli, which are enabled by the different sensory affordances associated with the artefact and only when the “correct” stimuli will be perceived, the interaction will occur.

It is the user goal to determine which affordance is the correct one, according to the goal he/she intends to achieve. To put it another way, the affordance must be designed so that it can include and unlock the user's idea of goal and it should then be thought of as goal-oriented. This is what Scarantino (2003) defines as “goal-affordances”, which manifest themselves as “doings”, events triggered by the selection of a goal. In this view, doings are such that it is possible to define a

description of the event when the goal is achieved, whichever the interpretation of goal for the considered user in the considered circumstance.

Goal-orientation is however strongly dependent on the available perceptible of information. Indeed, if the information context is not adequate, the user cannot associate the goal with the action to be taken (Gaver, 1991; Hartson, 2003).

Furthermore, resuming the notion by Norman (1988), affordances result from the mental interpretations of things, based on our past knowledge and experience applied to our perception of the things. This view refers to the perceived and actual properties of the “thing”, which can determine just how the thing could possibly be used. This means that affordances of a device are a set of all possible human behaviours allowed by the device (Brown, 2005). The author nonetheless identified three sets of human behaviours (namely, Operations, Plans and Intentions) and concluded that not all of these imply the existence of a goal. Indeed, while the Plan and the Intention refer to the achievement of a goal, the Operation (i.e. actions) might not. Subsequently, this means that affordances may or may not be associated with a goal and explains the notion of “negative affordances” which lead to the undesirability of the affordances clashing with the goal.

Taking up the Gibsonian notion of affordance, which is the perception of the relationship established between a user and an object within an environment (J. Gibson, 1977), Pucillo and Cascini (2014) have gone through the hierarchization of objectives (Carver, 1998) and goals (Hassenzahl, 2010), which then results in a hierarchization of the associated affordances.

On the lowest level of the hierarchy, the Motor-Goals, which are the objectives associated with single basic actions that can be undertaken by the actors. At the middle-level, the Do-Goals, achieved thanks to an action plan (es a set of basic actions performed with a logic). Finally, the Be-Goals, associated with the degree of satisfaction with which the need is satisfied and giving meaning to the action.

The idea of the model of Pucillo and Cascini (2014) is to explain the perceptions that allow users to undertake a set of actions and thus to scale the three levels of goals. From their point of view, the actions and effects they generate originate from four types of affordances:

- **Manipulation affordances:** associated with basic actions (Motor-Goal) and derived by perceptual information
- **Effect affordance:** connected to the effects generated by basic actions and derived by the capability of the user to correlate cause and effect
- **Use affordances:** associated with the pragmatic use and derived by action plans or mental models
- **Experiential affordances:** connected to the level of achievement of the Be-Goal.

These four types of affordances thus reflect the strong connection between affordances and goals.

2.4 Affordance in Human-Computer Interaction

To be pointed out, the definition of affordance in HCI. This can be derived by Gaver (1992), according to which "Affordances are properties of the world that make some action possible for an organism equipped to act in certain ways". These possibilities for action derive from a special configuration existing between the attributes of the object and the actor and is registered only if there is a compatibility between the physical attributes of the object and the actor. Compatibility is expressed through information: the attributes of the object must convey a certain number of information that can be perceived by the actor (Gaver, 1992). However, affordance exists regardless of perceptible information. This points out the central role of the information context to identify, interpret and perceive affordance and its peculiar importance in the digital settings, where information is more extensive than "traditional" physical contexts.

Using the information perceived by the user as a binary variable, Gaver proposes its own declination of affordances:

- False Affordance: a set of information is perceived by the user that suggests a perception that generates unwanted stimuli by the designer;
- Correct Rejection: the information level is such as not to generate stimuli that could deceive the user;
- Hidden Affordance: The actor cannot perceive the information that allows him to generate the perception of the object, and to have the stimuli that the designer had designed.
- Perceptible Affordance: The information is available to the user, so that they can have the perceptions related to the object.

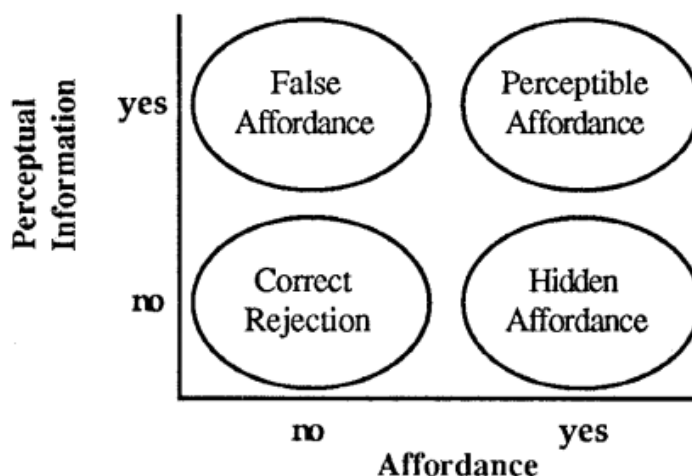


Figure 1: Affordance types (Gaver, 1992)

From this declination it can be deduced that the information, or rather the information context, acts as a switch for the interpretability of the Affordance.

The information, within the HCI, passes through the interface, which is the mean by which the user interacts with the digital artefact. This implies that many of the digital offerings of the digital artefact

manifest themselves through the user's perceptions of relating to the interface. The interface design process assumes importance. In particular, when considering digital products or services, the interface represents a portal for multiple functional aspects, which means that more affordances can arise from it. This leads to the conceptualization of nested affordances, which is the characteristic of some objects to afford multiple successive affordances.

Given the close link between the information context and the interpretability and perceptibility of the affordance, it is necessary, when talking about digital artefacts, to describe in an exhaustive manner the set of perceptions with which a user can relate. To do this, the researchers began to decline the notion of affordance. Hartson (2003) explained that the growing number of affordance declinations in literature arose from the need to explain this set of perceptions and allow authors to exhaustively catalogue the relationships between user interaction and information. That said, the further articulations and exemplification of "affordance" which have been developed in the last 40 years, resulted in a high rate of ambiguity, due to the lack of uniform evaluation criteria, which would guarantee robustness, and the non-uniform use of terminology (Jenkins, 2008; Evans, 2017). Finally, these definitions do not have the features necessary to support designers in the product development process for digital artefacts (Hartson, 2003; Kaptelinin, 2012).

2.5 Digital affordances

In this document, the definition of "digital affordance" will follow that of the previous joint research between Politecnico di Torino and Politecnico di Milano, according to which:

"Digital Affordance is the set of affordances that arise from the particular nature of digital artefacts, determined by the set of relationships existing between affordances".

This definition was formulated starting from that proposed in (Evans, 2017), which recalls the one presented in (Leonardi, 2013). The notion was conceived from the concept of nested affordance. In fact, the idea of nested affordances is perfectly combined with the characteristics of the digital artefacts (Kallinikos J., 2006; Faulkner P. &, 2010; Yoo YH, 2010; Yoo Y., 2012) and allows for the description of the digital affordances as a set of affordances, linked together by one or more relationships, which are associated with the digital system. These relationships are enabled by the modular, layered architecture of such artefacts.

With digital artefacts, affordance must embrace a new and broader information context (Hartson, 2003), in which form is independent of function (Autio, 2018) and multiple relational aspects are possible (Sun, 2014; Rapp, 2015).

In the case of digital system there are not only the affordances associated with the artefact, which act as a trigger for the user's actions, but there is another large set of affordances that are associated with the service that the artefact has enabled. These affordances are associated with the perception of use of the service. That is, they manifest themselves to the user while he/she is already using the service.

It is therefore necessary to investigate separately what the affordances associated with the digital artefact and the affordances associated with the digital service are.

2.5.1 Affordance in digital artefacts

Literature refers to digital artefacts either in a generic way or with reference to digital infrastructures, digital platforms, smart objects. Drawing on the work of (Eck, 2015), it is possible to conclude that a digital artefact needs to possess the following characteristics:

- Modifiability (editability; any immediate change or modification of the digital object)
- Interactivity (the offering of alternative paths along which users can activate the functions embedded in the object)
- Accessibility (the grating of access and modification, deeper to the logical structure)
- Distribution (boundlessness; the distribution makes possible various combinations from a larger ecology of objects)
- Granularity (decomposability; stands for the inherent decomposition of digital artefacts)
- Modularity (untidiness to a fixed product architecture and transferability to completely unrelated contexts of use)
- Reflexive dynamics (any access, assembly or otherwise manipulation can only be done using other digital artefacts).

The affordances of the digital artefact arise at the same time as the definition of architecture (Galvao, 2005; Galvao, 2006). The affordances are those that stimulate and give users the possibility to take any sort of action.

This stimulus is typically generated through sensory perceptions (Gibson, 1977) and are produced by the artefact itself. Therefore, we will refer to this type of affordances as “Sensory Affordances” and will associate them to the first “moment of interaction” (the moment prior to interaction).

2.5.2 Affordance in digital services

In this thesis we will consider ‘digital services’ as services, which are obtained and/or arranged through a digital transaction (information, software modules, or consumer goods) over Internet Protocol (IP) (Williams et al, 2008). The main characteristics of these services are:

- Digital delivery method: the ability to connect and use the infrastructure of the IP-based internet. To be noticed that the digital service may start digitally, but this does not mean that all interactions are limited to digital
- Tangibility of a digital service: being it based on intellectual capital; these same intangible assets often represent the crucial factor substantiating a firm’s market value (Stewart, 1997).
- Ownership: for a digital artefact, the physical possession (its ownership) might not be the same as having full control. The concept of digital rights is just one area where the provider of a digital service might represent a large number of digital owners in their interactions with other parties. Intellectual property protections are especially important for digital services, given that they are easily reproduced because of their digital nature (Cockburn, 2007).

The affordances associated with the service are manifested to the user only after he has interacted with the artefact and has therefore taken an action. These affordances are associated with the perceptions that the user experiences while the service is being provided. The quality of these affordances does not determine the end result but influences the user's future experiences and their future interactions with the system. For such a reason these affordances will be called “Experiential Affordances” and will be associated to the post interaction moment.

Table 1: Types of affordances (E. Perpignano, 2020)

AFFORDANCE	ASSOCIATED WITH	TIMING	EFFECTS	SOURCE
Sensory	Digital artefact architecture	Ex-Ante	It intervenes on the actions that are about to be taken	(Gibson, 1977; Norman D. , 1999)
Experiential	Service	Ex-Post	It intervenes on future actions	(Chenyi Chen, 2015; Kaptelinin, 2012; Pucillo et Cascini, 2014)

2.6 Evaluation of affordances

Recalling the work of (Pucillo et Cascini, 2014), it is possible to resort to the usability assessment as a measure that evaluates the affordance of the system. In

However, studying the usability linked to an affordance can be an extremely complex cognitive operation, since the concept of affordance is something abstract. Given these premises, referring to the work (Chenyi Chen, 2015) it was decided to evaluate the affordance of a system by evaluating some "affordance indicators". Evaluating the usability of the affordance indicators is much more intuitive than evaluating the usability of the affordance, however it remains an approximation.

Usability is a general property of all systems, which can be understood as the quality of use within a given context (Bevan, 1994). The ISO 9241-11 standard defines usability as "the Efficiency, Effectiveness and Satisfaction with which a specific user is able to achieve certain objectives in a given environment."

There are different methods for studying the usability of a system, which exploit different points of view. However, these methods have very limited accuracy. An alternative is to start from the study of the quality of use of a system through the analysis of the three variables suggested by the ISO standard:

- Effectiveness is a measure that seeks to link the system operations with the accuracy and completeness with which these operations are performed (Bevan, 1994).

- Efficiency is a measure of the related use of resources to achieve a given level of effectiveness. Resources can be time, cost or any type of physical or mental effort incurred by the user to complete the task.
- Satisfaction is a measure that evaluates the general usefulness perceived by the user when relating to the system. It can refer to a generic aspect or to a specific task.

Of the three variables used for evaluating usability, the most complex is Satisfaction. This measure shows a subjective and qualitative character. Satisfaction is important and useful because it offers an indication of the perception that the user has of usability, which otherwise would not be obtained by evaluating exclusively Effectiveness and Efficiency. To have a uniform judgment, this third metric is constructed as a compound variable. Typically, Satisfaction is a metric made up of 4 qualitative sub-variables that have been converted on a 5-value Likert scale (Likert., 1932).

Using usability metrics as a means for assessing affordance is to be perceived as an approximate solution to the problem of objective measurement of Affordance. A quantitative method does not emerge from the literature that allows to evaluate Affordance in an objective manner. However, it is suggested to exploit usability to obtain an affordance evaluation (J. McGrenere, 2000).

2.7 Method for analysing digital affordance

To proceed with the analysis of the Affordances, the proposal from the previous joint study will be studied.

The method requires to take the following steps:

1. **Identification of the actors:** for each digital system, the actors involved need to be identified. For each of them, outline the profile: identification of the objectives, how they interact with the artefact.
2. **Construction of the flow chart:** needed to evaluate the set of paths that the user can take, which are the set of actions and states that the user can face.
3. **Definition of the architecture:** represented through a block diagram. The diagram shows how the system works and how the various modules interact with each other at the level of functions and information exchange. The definition of the architecture serves to identify the links between the different modules that make up the system and to identify the elements within each module. The architecture can be reworked in a hierarchical manner to highlight the hierarchical order existing between the modules and elements. This hierarchical order will then reflect the hierarchical order that is established between the affordances.
4. **Identification of the affordance indicators:** these elements are identified as the key indicators of affordance. These elements are then grouped into five categories (Roskos, 2017) which are able to describe the digital system in an exhaustive manner.

5. **Identification of the Affordances:** starting from the functional structure of the system, the affordances were expressed in such a way that they were relations (Maier J. R., 2009, Evans, 2017).
6. **Construction of the incidence matrix:** once both the affordance indicators and affordances have been identified, an interaction matrix has been constructed with the indicators on the columns and the affordances on the rows. With this matrix, each affordance can be associated with the different affordance indicators from which the perception of affordance originates. It is this matrix that allows you to obtain the assessment of the affordance.
7. **Evaluation of the Affordance indicators:** The evaluation need to be made using a 3-value Guttman scale (Guttman, 1950): +1 if the perception of the element is positive; 0 if you are unable to give an evaluation to the element; -1 if the perception assessment is negative.
8. **Affordance assessment:** according to the assessment, affordances need to be evaluated. These affordances were then sorted on the artefact and on the service. This allows to understand whether sensory or experiential perception prevailed, and therefore on which component of the digital system we should intervene.
9. **Evaluation and considerations of the digital artefact only:** Based on the criticalities that emerged in the analysis of point 8, the analysis of the affordance indicators of the digital artefact was analyzed in depth. The analysis of these components is linked to the sensory outputs that the digital artefact generates (vibrations, flashing lights, images, etc.) and in particular to the role that the graphic elements play (Roskos et al., 2017): buttons, icons, colours, text position. These elements are closely linked to social conventions which represent an element that facilitates the interpretation of the affordance.

As explained in the 4th step, this method classifies affordance indicators into the characteristics of the system, as proposed by (Roskos, 2017). Then, these characteristics were associated either to the Sensory or to the Experiential Affordance, as described in 2.5. Consequently, this resulted in the affordance indicators, as part of a certain characteristic, being associated to either one of the affordance types.

The distinction results into affordance indicators being part of:

- Functionality: refer to the Sensory (Artefact) Affordance
- Communication: refer to the Sensory (Artefact) Affordance
- Accessibility: refer to the Experiential (Service) Affordance
- Administration: refer to the Experiential (Service) Affordance
- Instrument: refer to the Experiential (Service) Affordance.

There the model takes the characteristics of the system as cluster to the association of the affordance indicators to Sensory and Experiential Affordance. It is the belonging to a certain characteristic which defines the type of affordance an indicator might be referred to.

The categorization for the case of food delivery is provided below.

Caratteristiche del sistema digitale	Indicatori dell'affordance	Tipologia di Affordance
Funzionalità (F)	Struttura di Navigazione	Sensoriale
	Mappa del sito	
	Funzioni di ricerca	
	Ordinamento dei risultati	
	Menu	
Comunicazione (C)	Email	
	Sms	
	Notifiche	
	Chat	
	Telefono	
Accessibilità (A)	Stato dell'ordine	Esperienziale
	Contenuti multilingua	
	GPS	
Amministrazione (AM)	Account utente	
	Impostazioni del sistema	
	Pagamento	
	Help desk	
	Manutenzione	
Strumenti (S)	Sistema schedulazioni ordini (ristoranti)	
	Sistema schedulazioni ordini (rider)	
	Prestazioni del sistema	

Figure 2: Categorization of affordances (E. Perpignano, 2020)

2.8 Affordance for engineering design: the role of the user

According to D. Normann (1998), by detecting the affordances, it is possible to better design systems' architecture so that to allow the user to interact with an artefact in the most effective, efficient, and satisfactory way. Therefore, affordance-based design theories can offer an analytical basis for improvement proposals to the quality of digital systems and can be most valuable for new digital-enabled services, which still lack service maturity. However, being a rising research strand, the connection between affordances and digital artefacts has not been fully formalized, while it is still not clear how to evaluate the affordances in the digital word. Indeed, the concept of affordance has already been studied for a while and jet theorized for the "physical" word, whereas there is not a specific protocol for digital artefacts. Moreover, as (Sengers and Gaver, 2005) noted, historically in HCI systems and their features are designed mainly to convey the designers' meanings and interpretations to the users. The designers would decide what possibilities and opportunities should be offered to the end users. From the cognitivist viewpoint, this means that the system affordances were determined by the authoritative focus of the designers.

Only in the last few years, approaches such as usability engineering, participatory design, ethnography, etc. have been the driving force for designing systems with more user focus. The concept of affordance, however, faced only minor changes through some activity-centered

perspectives (e.g. Baerentsen, Trettvik 2002) and the authoritative view of designers remained the same.

The overall approach introduced by (Maier & Fadel 2003) provides a starting point for affordance modelling as a method for user needs capture. Indeed, it is claimed that affordance should be considered as more fundamental to design than other concepts such as function and behavior. Thus, a generalized theory of affordances applicable to design is proposed. According to this theory, once user needs are gathered and understood, they can be structured as affordances (Maier and Fadel 2003). Indeed, the affordances provided by an artefact are user dependent; the desired affordances, benefits a user desires from an artefact, are solution independent. The concept of a desired affordance does not assume affordances are inherent to an artefact; rather, desired affordances are the relational benefits that users hope to gain from an artefact. The desired affordances are an abstraction of the user needs.

A set of common affordances was also identified allowing for further organization, as presented in the image below.

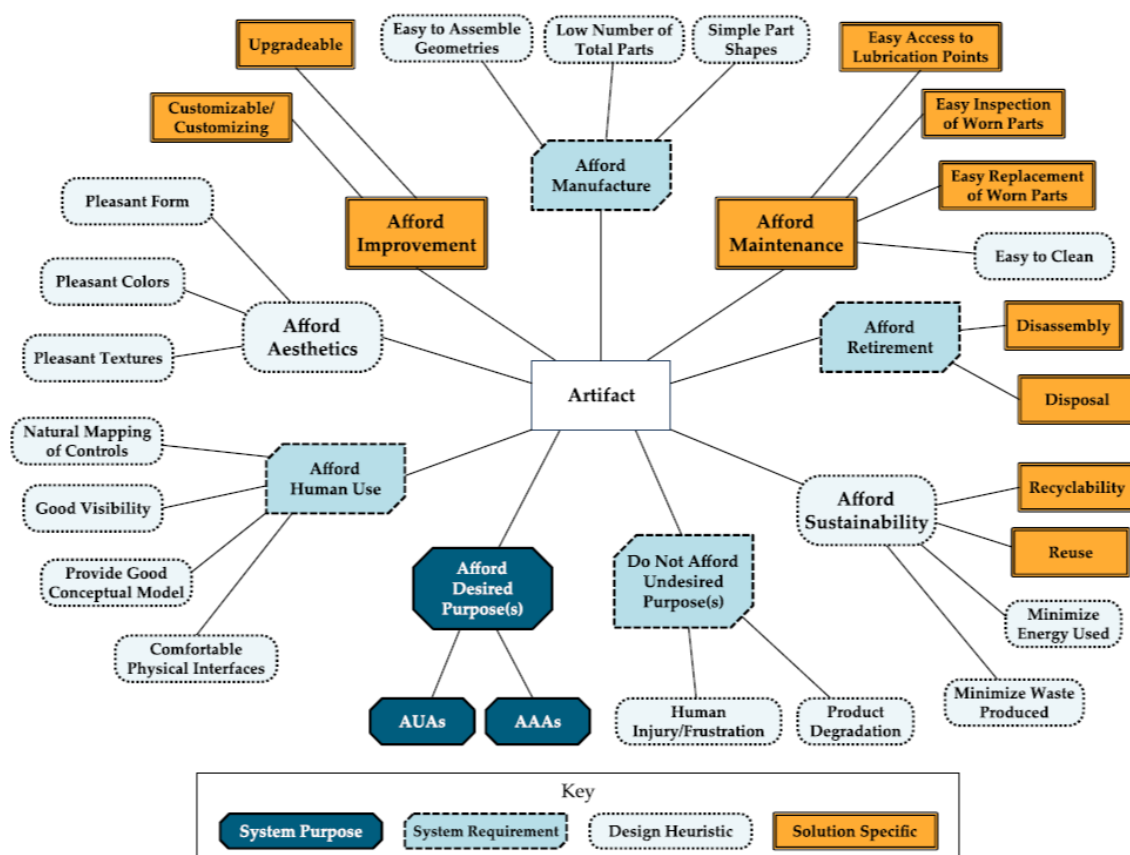


Figure 3: Generic affordance structure—recreated from (Maier & Fadel 2003)

Additionally, three methods for organizing affordances are described in (Maier and Fadel 2003).

- Topical organization: groups affordances by their generic category;

- Hierarchical organization: groups affordances by priority level (which is the importance of the affordance);
- User group organization: groups affordances according to users that desire each affordance.

As for the last categorization, the research states that, when considering the user, not only the end user should be considered, but anyone who might interact with the artifact throughout its life-cycle. Thus, insights can be derived in other areas than use, such as human factors, mass customization, design-for-manufacture / maintenance / serviceability / recycling, etc.

These methods are introduced for designing Artefact-User Affordances (conceived as a relational benefit provided to the user that arises from the interaction of an artefact and a user) and Artefact-Artefact Affordance (relational benefit provided to the user which results from the interaction of two or more artefacts) (Maier and Fadel 2003).

These affordance-based methods presented offer a very different way of thinking from what would be used in a purely functional approach. In particular, the affordance-based methods emphasize satisfaction of user demands and wishes (what the artefact should afford) while safeguarding at each step against introducing unwanted or dangerous features (what the artefact should not afford). The affordance-based methods also lend themselves to taking advantage of the multiple affordances of various objects, to achieve naturally what is sometimes termed “functional integration”.

However, several limitations of previous research inhibit the capture of user needs with the affordance-based approach. First, the overall structure of the model does not identify who the users are and what affordances they want the artefact to have. Additionally, it is unclear how the operating environment and user characteristics are captured, either within the model or in a separate model (Cormier et al., 2014).

Designers should capture the characteristics of each user as they influence what structure is required to provide the desired affordances. User characteristics that can influence the structure of the artefact include those related to human factors, knowledge, and preferences, as well as existing constraints. User characteristics are not required to capture user needs as desired affordances but are required later in the design process when designers must determine whether a proposed structure of the artefact provides the desired affordances. Desired affordances are the relational benefits that users hope to gain from an artefact. The desired affordances are an abstraction of the user needs (Cormier et al., 2014).

Indeed, there is a need to examine which aspects could shape customers' perception, intention, and behaviour. Furthermore, since previous studies have simply addressed aspects related to customers' initial adoption, there is the necessity to go further in this research by considering e-satisfaction and customers' continued intention to reuse.

Therefore, the key question addressed by this research relates to the discovery of factors influencing the customers' experience in terms of behavioural intention, use behaviour and satisfaction with use. Each of these has been associated to one of the moments of interaction (pre, post and during interaction) described in 2.2. Indeed, this will serve for completing a user-discovery map which can help designers to identify user needs and thus to design delivered affordances.

3 Literary review

Since all previous affordance models and theories do not include users (Maier & Fadel 2003; Maier & Fadel 2009), the goal of this work will be to contribute to create a link between the two. Indeed, the power of affordance lies in the fact that it captures the relationship of the artefact to the various users which are expected to interact with it. Consequently, we aim at capturing these different relationships.

For the scope of this thesis, the relationship artefact-user will be represented by the users' interactions with the artefact. Influencing factors will be identified by the factors which drive and explain behaviour; effects of the interaction will be represented by:

- **Behavioural Intention (BI):** following Warshaw and Davis (1985), behavioural intentions are here referred to 'the degree to which a person has formulated conscious plans to perform or not perform some specified future behaviour' (Warshaw & Davis, 1985, p. 214).
- **Use Behaviour (UB):** refers to the way users do behave, under a person's volitional control (free will) (Ajzen & Fishbein 1980);
- **Satisfaction with Use (SU):** this dimension is functional to the evaluation of affordances, based on the Usability notion (Pucillo et Cascini, 2014). In the next section we will deal about it with greater detail.

The next sections will indeed provide an overview of behaviour intention, use behaviour and satisfaction with use, which are hereby linked to the three moments of interaction (see 2.2). Then, behaviour and satisfaction predicting elements will be described. Additionally, the UTAUT2 model will be presented, which serves as a basis to represent the critical factors and contingencies related to the prediction of behavioural intention. Finally, an overview of the main predictor discovered and covered by prior literature in the field of online food delivery services will be given.

3.1 Behaviour and Satisfaction

Much previous research found that behaviour intention and usage behaviour have a significant relationship (Chen, Gillenson & Sherrell 2002; Davis 1989; Davis, Bagozzi & Warshaw 1992; Dishaw & Strong 1999; Mathieson, Peacock & Chin 2001; Moon & Kim 2001; Szajna 1996; Taylor & Todd 1995b; Venkatesh & Davis 2000; Venkatesh et al. 2003). In the TAM model it is asserted that an individual's preference to perform the activity (i.e. behavioural intention) will in fact closely resemble the way they do behave (Davis, 1989) and thus it concludes that intention is a proper proxy to examine and predict a user's behaviour toward a particular technology or system. This leads to many empirical

studies just focusing on explaining behavioural intention as they take the linkage between intention and use behaviour for granted (Agudo-Peregrina et al., 2014).

Recent literature (Bagozzi, 2007) has begun to question the validity of traditional acceptance models, and mainly the causality of this relation. There are three major issues with regards to the linkage behaviour-intentions. First, all the models resting on this connection (e.g., TAM, TRA, TPB) treat behaviour as the final goal to be reached and fail to consider that many actions merely are means to reach and fulfil more fundamental ends or goals. Taking back the definition provided by Norman (1988), intentions can be said to be “a specific statement of what is to be done”, which indeed is not specific enough to control actual actions, since this description may be concrete, abstract or a mixture. Second, since intentions are made prior to acting, and the time-gap can be large, with many intervening steps needed and obstacles occurring, often unanticipated. This results in various psychological and instrumental steps that go on between intention formation and action initiation. Third, TAM assumes that when someone forms an intention to act, they will be free to act without limitation. In the real world there will be many constraints, such as limited ability, time constraints, environmental or organisational limits, or unconscious habits which will limit the freedom to act (Bagozzi 1992). The awareness of these impediments changes the orientation of decision makers in fundamentally different ways than focusing only on behaviour, per se (Bagozzi, 1992; Bagozzi and Warshaw, 1990; Bagozzi and Kimmel, 1995; Bagozzi and Edwards, 1998). Therefore, in this document, BI and UB will be treated differently and will not be considered to have any causality relationship.

With regards to satisfaction to use, recalling the work by (Pucillo et Cascini, 2014), it will serve for the usability assessment as a measure that evaluates the affordance of the system. In fact, we aim at evaluating the perceptual and emotional aspects related to the user experience. However, given that satisfaction is the most complex variable used for evaluating usability, it needs to be treated as a stand-alone metric. It can be measured in relation to the user's perception of the usefulness of the system, the quality of the information, the quality of the interface and general satisfaction. (Lewis, 1995).

Satisfaction is moreover linked to behaviours. Several studies (Ajzen & Fishbein, 2005; Amoroso & Lim, 2017; Christodoulides & Michaelidou, 2010; Wang, Tseng et al., 2019) have acknowledged the impact of satisfaction on the customer's intention. Indeed, customers who formulate a habitual behaviour towards a new system will retain their motivation to use such a system in the future. (Amoroso and Lim, 2017; Sun and Chi, 2018).

In more general terms, adopters of any new systems are more likely to cognitively evaluate the actual outcomes with the expected ones. As it will be explained in the next chapter, expectations influence use behaviour and intentions to use. Accordingly, their future intention to reuse will be strongly predicted by the extent to which users are satisfied with their experience of such a new system. Thus, satisfaction depends on the meeting or exceeding of users' expectations and helps explaining repeated behaviours.

In the light of the above, the following relationships will be considered:

- **Prior to interaction:** Affordances result from the mental interpretations of things, based on our past knowledge and experience applied to our perception of things (Norman, 1988). This “interpretation” led us to the formation of behaviour intentions.
- **During interaction:** Action is stimulated by the “right” affordances, which thus need to be thought of as goal-oriented (Scarantino, 2003; Brown, 2005; Pucillo et Cascini, 2014) and given in the proper information context (Gaver, 1991; Hartson, 2003). Action will be here associated to use behaviour.
- **Post interaction:** Experiences generate perceptions of which a trace remains within the user and which will guide the user's future actions: these are learning affordances (Kaptelinin, 2012). The results of the interaction refer to the satisfaction with use.

3.2 Predicting factors

The following factors have been derived by the revised literature, which will be summarized in the next section of this document.

3.2.1 Convenience

An early application of the notion of convenience can be found in the term “convenience good”, according to which convenience relates to the savings of time and effort in the process of purchasing the product (Yale and Venkatesh, 1986). Time and effort, as dimensions of convenience, remain consistent in the following convenience notions, which however conceive it as an attribute of not only a product, but also a service which reduces its non-monetary price (Kelley, 1958; Kotler and Zaltman, 1971).

In this document, the “dimensions” by Brown (1990) will be used for the definition of convenience in services.

- **Time Dimension:** this dimension refers to services which are provided at the time that is more convenient for the customer. It is important to notice that this does not mean that the service but be “timesaving”. Indeed, the benefitting from the service may require the consumer just as much clock time as others, but the acquisition and use of the service will happen at a more convenient time.
- **Place Dimension:** this dimension refers to the provisioning of the service, which should be the more convenient for the customer.
- **Acquisition Dimension:** this dimension refers to the possibility service providers may give to the customer to financially or otherwise purchase the services.
- **Use Dimension:** this dimension refers to the service being made more convenient for the customer to use
- **Execution Dimension:** this refers to how much mental or physical effort the consumer wishes to expend in obtaining a product or service.

Nevertheless, a more recent study provides insight into convenience dimensions where the dimensions of acquisition and use were not considered relevant to the use of technology. Thus, this

notion embraces just the three dimensions of time, place and execution (Yoon and Kim, 2007). The authors made the effort of rewording the definitions, for a more general application:

- **Time dimension:** the degree of perception held by someone that they can use a channel to accomplish the task at a time that is more convenient for them.
- **Place dimension:** the degree of perception held by someone that they can use a channel to accomplish their task in a place that is more convenient for them.
- **Execution dimension:** the degree of perception held by someone that the channel is convenient in the process of accomplishing the task.

In this research the definition by Yoon & Kim (2007) will be followed. Thus, use dimension will be neglected since internet users can trust their own ability to use online services and therefore believe in their own ability to use the service without the need for external help. The acquisition dimension has instead been incorporated in the execution dimension. Given the definition of this dimension given by Yoon and Kim (2007) and considering the specific case of the food delivery, the “process of accomplishing the task” incorporates the ability to “financially and otherwise purchase the service” as defined by Brown (1990).

3.2.2 Hedonic Motivations

Shopping for goods or products has been largely regarded as a rational process seen from a utilitarian perspective, characterized as task-related and rational mission (Batra & Ahtola, 1991; Forsythe and Bailey, 1996; Khajehzadeh et al., 2014). However, in the most recent explanations of the products acquisitions’ processes, research has seen resurgent interest in shopping’s hedonic aspects, particularly as researchers have recognized the importance of its potential entertainment and emotional worth (Babin et al., 1994; Langrehr, 1991; Roy, 1994; Wakefield & Baker, 1998).

“Hedonic motivation” is defined as the fun or pleasure derived from using technology and it is an important determinant of consumer’s technology acceptance and use (Alalwan, 2018; Alalwan,; Baabdullah et al., 2019; Brown & Venkatesh, 2005; Shaw & Sergueeva, 2019;).

This study represents hedonic motivation as an umbrella term to include similar constructs such as: hedonic expectancy (Ahn, Kang, & Hustvedt, 2016), perceived enjoyment (e.g., Anandarajan, Igbaria, & Anakwe, 2002; Gao, Krogstie, & Yang, 2015), and perceived playfulness (Robin, McCoy, & Yáñez, 2016).

This predictor descends from the results of the major acceptance research models such as: Davis’s (1989) technology acceptance model (TAM) and Venkatesh’s, Morris, Davis, and Davis, (2003) unified theory of acceptance and use of technology (UTAUT). Indeed, researchers found motivation of individuals to perform an activity was of dichotomous nature, namely extrinsic and intrinsic motivation (Deci & Ryan, 1980; Vallerand, 1997). Extrinsic motivations include productivity gains or the accomplishment of a utilitarian goal. Intrinsic motivations instead refers to individuals performing certain activities for the activity itself, to experience pleasure and satisfaction inherent to the activity (Deci & Ryan, 1980).

In more general terms, when consumers search for a particular product or service, they are also searching for expected sensory stimulation, symbolism or simply fun to be experienced during the purchasing and usage process (Holbrook and Hirschman, 1982). The hedonic perspective does not replace the traditional consumption theories; rather, it extends the applicability of these theories, providing a complete picture of the customer experience. This stream of interpretation is in line with Venkatesh et al. (2012), which believe that hedonic motivation is necessary to complete the “utility” predictor.

Recent research (Bilgihan, 2016) found that hedonism is significant to e-commerce in terms of brand awareness and trust, with significant effects in e-loyalty by creating positive online customer experiences. In terms of the hedonic website visit, the motivations of a user to visit a website is mainly affected by the enjoyment of the process.

3.2.3 External Influence

External, social influence has been among the most important factors considered in relation to customers using or rejecting mobile commerce applications. (Venkatesh et al., 2003) conceptualized social influence as “the extent to which an individual perceives that important others believe he or she should apply the new system”. Indeed, customers are more likely to return to their social system either to acquire more information and enlarge their awareness or to have social approval for their decision to use a new system (Khalilzadeh, Ozturk, & Bilgihan, 2017; Verkijika, 2018). Several studies on mobile commerce have demonstrated the significant role of social influence.

It could also be argued that customers are more likely to be affected by those around them when judging their experience (satisfaction or dissatisfaction). Indeed, the social approval that customers could have from others will enhance the social values captured in using such systems, and, accordingly, the level of customer satisfaction (Gallarza & Saura, 2006). In line with this proposition, social influence was empirically proved by (Hsiao et al., 2016) to have a significant role in shaping the user’s satisfaction with mobile social apps.

External influence is represented as a subjective norm in many theories (Venkatesh et al. 2003) including the TRA, TPB, DTPB, TAM2, and C-TAM-TPB. Not only do these theories suggested that social influence is found as a direct determinant of behavioural intention but some other research also comes up with the same suggestion (Lucas & Spitler 1999; Venkatesh & Morris 2000). In contrast, a number of researchers found that social influence (SI) has no significant effect on behaviour intention (Chau & Hu 2001, 2002; Davis 1989; Dishaw & Strong 1999; Mathieson 1991; Venkatesh & Morris 2000; Venkatesh et al. 2003). Some articles suggested both non-significant and significant effects of SI toward intention because they studied in different conditions and generated inconsistent results of the effect of SI on behaviour intention. More importantly, it has been found that social influence has significant effects on usage (Igbaria, Parasuraman & Baroudi 1996; Thompson, Higgins & Howell 1991). Although not being tested, (Hartwich and Barki, 1994) suggest that subjective norm was more important when system use was perceived to be less voluntary. But it is questioned that external influence will be really less important when the Internet use was perceived to be in a voluntary environment. The inconsistencies in these findings associated with social influence effect

on usage or behaviour intention have led to an interesting question with reference to this specific use case.

3.2.4 Trust

Parties in online environments are often anonymous to each other and decoupled from their offline identities (Watt & Wu, 2018). Thus ratings systems, user-generated reviews, profiles, centralized guarantees, etc. are needed to overcome the information asymmetries that exist between participants on a platform.

All transactions require a minimum level of trust between participants in order to occur. This is because any exchange requires a credible commitment that no parties will renege on their side of the agreement after the fact. Without this, transactions may not occur even if they would benefit both parties.

Digital and online systems face (at least) three trust challenges:

- Parties in online environments are often anonymous to each other and decoupled from their offline identities
- Physical interactions that traditionally occur in offline environments are often impossible in an online environment.
- Online platforms possess the ability to collect and use a large amount of data about participants and their activities (Watt & Wu, 2018).

Consequently, previous studies in the field of online transactions found that perceived security is a key factor influencing behavioural intentions to install mobile apps (Chin et al., 2018), to use mobile app features (Johnson et al., 2018; Ooi et Tan, 2016) and in customer satisfaction with mobile apps (Kumar et al., 2018; Susanto et al., 2016).

Perceived security makes consumers trust that all the transaction processes will turn out well, and similarly they trust they can accomplish the goal of the transaction without danger or disappointment. Thus, consumers who perceive that the transaction is secure are more likely to use, and to recommend apps; this may help other customers in their decision-making (Youn & Kim, 2008). As a result, digital systems have developed novel and diverse ways to facilitate exchange between their participants. These solutions form a rich world of ratings systems, user-generated reviews, profiles, public transaction histories, centralized guarantees, and many other means to overcome the information asymmetries that exist between participants. Indeed, security concerns are important at a social level when deciding whether to recommend the service to others (Belanch et al. 2020). User will independently engage in a positive feedback loop and thus will avoid exposing others to possible negative consequences.

3.2.5 Facilitating conditions

The facilitating conditions determinant is defined and used in this research as: “The degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system” (Venkatesh et al. 2003, p. 453).

Facilitating conditions were modelled as a direct antecedent of behaviour intention and usage in the theory of DTPB (Taylor & Todd 1995). It has been suggested that the absence of facilitating resources represents barriers to usage and may inhibit the formation of intention and usage. However, the presence of facilitating resources may not encourage usage (Taylor & Todd 1995).

In general, with adequate experience with technology, users are less likely to be influenced by the role of facilitating conditions to form their intention to use new systems (Mathieson, 1991; Venkatesh et al., 2003, 2012). (Okumus et al., 2018) reached the same conclusion by disproving the impact of facilitating conditions on the customer's intention to use mobile food diet apps, and Shaw and Sergueeva (2019) empirically rejected the impact of facilitating conditions on customers' intention to use mobile commerce.

(Ajzen, 1991) described perceived control as the individual's perception of his/her ability to adopt a particular behaviour, that is, his/her belief that (s)he possesses the knowledge and/or resources required to develop a certain behaviour. An individual who needs high levels of perceived control doesn't trust his/her-own self-efficacy (Belanche, et al. 2011), that is a person's belief in his/her ability to successfully perform a specific task (Bandura, 1982)

Such results could be attributed to the fact that facilitating conditions are more related to the customer's immediate experience, either in terms of actual usage behaviour (Alalwan, Dwivedi et al., 2017) or satisfaction (Chan et al., 2010; Maillet et al., 2015).

3.3 Behaviour predicting theories – UTAUT2

Among the existing theories on behaviour prediction, the UTAUT2 model (Venkatesh et al., 2012) will be considered in this document. This model is an expansion of UTAUT, as explained by (Venkatesh et al., 2003), which depicts the critical factors and contingencies related to the prediction of behavioural intention and technology uses in an organizational context. Compared to UTAUT, the extensions proposed in UTAUT2 produced a substantial improvement in explaining and predicting behaviours in a consumer use context.

The UTAUT2 model, as presented by Venkatesh et al. (2012), is made up of the followings:

- Performance expectancy is defined as the degree to which using a technology will provide benefits to consumers in performing certain activities
- Effort expectancy is the degree of ease associated with consumers' use of technology
- Social influence is the extent to which consumers perceive that important others (e.g., family and friends) believe they should use a particular technology
- Facilitating conditions refer to consumers' perceptions of the resources and support available to perform a behaviour
- Hedonic motivation is defined as the fun or pleasure derived from using a technology,

- Price value, due to consumers having to bear the costs associated with the purchase of devices and services. It is positive when the benefits of using a technology are perceived to be greater than the monetary cost.
- Habit defined as the extent to which people tend to perform behaviours automatically because of learning.

Other than the direct impact of these factors on Behavioural Intention and Use Behaviour, the model postulates the indirect effect of the moderating variables, namely age, gender and experience. These variables do not impact behaviours per se, while instead render the effect of each direct factor “stronger” or “weaker”.

With respect to the original conceptualization of UTAUT (Venkatesh et al., 2003), voluntariness has not been considered as a moderating variable. This change can be explained considering that the extended version of the UTAUT addresses the context of a voluntary behaviour (voluntary technology acceptance and use among consumers), whereas the original UTAUT studies behaviours under organizational mandates.

This model has been chosen since it gives a theoretical foundation suited to the customer’s perspective. UTAUT2 is indeed the most comprehensive theory in understanding individual technology adoption and use. Second, hedonic motivation can be reviewed as an important theoretical addition to UTAUT2 (the main difference with the initial UTAUT model), shifting the focus from extrinsic motivation for the adoption of a dominant paradigm of technology to the intrinsic motivation. Third, this meta-analysis technique is one of the most effective tools to collect, analyse and synthesize the main findings of existing research findings.

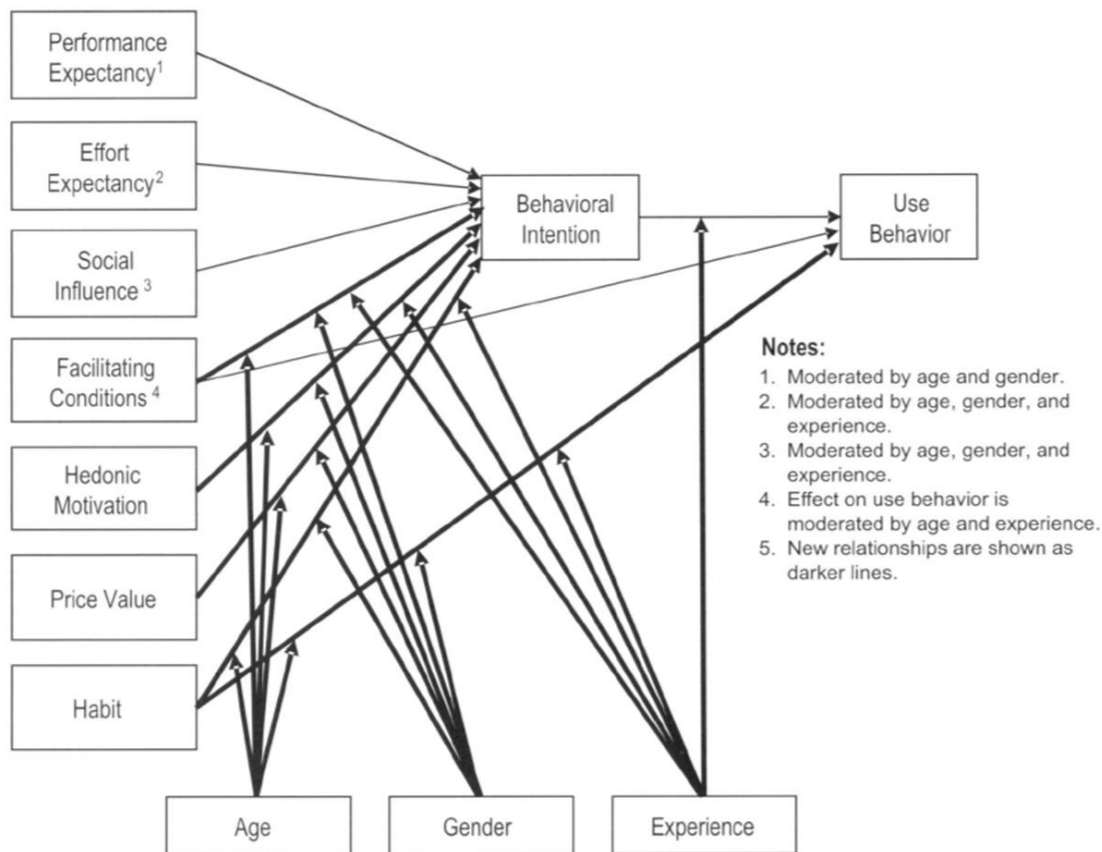


Figure 4: UTAUT2 model (Venkatesh et al., 2012)

3.4 Behaviours: the case of food delivery

The literature revised has been selected and extracted from Databases (HAL, Taylor & Francois, ScienceDirect, ecc...) and scientific Journals (Engineering Design, New Ideas in Psychology, International Journal of Hospitality Management, International Journal of Information Manageme, Journal of Retailing and Consumer Services among others). The number of 12 empirical studies (both qualitative and quantitative) published on both OFDs and FDAs has been revised.

Prior literature focused on diverse geographical contexts such as Indonesia (Elvandari et al., 2017; Suhartanto et al., 2019), China (He et al., 2018), Malaysia (Yeo et al., 2017), South Korea (Roh and Park, 2018) and Colombia (Correa et al., 2018). No publication has been found with specific reference to the European Union or Italy in particular.

Scholars have used different theoretical frameworks. This included the contingency framework and the extended IT continuance model (Yeo et al., 2017), the technology adoption model (TAM) (Correa et al., 2018; Roh and Park, 2018), the theory of reasoned action (TRA) (Correa et al., 2018), innovation diffusion theory and self-efficacy theory (Roh and Park, 2018), and electronic service quality (E-S-Qual) (Elvandari et al., 2017; Sjahroeddin, 2018; Yusra & Agus, 2018).

The main ten sources have been reported here. The following papers have been selected to understand and evaluate customer behaviours in their interaction and engagement with online food

delivery services. Moreover, these served to elaborate on the various motives behind the usage of different FDAs.

For each paper, the source, the number of citations and the method of analysis used by the author.

Table 2: Literary review

AUTHOR	SOURCE	PAPER	YEAR	CITATIONS*	METHOD
A. Alalwan	International Journal of Information Management	Mobile food ordering apps: An empirical study of the factors affecting customer e-satisfaction and continued intention to reuse	2020	22	UTAUT2
A. Ray, A. Dhir, P. Kumar Balaa, P. Kaurb	Journal of Retailing and Consumer Services	Why do people use food delivery apps (FDA)? A uses and gratification theory perspective	2019	29	Uses and gratifications (U&G) Theory
V. Yeo, S.K. Goh, S. Rezaei	Journal of Retailing and Consumer Services	Consumer experiences, attitude and behavioural intention toward online food delivery (OFD) services	2017	132	Contingency Framework and Extended Model of IT Continuance
S. Lee, H. Sung, H. Jeon	Sustainability (Switzerland) 11(11),3141	Determinants of Continuous Intention on Food Delivery Apps: Extending UTAUT2 with Information	2019	24	UTAUT2
M. Cho, M. A. Bonn, J. Lic	International Journal of Hospitality Management	Differences in perceptions about food delivery apps between single-person and multi-person households	2019	37	Quality attributes
Lee, E.-Y., Lee, S.-B., Jeon, Y.J.J.	Social Behavior and Personality 45(9), pp. 1461-1474	Factors influencing the behavioral intention to use food delivery apps	2017	18	
Kapoor, A.P., Vij, M.	Journal of Retailing and Consumer Services	Technology at the dinner table: Ordering food online through mobile apps	2018	32	Empirical test though an app attribute-conversion model
Pigatto, G., Machado, J.G.C.F., Negreti, A.D.S., Machado, L.M.	British Food Journal 119(3), pp. 639-657	Have you chosen your request? Analysis of online food delivery companies in Brazil	2017	26	Qualitative and exploratory approach
Roh, M., Park, K.	International Journal of Information Management	Adoption of O2O food delivery services in South Korea: The moderating role of moral obligation in meal preparation	2019	22	Partial least squares structural equation modelling (PLS-SEM)
Belanche, D., Flavián, M., Pérez-Rueda	Sustainability (Switzerland) 12(10),4275	Mobile apps use and WOM in the food delivery sector: The role of planned behavior, perceived security and customer lifestyle compatibility	2020	6	SmartPLS algorithm, followed by bootstrapping

The first commonality among these sources is their relative temporal proximity, symptom of the relative newness of the considered service and the subsequent interest by researchers and scholars.

Secondly, they all identify factors which can explain and predict users' behaviour in their interaction with such service.

The results of the most relevant sources are summarised in the next section. For each study, every influencing element has been revised in term of its capacity to predict one or more among BI, UB or SU.

3.4.1 A. Alalwan, 2020

The aim of this study was to identify and empirically examine the main factors predicting the e-satisfaction (e-SATIS) with MFOAs and customers' intention to reuse (CI) this type of services, with a specific focus on the Jordanian market. This research proposes an integrated version of the UTAUT2 model, supplemented with some specific features of the service (namely, online rating, reviews and tracking). The results can be summarized as follow:

- Performance expectancy (PE) has been identified as the most influential predictors, for both e-satisfaction (e-SATIS) and continued intention (CI). This demonstrates that FDA have new, attractive features that allows customers to have more mobility and flexibility in ordering food than traditional ways such as physically visiting restaurants or telephoning them.
- Effort expectancy (EE) failed to predict e-satisfaction and continued intention to reuse. This can be due to the sample' characteristics (all participants to this empirical study are actual users who have had long experience in using smartphones and mobile apps). This effected their trust in their ability to use MFOAs and to overcome any difficulties in using such apps.
- Hedonic motivation (HM) was confirmed to have a crucial impact on both e-satisfaction and continued intention. This result could be attributed to the fact that psychological and hedonic benefits play an important role in shaping the customer's feeling of pleasure and the decision to use or reject new products and innovations (Brown & Venkatesh, 2005; Davis et al., 1992; Van der Heijden, 2004). Furthermore, the considerable role of hedonic motivation could be explained by MFOAs still being a new and innovative technology.
- Facilitating conditions (FC) were able to predict e-satisfaction, while continued intention to reuse was not predicted by this factor. To put it differently, without the existence of such facilities, customers would not be able to efficiently use MFOAs and attain the benefits required for them to be satisfied. However, given the strong connection relation between facilitating conditions and customers' immediate experience, this factor was not able to predict future use of this type of service.
- Social influence (SI) failed to explain both e-satisfaction and continuous use according to the empirical results of the current study. This result might be due to a bias in data collection (all the participants are actual users of the service). Indeed, according to Venkatesh et al. (2003), customers largely rely on other opinions and recommendations in their initial usage of new systems, whereas the impact of social influence could diminish or vanish once sufficient experience has been gained.
- Habit (HB) could be formulated as the customer's tendency to act spontaneously due to his or her accumulated learning experience (Hirt et Cheung, 2007). This study's results support the positive impact of e-satisfaction on habit. This means that those customers who are

pleased with their experience of using MFOAs are more likely to have a habitual behaviour of using MFOAs. In general, people who are happy about the outcomes of their prior behaviour and experience are more likely to keep repeating such behaviour.

- Online review (OR), online rating (ORT), and online tracking (OT). This study's results show that three can predict both e-satisfaction and continuous use. Indeed, in the current study it has been found that users are noticeably interested in the availability of reviews and ratings provided by other customers on the FDA. This indicates the perceived credibility, trustworthiness, usefulness, richness, and relevance of these additional pieces of information. With regards to online tracking, it can be regarded as a feature that make the experience with FDA simpler and more efficient (reduces time, effort, and the cost of human contact), given that customers can follow the stages of their order on real-time, directly on their apps.

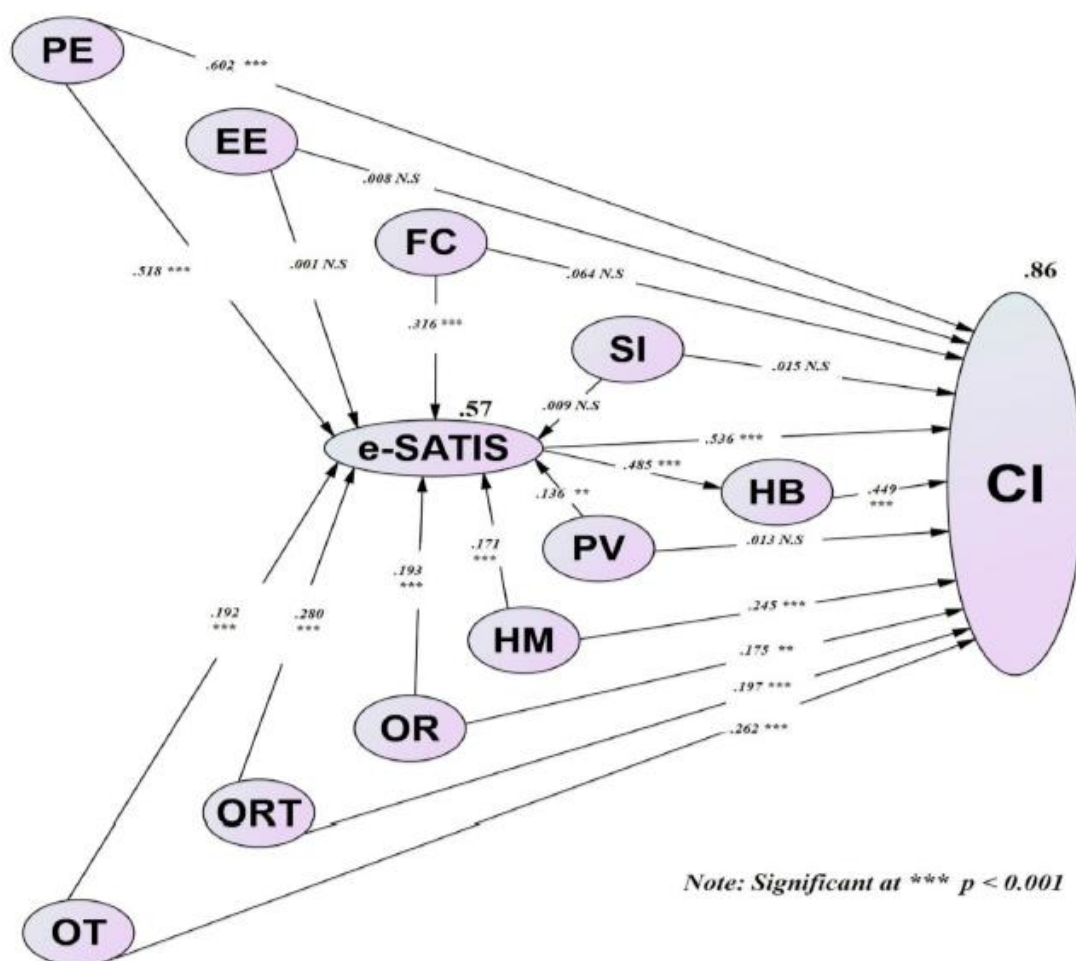


Figure 5: Conceptual Model (A. Alalwan, 2020)

With reference to the predictive elements of this thesis, it is necessary to clarify the followings.

First, in the light of the definition given to performance expectancy, it can be argued this refers to what we identified as convenience. Indeed, resuming the definition by (Venkatesh et al., 2003), PE is defined as the ability of the new system and application to help customers attain what they need and want in a more convenient and productive way. The same conclusion can be drawn for EE, which instead refers the degree of ease associated with consumers' use of technology (Venkatesh et al.,

2003). This aspect can therefore be considered relevant in the evaluation of the dimension of “convenience in execution”.

3.4.2 A. Ray et al., 2019

This study served at identifying the various motives behind the usage of different FDAs by developing a psychometrically valid and reliable instrument that measures different uses and gratifications (U&G) behind the use of FDAs. Additionally, the association between different U&Gs and intentions to use FDAs were investigated. At the end, eight main gratifications have been identified behind the use of FDA, namely, convenience, societal pressure, customer experience, delivery experience, search of restaurants, quality control, listing, and ease-of-use.

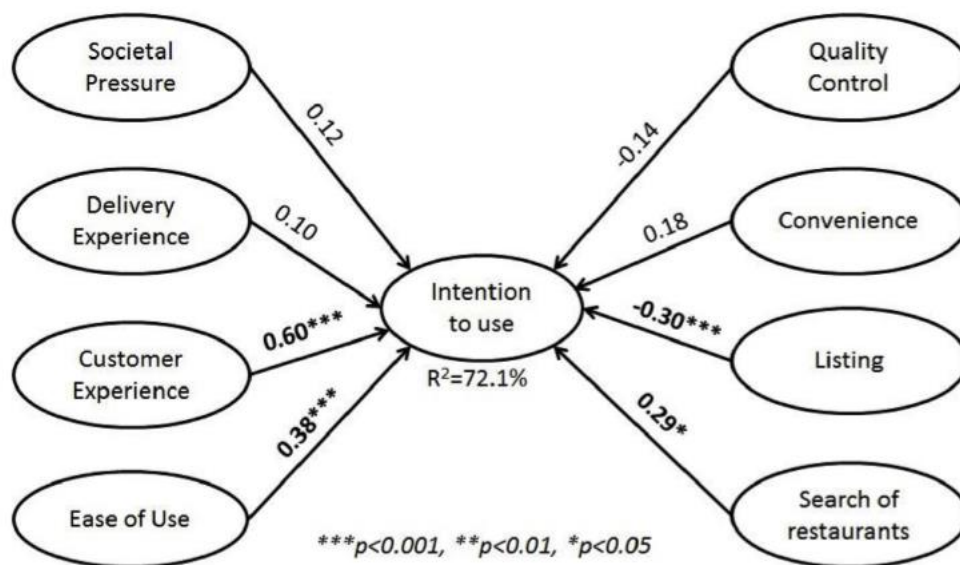


Figure 6: Conceptual Model (A. Ray et al., 2019)

- Social pressure: no significant association with intention to use has been found which was inconsistent with prior literature. Possible reasons for this disconnect have been suggested by the author (such as, food choices being mostly individual), which however lack scientific support.
- Delivery experience: no significant relationship was found, differently from prior literature (Hume, 2008; Kim et al., 2012; Othman et al., 2013). This might be due to the service promise of a good delivery experience from of all FDAs, which consequently make it no longer a differentiating variable in the context of intentions to use.
- Customer experience: in accordance with earlier studies (Chan et al., 2014; Chiu et al., 2009; Kim and Choi, 2013), a positive association to intentions to use FDAs has been found. This suggests that mechanisms such as coupons, discounts, loyalty programs, referral programs, and advertisements are useful in enhancing the intention to use FDAs among consumers.
- Ease-of-use: supporting findings of the prior literature (e.g., Kuo and Yen, 2009; Lu and Su, 2009), this study suggest that customers value ease-of-use, i.e., order placement process, a feature to track order progress and filter options contribute to ease, which is positively associated with intentions to use FDAs.

- Quality control (in the form of photos, reviews, and ratings): the study results suggested an insignificant relationship, in contrast with other previous research works (Kim and Lennon, 2013; Saha and Theingi, 2009; Sjahroeddin, 2018; Zhang et al., 2011). A possible explanation to this result might be that these activities being mainly directed at the selection process related to a different available restaurant or food items and not associated with intentions to use FDAs.
- Convenience: no support to the linkage to intention to use was found, which is inconsistent with the majority of the prior literature (Correa et al., 2018; He et al., 2018; Pigatto et al., 2017; Roh and Park, 2018; Yeo et al., 2017).
- Listing of restaurants (according to area, cuisine, and menu size - intended as usability-related measures): was found to have a negative impact on intentions to use FDAs. The author however warns to further investigate on this point
- Search of restaurants: the relationship with intention to use was supported, consistently with most of the prior literature (e.g., Pigatto et al., 2017; Tsai et al., 2014). Users value that FDAs help them to search new, famous, nearby restaurant eateries and this motivates them to use FDAs.

The followings clarifications are however needed for the scope of this work.

First, in the examined research convenience refers to the ability to use something without difficulty. FDAs can provide comfort by providing options to compare food prices from different restaurants, enable customers to avoid waiting time at restaurants and traffic-related situations. However, this definition is considered overlapping to that of search of restaurants, which refers to the efficient searching of restaurants and famous eateries, and of ease-of-use, that is regarded as the easiness of using the service (such as in the order placement process, in the filtering food choices, etc.). All these features refer to the “Convenience in execution” dimension. However, given that two out of three of these factors did not resulted in confirming a relationship with intention to use, we can conclude Convenience not being able to predict BI according to the results of this model.

Secondly, the above mentioned “quality control” is here referred to the concept of trust. Retrieving the explanation provided in 3.2.4, ratings systems, user-generated reviews, profiles, centralized guarantees, etc. are needed to overcome the information asymmetries that exist between participants on a platform and thus increase its perceived trustworthiness.

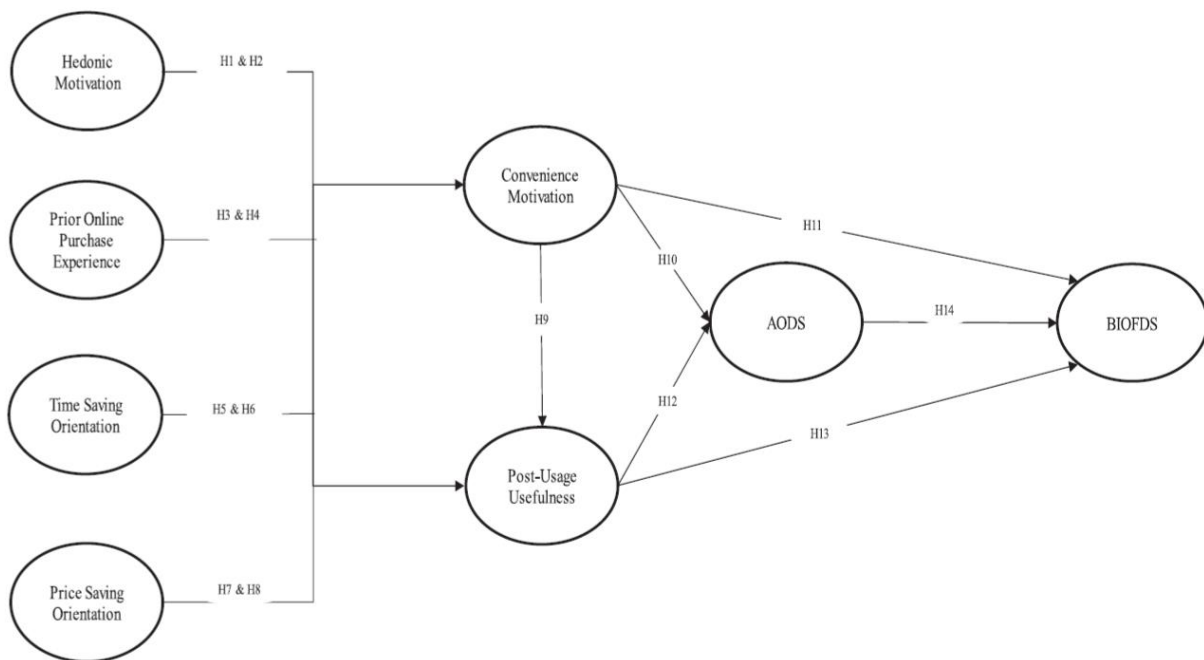
3.4.3 V. Yeo et al., 2017

This study proposes an integrative theoretical research model based on the Contingency Framework (Anderson and Srinivasan, 2003) and Extended Model of IT Continuance.

- Hedonic motivation has been proven to be an important factor that leads to a positive attitude and intention to purchase. This means that with a better hedonic motivation, attitude towards OFD services tends to be positive ultimately leading to intention to use OFD. When users perceive that OFD services are able to provide fun and pleasure, they are more likely to have a positive attitude and tend to use OFD services.

- A person's online purchase experience would be considered an important factor that affects both attitude and intention to purchase (Weisberg et al., 2011). However, prior online purchase experience has an indirect relationship with attitude through the mediation of convenience motivation.
- Time Saving orientation is confirmed to improve attitude towards OFD. The result is coherent with previous studies (Childers et al., 2002; Eriksson and Nilsson, 2007) that time saving improves attitude through ease of use and usefulness. When users are able to save time, they are more likely to use OFD services.
- Price saving orientation has been found to have an indirect relationship with attitude through the mediation of post-usage usefulness. Therefore, the results have shown similarity with past research where consumers will be concerned with prices and discounts that they can acquire through purchasing online and in this case, specifically in attitude towards OFD services.

The above-mentioned factors all are considered to have an indirect effect on attitudes. Indeed, they influence the two identified latent variables, namely convenience and post-usage usefulness. Results have further demonstrated a positive relationship between these latent variables and attitude / behavioural intentions. This means that with a better perception of post-usage usefulness and convenience motivation, a person's attitude towards OFD services will improve significantly, thereby increasing intentions to use OFD services.



Note:
 Attitude towards online food delivery services (AODS)
 Behavioral intention towards online food delivery services (BIOFDS)

Figure 7: Conceptual Model (V. Yeo et al., 2017)

3.4.4 S. Lee et al., 2019

The purpose of this study was to employ an extended UTAUT2, integrated with information quality, to validate the key determinants in continuous use intention for food delivery apps. This integration derives from studies on Internet shopping. (Ahn et al., 2004) found that information quality had a significant effect on use intention, mediated through usefulness and ease of use. (Liao et al., 2006) validated the mediating role of the quality of in-site content on the relationship between consumer trust, information usefulness, and continuous use of e-commerce. (Shih, 2004) stated that perceive information quality affected users' intentions to accept e-shopping through ease of use and usefulness.

Through a sample survey of 340 respondents who had ordered via online food delivery providers, the following results have been derived:

- Performance expectancy is revealed being the determinant factor with the strongest positive influence on the continuous use intention of delivery apps
- Social influence has proven being crucial in influencing use intention, thus demonstrating that users are affected by peers in their behaviours
- Habit has resulted to influence use intention. The average value of the habit factor was 2.508, indicating that the positive relationship returned in the analysis results in fact implies a negative relationship. Thus, respondents' use of delivery apps is not by force of habit, while instead depends on their perception to be more useful than ordering food via phone or smartphone
- Information quality emerged to have a crucial role in enhancing the effects of performance expectancy, but no direct effect on the continuous use intention, implying that the accuracy and reliability of information has no effect unless their usefulness is perceived by the user. Considering this factor alone, information quality was found to positively influence continuous use intention with performance expectancy as the mediating variable. These findings demonstrate that providing accurate and reliable information in a detailed manner via an adequate app design will lead consumers to perceive delivery apps as useful. This suggests that consumers will form continuous use intention when they perceive the usefulness of delivery app services, such as saving time, the speed of conducting a transaction, and the diversity of purchase opportunities
- Ease of use and facilitating conditions do not significantly modify use intention of delivery apps. This is attributable to the advancement of smartphones and ICT technology that have stabilized app implementation to the extent that consumers face few difficulties in using them.
- Hedonic motivation does not play a significant role in use intention. The result on hedonic motivation may be attributable to the short process from search to order, giving consumers little time for enjoyment.
- Price-value has not resulted a key factor determining the continuous use intention of delivery apps. This is due to consumers not perceiving any difference in material benefits between placing an order via phone/smartphone or delivery app.

For the purpose of this thesis, given the definition of performance expectancy, it can be argued this refers to what we identified as convenience. Indeed, resuming the definition by (Venkatesh et al., 2003), PE is defined as the ability of the new system and application to help customers attain what they need and want in a more convenient and productive way.

Moreover, the peculiar integration of this model will be taken into consideration in the next sections of this document, given its design-specific nature.

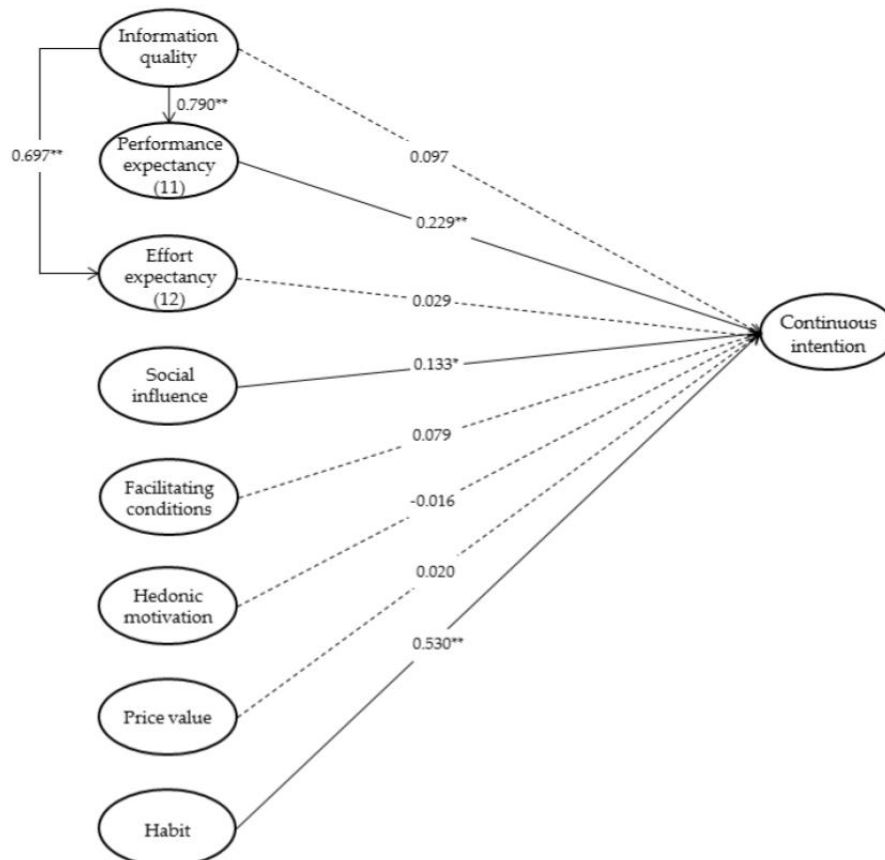


Figure 2. Structural equation model with parameter estimates. * $p < 0.05$, ** $p < 0.01$. Non-significant paths are shown in dotted lines.

Figure 8: Conceptual Model (S. Lee et al., 2019)

3.4.5 M. Cho et al., 2019

This study posits that product or service-oriented quality attributes should be addressed when examining quality attributes of food delivery apps and their impact upon user-perceptions.

Hence, the study was designed to specifically explore the most salient quality attributes associated with food delivery apps in consideration of their impacts upon user-perceived value, attitudes, and intention to continuously use and recommend to others. Moreover, this study considers the type of household (single-person VS multi-person) as a moderating factor which englobes diverse users' demographics. Single-person households represents younger generations, tech-savvy individuals of consumers demanding home delivery via food apps. The author argues that, since food purchasing

and consuming patterns may differ significantly between single-person and multi-person households, then their perceptions and preferences about food delivery app quality attributes may be significantly different.

Considering that researchers have regarded consumer evaluations about product or service quality as one of the important determinants of positive perceived value (Wang and Wang, 2010), the study aims at understanding how mobile consumers' perceived app quality attributes influence their perceived value. A positive link between the five-dimensional attributes of food delivery app quality and user value perception is then tested. Results are the followings:

- Convenience, design, trustworthiness, and variety of food choices are found to have a significant and positive effect upon user-perceived value.
- Price has no significant influence on user-perceived value

In addition, the positive relationships between user-perceived value, attitudes toward using food delivery applications and intention to continuously use supported. Further, attitudes towards using food delivery applications had a positive relationship with intention to continuously use food delivery applications.

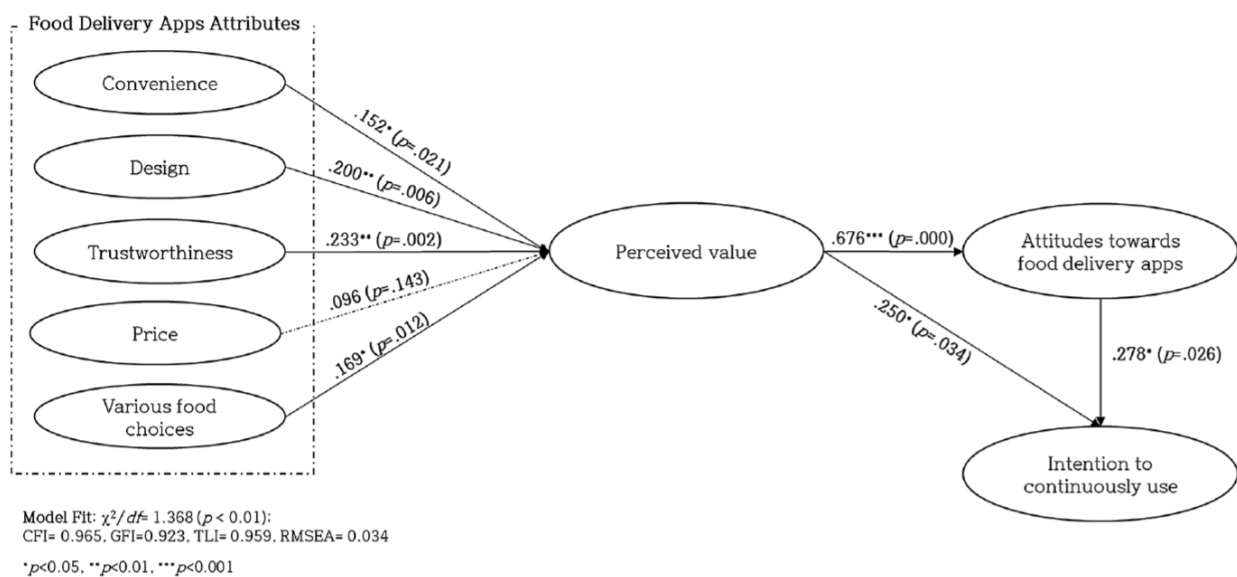


Fig. 2. Results of testing Hypotheses.1–8.

Figure 9: Conceptual Model (M. Cho et al., 2019)

With regards to differences between single-person and multi-person households, results revealed that the relationships between convenience, design, price and various food choices, and user-perceived value were found to be significant. Specifically, respondents from the multi-person household group are more likely to perceive value if they positively evaluate the convenience and design quality attributes of food delivery apps. In contrast, the effect of price upon perceived value in the single-person household group is stronger for the single-person household group.

3.5 Externalities in affordance

Within the aim of the study, significant similarities to users' perceptions towards food delivery and other online services have emerged. In particular, it has resulted users perceive and understand their experiences with online food deliveries similarly to that with e-shopping. In this section, some examples of the detected similarities will be presented.

First, it has emerged that photos have the same effect in enhancing customers' trust towards the platform. Indeed, (Grill-Spector & Kanwisher, 2005) have shown that product images have a positive impact on the perception of trust, enabling consumers to increase their willingness to purchase products in an e-commerce environment. Product photos are an important way to help consumers enhance their product understanding;(Jiang & Benbasat, 2004). According to (Xia et al. 2020) consumers usually rely on the provided product photos and descriptions to judge a product. Product presentation is an extra dimension that retailers can manipulate to influence ecommerce consumers.

Similarly, the amount of content (number of available food options provided) increases the perceived trustworthiness of the platform. Alike, online retailers who have offered a wide variety of products and selections seem to be more successful (Christian & France, 2005). This can be explained by admitting that consumers expect online retailers to offer a wide range of product variety online (Jarvenpaa & Todd, 1996). Online marketing research also shows that consumers shop online for the benefits of the available product variety and that a wide product selection contributes significantly to greater website satisfaction, better attitudes toward online shopping, and greater store loyalty (Bansal et al. 2004; Koo 2006; Lim and Dubinsky 2004).

Finally, with regards to convenience, research shows that both services share this as a major attractor for mobile technology use in addition to task fulfilment (Anckar and D'Incau 2002; Carroll, Howard, Peck, and Murphy 2002; Carroll, Howard, Vetere, Peck, and Murphy 2002; Mick and Fournier 1995). Mobile services are instant, and people appreciate the rapid access to services compared to the alternatives. Self-services are often perceived superior to interpersonal service, because they save time and are easier to use and more effective than interpersonal service (Meuter et al. 2000), allow convenient access to services wherever and whenever the customers wish to use services.

In the light of the above, this study hypothesises the existence of externalities in digital affordances. Indeed, given the previous experiences and stimuli the user has acquired with a digital system, he/she will be likely to search for the same stimuli in his/her experience this another system. The conditions for this to happen is the users' interpretation of the system. Indeed, in case users interpret and understand the system as similar as another they already know, they will recall to memory the perception originated in their previous experience. Thus, perception will guide the user's future actions.

Despite this concept being not new to literature on affordance (and thus being referred as learning affordance) (Kaptelinin, 2012), no previous research has been found dealing on the matter in the case of digital systems. In particular, it is not clear how learning (thus, the speed at which one transpose the experience in a certain context to another one) could be affected in digital systems, in comparison

to “traditional”, physical ones. An assumption might be that, because of the continuous exposure to the digital artefacts / system that enable the service, users are learning by their experience faster. Indeed, the occasions in which they are asked to recall a precedent experience are multiplied, given the continuous interaction with the artefact.

However, this conclusion needs to be further investigated.

4 Model definition

The goal of this work is to support research that introduces a modern point of view in the development process of digital artefacts, based on the notion of affordance.

Since affordance “is in interaction” (Gibson, 1986; Vyas et al. 2006), this document proposes a customer-discovery map, which can help designers identifying factors driving users’ intentions and behaviours before, during and after interaction. This passage is fundamental to draw a comprehensive picture of the users’ relationship with the artefact and the environment and consequently their perceptions of the affordances of the service.

4.1 Methodology

The construction of this model has followed a progressive approach. First, by funding the hypothesis on the results of previous literature, the identified predicting factors have been linked to BI, UB and/or SU. Secondly the model has been validated through interviews and focus groups to better represent behaviours of Italian users. Eventually, factors have been merged and the model readjusted. The validation process will be further detailed in the following chapter.

The revision of the model has been functional to ensure the model to be parsimonious. Indeed, a model that provides good prediction while using the fewest predictors is preferable according to (Bagozzi 1992). Nevertheless, other researchers have argued that parsimony is not desirable by itself but rather is desirable only to the extent that it facilitates understanding (Venkatesh et al. 2003).

The UTAUT2 theory has served as a starting point for the development of this model. The former theory indeed is an extension of the unified theory of acceptance and use of technology (UTAUT) to study acceptance and use of technology in a consumer context in general. However, the objective of the model proposed in this work is less general, given its aim of depicting a complete picture of use behaviour, behavioural intention, and satisfaction with use in the specific case of food delivery. The choice of UTAUT2 as a background theory for the development of this model descends from the fact that it covers the main constructs that have been approved by prior studies on MFOAs, such as performance expectancy, effort expectancy, social influence (Okumus et al., 2018) and hedonic motivation (Tamilmani et al., 2019; Yeo et al., 2017).

It is also worth mentioning that a deeper investigation on prior studies of MFOAs revealed the necessity of studying specific features and characteristics of digital ecosystems (Cho et al., 2019; Kapoor & Vij, 2018; Saumya, Singh, & Dwivedi, 2019; Wang, Tseng et al., 2019). In light of the above, the precedent UTAUT2 theory has been adjusted to better fit the use case.

4.2 Content

The content of this model derives from the analysed literature on behaviours in the specific case of food delivery. A limitation of these previous studies is that the results are in some cases contradictory and this prevents drawing significant conclusions on customer attitudes and behaviours. These different results could descend from the diverse geographical regions in which these studies have been conducted - Jordanian (Alawan, 2020), India (Ray et al., 2019), just to name a few. These regions are characterized by distinct cultures, which could influence behaviours. Moreover, these areas have dissimilar digital infrastructures and socioeconomic conditions, which differently influence the diffusion of the service and thus attitudes towards its usage, as will be further detailed in 5.2. None of these studies have been conducted in Europe, neither in Italy. Thus, this study aims at taking a step forward to fill this gap by providing an overview that fits in the region.

With regards to the main adjustments to the UTAUT2 model, the followings are worth mentioning:

- The introduction of “Convenience”: this predictor not only englobes the “Performance Expectancy” and “Effort Expectancy” of the UTAUT2 model, but also stresses the peculiar characteristic of this service, as will be better detailed in the below sections of this chapter.
- Price Value: this predictor has not been considered relevant for this study. Despite previous literature identifying a correlation between price value and behavioural intention, this research is mainly focused on the service design elements and affordance, without other considerations regarding pricing. Thus, in order not to go out of scope, this factor has been excluded from the proposed model.
- Habit: this predictor has not been considered. Habits indeed provide a sort of default response, unless people are sufficiently motivated and able to tailor their behavior to current circumstances. Therefore, habits can be considered as involuntary actions, which develop as people go about pursuing their goals. Habits are developed through instrumental learning and built on the fundamental principle that rewarded responses are repeated (Thorndike 1898). When repeatedly pursuing a goal such as making coffee, people experience covariations between context cues (e.g., coffee filter) and actions (e.g., measure grounds) that lead to goal attainment (Wood & Runger, 2016). This leads to the conclusion that habits can be incorporated in the moderating factor of “experience”, so that the higher the experience, the more habitual the behaviour pattern. In light of the above reasons, habit will be excluded from the model.

4.2.1 Moderating factors

While the predicting elements have been derived by previous literature, the introduction of the moderating variables is a typical characteristic of the UTAUT2 model, which is here preserved to explain differences in users’ behaviours. Reconsidering the moderating variables by (Venkatesh et al. 2012), some adjustments have been done.

First, gender has not been considered to have a significant role in strengthening the effect of the predicting element. This conclusion has been derived by (Statista Global Consumer Survey, 2020), which highlights no difference between male and female users. According to this research, indeed, male users constitute the 50.6% of users, with not significant differences in the penetration rate among the two sexes. Moreover, according to (Beyondata OFD user insights, 2019) no significant difference can be found on meals' preferences. These similarities in users' behaviours and preferences can be considered as a proxy of the negligible role of gender as a moderating factor.

Secondly, Age and Experience (to be considered as previous experience with online services) have been included as moderators, following the UTAUT2 model. Indeed, since affordance depends on the reference user, he/she must be considered variable in its nature (Rapp, 2015). Age can be considered a good predictor of differences in users' behaviour. Indeed, some discrepancies in terms of both penetration rate and food preferences can be found among age-groups (National market observatory of online food delivery in Italy, 2020). Age could also be considered as a proxy of experience with digital systems, assuming that Millennials and generation Z are the most-experienced ones. However, in this study Experience will be considered separately. Indeed, affordances are the result of an interpretation of an object, built on the experience and knowledge that we apply to the perception (Norman, 1988). Moreover, previous research suggest that veterans (high-experience users) and new newbies (low-experience users) behave and interact differently with a technology (Venkatesh et al., 2003, 2012; Giannakos & Vlamos, 2013) which however did not find any correlation between age and experience. Thus, in case this factor was not considered, the validity of this work would have resulted to be approximated.

Finally, context has been considered having a moderating role. In this document, context relates to the situation in terms of circumstances in which the mobile services are used. The 'circumstances' of use may be physical or psychological.

Physical conditions (here named Environmental) are objective circumstances related to the mobile service, such as unavailability of other services, device used to access the service, weather, saturation of the service, moment in which it is used, etc. These conditions refer to temporal and spatial context of service use. Indeed, these are an integral part of the mobile service process (Anckar and D'Incau 2002; Nysveen et al., 2005). Mobile contexts differ from the traditional context of use (Tamminen et al. 2004). In a mobile service context, the situation may change due to physical influences like network availability or temporal influences, such as lack of time (Mallat 2005). So far, everyday life situations that would take into consideration these aspects have received little attention in mobile service research (Hyvönen and Repo, 2005).

Psychological conditions (here named Individual) refer to subjective circumstances dependent on the customer's mood and reflect the subjective context of use. Indeed, studies have demonstrated that mood influences human behaviour because it seems that subjects in a more positive mood state deal more easily with negative short-term experiences (i.e., they are more "optimistic", Mendl et al., 2009, 2010b). A positive mood might therefore alleviate single negative events and stabilize emotional reactions, that is, subjects will react also less strongly to positive events (Mendl et al., 2009, 2010b; Muehlemann et al., 2011; Laeger et al., 2012; Reefmann et al., 2012). Moods become particularly

important and visible in situations of ambiguity and uncertainty or when the expectation of a subject is pre-shaped (Schachter and Singer, 1962; Mendl et al., 2009; Roelofs et al., 2016). In the case of online food delivery both conditions apply. Indeed, on the one side, ambiguity is intrinsic to the online transaction. On the other, expectations are incorporated in two categories of search for information with respect to product/service quality, labelled 'external search' and 'internal search' (Beales et al., 1981). Specifically,

- External search factors include information gained through outside sources, which propose include 1) explicit service promises, 2) implicit service promises, and 3) word-of-mouth communications.
- Internal search factors include past experience, which both influence the level of desired and predicted service

Therefore, this model considers the formation of expectations, incorporating them in the Social influence (which represents external search factor) and the Experience (which represents internal search factors). To preserve the parsimony of the model and to avoid redundancy, expectations have not been considered as a variable per se.

4.3 Hypothesis

This model presents and summarizes five of the seven factors (performance expectancy; effort expectancy; social influence; facilitating conditions; hedonic motivation), as suggested by Venkatesh et al. (2012). Further, another construct associated with online transactions (trust) will be included in the same model. It will represent the ability of these factors to affect Behaviour intention (BI), Use Behaviour (UB) and Satisfaction with use (SU).

In this section, the hypothesis underlying this model will be explicated.

4.3.1 Behaviour intention

The consumption of food delivery services is typically reserved to occasions of social experiences, of sharing with family (39%) and partners (30%) and which are mainly experienced during the weekend according to results from the National market observatory of online food delivery in Italy. In the context of FDAs, societal pressure can be identified as the advertisements on FDAs from various sources, e.g., media, friends and peers. Societal pressure has been studied in the prior consumer literature in multiple contexts. Scholars have found a positive association of societal pressure and use intentions in different settings, such as eating purposes (Liu et al., 2019), purchase intentions (Kim, 2018), and continuance intention (Shao, 2018). Thus, this study postulates that:

H1: External influence will positively affect users' behaviour intention with OFDs

In the specific case of food delivery, the relevance of hedonic motivations is again confirmed by the National market observatory of online food delivery in Italy 2020. Serenity and happiness (56%), desire to celebrate new adventures and life changes (30%), birthdays and anniversaries (23%) are indeed the most common "moods" for online food ordering. This is in accordance with recent

research (Bilgihan, 2016), which found that hedonism is significant to e-commerce by creating positive online customer experiences. With similar positive results (Wagner et al., 2016) empirically demonstrated that hedonism is very important for Internet-enabled television shopping, especially because it happens in the household context with a relaxed attitude, relating enjoyment with shopping intentions. Therefore, based on the arguments above, it is believed that users' behaviour intentions are formed according to the hedonic effects the behaviour will produce. Therefore, the following hypothesis is proposed:

H2: Hedonic motivation will positively affect users' behaviour intention with OFDs

FDOs can provide comfort by providing options to compare food prices from different restaurants, enable customers to avoid waiting time at restaurants, and also avoid traffic-related situations. Prior studies on OFDs suggest that convenience (Pigatto et al., 2017; Roh and Park, 2018; Yeo et al., 2017) are positively associated with usage intention. FDAs can provide comfort by providing options to compare food prices from different restaurants, enable customers to avoid waiting time at restaurants, and also avoid traffic-related situations. Moreover, previous studies on OFDs suggest that other factors such as location compatibility (Correa et al., 2018; He et al., 2018), traffic avoidance (Correa et al., 2018) are positively associated with usage intention. Hence, this study proposes:

H3: Convenience will positively affect users' behaviour intention with OFDs

4.3.2 Use behaviour

When a product is purchased online, asymmetric information possessed by the buyer and seller will eventually lead to the exposure of additional risk to the customer (Pavlou & Dimoka, 2006). This happens when the buyer cannot physically check the product and must, thus, rely on possibly inaccurate or insufficient information provided by the seller (H. G. Lee, 1998). Behaviour and actions are therefore significantly different in case the users can (have the instruments to) trust the online environment with which they are interacting. For instance, buyers' negative information is read more carefully than positive information and buyers perceive these posts to be more useful (Ito, Larsen, Smith, & Cacioppo, 1998).

H4: Trust will positively affect users' use behaviours with OFDs

It is quite intuitive liking a greater convenience orientation to a higher likelihood of outsourcing meal preparation to third parties, to save time and energy (Harris & Shiptsova, 2007). Indeed, many research works have reported that greater convenience positively affects the usage of convenience food (Bava, Jaeger, & Park, 2008; Candel, 2001; Scholderer & Grunert, 2005), ready meals (Buckley, Cowan, & McCarthy, 2007), and take-away meals (Buckley et al., 2007). Thus, using food-delivery services matches the inclination of convenience-orientated people to save time and energy spent on meal preparation (Roh, M., Park, K., 2019). Moreover, convenience-oriented people do not consider the usage of food-delivery applications as too overwhelming, presumably due to their familiarity with such outsourcing methods. (Roh, M., Park, K., 2019). Indeed, convenience-orientation renders influence people's familiarity with and knowledgeable about these outsourcing methods, so that the

more convenience one is looking, the higher will be the probability to perceive O2O food-delivery services as easy to use (Kim & Joo, 2014). This study therefore hypothesizes the following

H5: Convenience will positively affect users' use behaviour with OFDs

4.3.3 Satisfaction with use

It has been found that users are noticeably interested in the availability of trust-enhancing mechanisms (such as reviews and ratings provided by other customers) on the FDA (A. Alawan, 2020, Cho et al., 2019). This indicates the perceived credibility, usefulness, richness, and relevance of these additional pieces of information, which will then impact the overall satisfaction with the service Algharabat, Rana, Dwivedi, Alalwan, & Qasem, 2018; Cheung et al., 2008; Filieri, 2015; Guo, Barnes, & Jia, 2017; Jiang & Benbasat, 2004; Mathwick & Mosteller, 2017). Trustworthiness has been widely accepted as a critical attribute, which leads to greater loyalty for using mobile apps (Nilashi et al., 2015). Indeed trustworthiness motivate customers use such apps, and to feel satisfied with their experience. In this regard, a research study on amazon.com demonstrated a direct relationship between online features, such as linguistic style and star rating, and conversion rates (Ludwig et al., 2013). Online rating was also observed by Pavlou and Dimoka (2006) to have a crucial role not only in predicting customer trust in eBay.com but also in customers' purchase intention.

H6: Trust will positively affect users' satisfaction with use of OFDs

Customers are more likely to be affected by those around them when judging their experience (satisfaction or dissatisfaction). Indeed, the social approval that customers could have from others will enhance the social values captured in using such systems, and, accordingly, the level of customer satisfaction (Gallarza & Saura, 2006). In line with this proposition, social influence was empirically proved by (Hsiao et al., 2016) to have a significant role in shaping the user's satisfaction with mobile social apps. Therefore, the following hypothesis will be considered in this work:

H7: External influence will positively affect users' satisfaction with use of OFDs

Satisfaction is linked to the psychological and hedonic benefits of the use new products and innovations (Brown & Venkatesh, 2005; Davis et al., 1992; Van der Heijden, 2004). Furthermore, the considerable role of hedonic motivation could be explained by MFOAs still being a new and innovative technology. Furthermore, MFOA features empower customers to co-create value (for instance, by providing feedback trough reviews and ratings) (See-To & Ho, 2014). Therefore, the customer is more likely to perceive his or her important role both for other customers and for service providers, which will accordingly increase their feeling of pleasure. This is consistent with the results from (Iyer et al., 2018), which confirmed the role of hedonic value in contributing to the level of customers' satisfaction with mobile retailing apps. Similarly, (Hsiao et al., 2016) postulated the strong significant relationship between enjoyment and users' satisfaction. This leads to the following:

H8: Hedonic motivation will positively affect users' satisfaction with use of OFDs

Recent study has revealed that convenience motivation, which falls under the individual level factors, is able to positively moderate the relationship between satisfaction and e-loyalty (Anderson and

Srinivasan, 2003). Previous study (Chang et al., 2012) has empirically demonstrated that convenience motivation does affect attitude in the context of adoption of English learning among college students. Moreover, as explained by (A. Alawan, 2020), convenience can be referred to all that makes the experience with FDA simpler and more efficient (reduces time, effort, and the cost of human contact), given that customers can create and follow the stages of their order on real-time, directly on their apps.

H9: Convenience will positively affect users' satisfaction with use of OFDs

In the case of food delivery, (A. Alalwan, 2020) demonstrated that without the existence of facilitating conditions, customers would not be able to efficiently use food delivery services and attain the benefits required for them to be satisfied. Such results are similar to those of (Chan et al., 2010) and (Maillet et al., 2015), who demonstrated the role of facilitating conditions on satisfaction. Moreover, without the existence of such facilities, customers would not be able to efficiently use MFOAs and attain the benefits required for them to be satisfied. However, given the strong connection relation between facilitating conditions and customers' immediate experience, this factor was not able to predict future use of this type of service (Ray et al., 2019).

H10: Facilitating conditions will positively affect users' satisfaction with use of OFDs

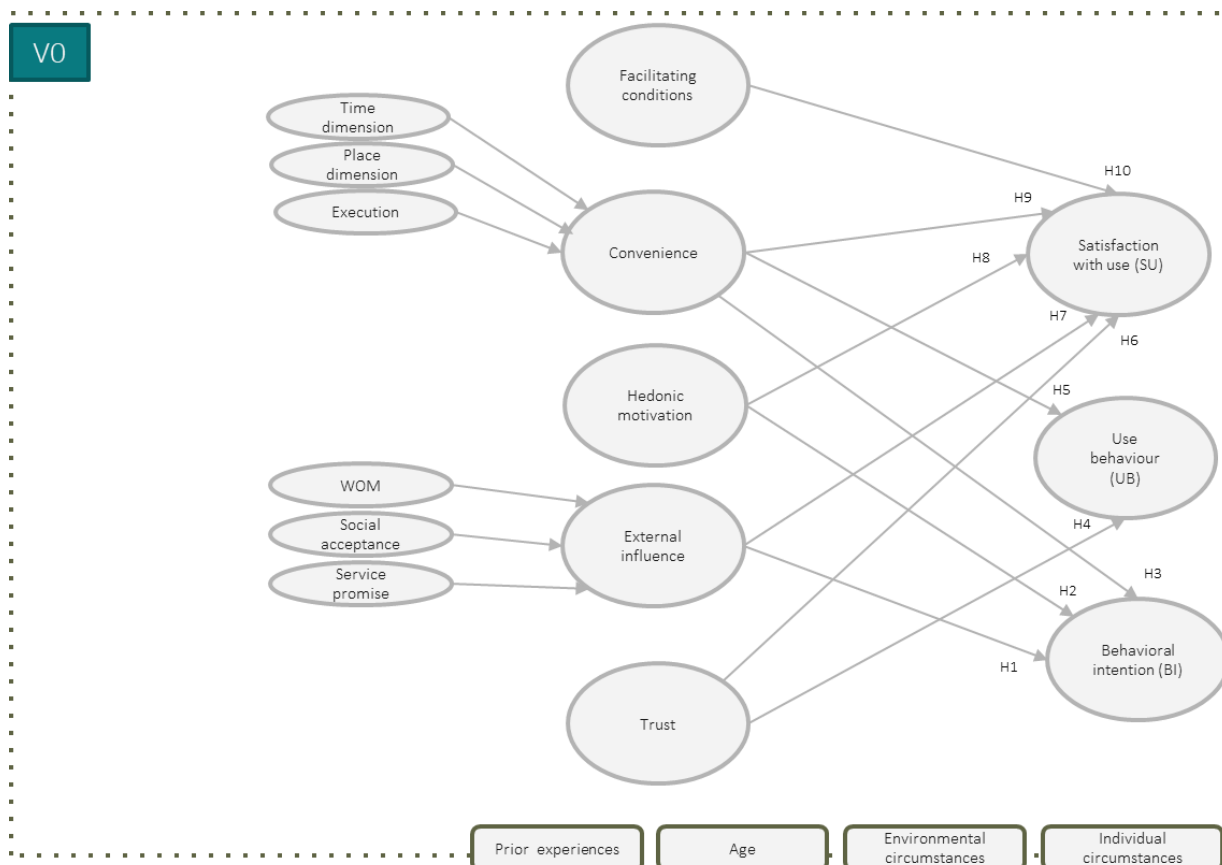


Figure 10: User-discovery map: Version Zero (V0)

5 The use-case: Food Delivery

Prior research has mostly examined consumer attitudes toward online services/retailing in general and a few researchers have addressed consumer experiences with online food delivery (OFD) services. Moreover, no previous research has been found addressing the need to design this service using the affordance notion, neither a map of the affordances of the food delivery. This research aims to provide a contribution to fill this gap. First, a comprehensive picture of the service will be provided, considering its definition and functioning. Then, major trends, in Europe and in Italy, will be discussed. Finally, architectural characteristics (modules and functional models) and affordance elements (affordances and affordance indicators) will be described.

5.1 The various definition of the service

Food delivery (FD) providers can be categorized as being either Restaurant-to-Consumer Delivery or Platform-to-Consumer Delivery operations (Li et al., 2020). Restaurant-to-Consumer Delivery providers are in charge for both preparing the food and deliver it. Such providers typically include large, multinational chains, such as KFC, McDonald's, and Domino's. The order can be made directly through the restaurant's online website mobile app or via third-party platforms or intermediaries. Platform-to-Consumer operators are instead not responsible for food preparation. Instead, they only handle digital meal order. Moreover, third-party platforms can provide diverse service to their partner restaurants. In some cases these platforms work as marketplaces for the restaurants, which remain in charge for delivery. In other cases, they offer delivery services to partner restaurants and thus are delivery operators.

Another categorization proposes to distinguish between single and multiple restaurant intermediaries (Sjahroeddin, 2018; Yeo et al., 2017). In the first case, it is the restaurant which provide its own FD service; in the latter, multi-restaurant mobile applications work as intermediaries for different restaurants (Sjahroeddin, 2018).

The core of their business of these intermediaries is to provide a facility that allows the customers to map restaurants around them. Customers can choose a restaurant and then place their order. If the order gets accepted by the restaurant, the food will be delivered to the customer. In addition, the food delivery platforms serve a variety of functions including providing consumers with a wide variety of food choices, the taking of orders and the relaying of these order to the food producer, the monitoring of payment, the organization of the delivery of the food and the provision of tracking facilities (Li et al., 2020). They are not liable for the actual food preparation (Ray et al., 2019). Online FD platforms can either be responsible for recruiting and training professional delivery people, or they may also resort to crowdsourcing logistics, using delivery people who are not necessarily employed by the online FD platform. Professional delivery people are usually trained, and at least part of their salary is guaranteed, while a portion is commission-based. In contrast, the independent

delivery people who are frequently known as “riders” are paid on a commission (per order) basis. Restaurants can sign up to the Online Food Delivery services and will then be listed on the platform. The restaurant will be charged a commission for orders that were transmitted via the platform.

5.2 Relevance of the use case: global trends

The rise of online FD is a global trend. The adoption of these services is already substantial high, even given their relative newness. This is due to the fact that the online FD industry has been very proactive in the way it has developed new markets and cultivates consumers’ eating habits, by introducing new food categories and options to the choosing and purchasing of food online.

It must be mentioned that, as food service industry customers are notoriously fickle, the industry is in constant need to keep up with changes in taste, fashion, and ease of access. Nevertheless, the food industry is a saturated market, though, retailers have begun providing additional services to remain competitive (Yeo et al., 2017). Technology assists in this process, so that food services now rely on technology in all the stages of the marketing funnel (Bickerton, 2015).

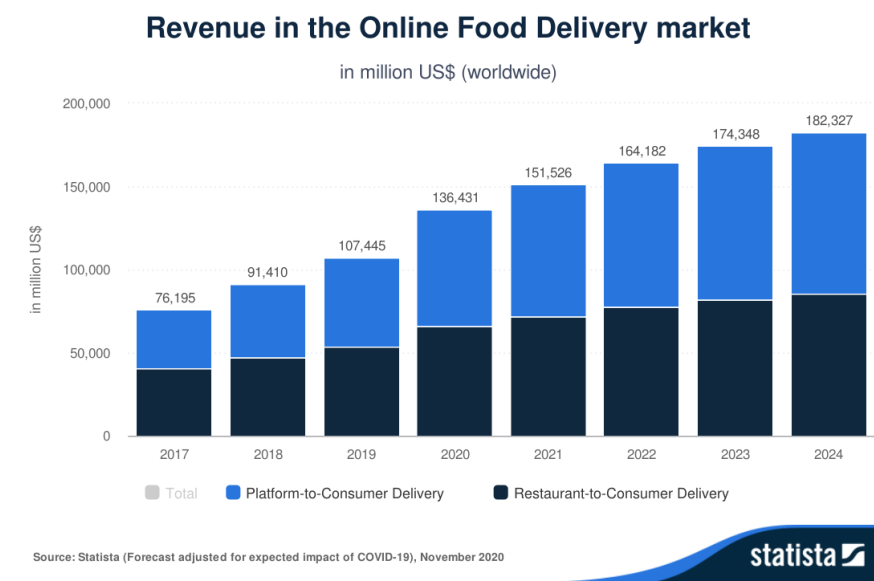


Figure 11: Revenue in Online Food Delivery Market (Statista Digital Market Outlook, 2020)

The below diffusion curve shows successive groups of consumers adopting Online Food Delivery (for this the graph above shows the penetration rate of selected countries), according to a research from Statista (Statista Digital Market Outlook, 2020). Considering the already high diffusion rates, Online Food Delivery is likely to grow slower in the next years. However, while the popularity of online ordering is growing fast, a considerable share of food orders is still placed over the telephone. This still means untapped potential for the Online Food Delivery market, especially considering the Platform-to-Consumer Delivery, which accounts for 48% of total revenue within the Online Food Delivery segment in 2018. Yet commissions and delivery fees are high compared to Restaurant-to-Consumer Delivery services and profits are therefore harder to extend, especially in new markets.

Innovation diffusion curve for 2019

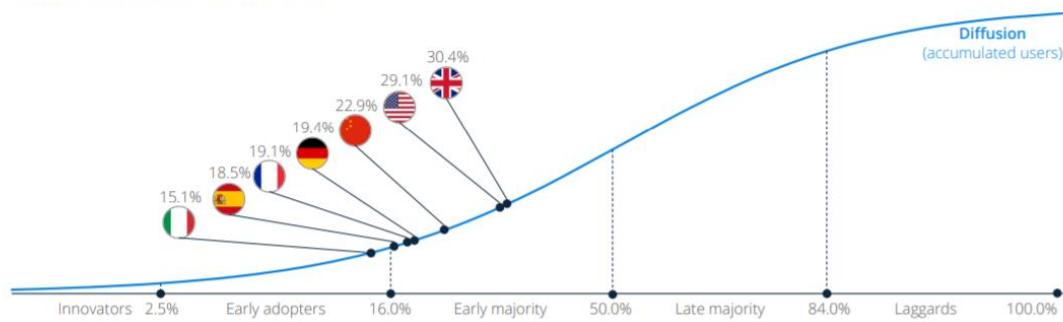


Figure 12: Food delivery Innovation diffusion curve 2019 (Statista Digital Market Outlook, 2020)

The main followings can be considered as the main reason for the diverse adaptation rates of the service.

First, adoption depends by the existence of an adequate digital infrastructure. Metrics such as internet penetration, smartphones penetration, connection speed and broadband subscription. Indeed, e-Services in general have recently gained popularity because of these factors, which allow the establishment of more sophisticated services and enable consumers to integrate digital services in their everyday lives.

Secondly, the rising adoption of this service is also influenced by various socioeconomic factors. These include GDP, average consumer spending per capita of private households, share of population living in urban areas. Of particular significance, the global rise of expenditure on a combination of increased quality, convenience, and variety of foods. And, as the global expenditure for food products rises, the revenue of food delivery services is likely to increase.

With regards to players, competition is fierce. Many countries around the world have at least one major platform for food delivery. In the U.S., UberEATS is the fastest-growing meal delivery service, reaching out to industry leader GrubHub. Also, DoorDash is trying to close that gap with 400million in new funding (March 2019). In China, ordering food online to pick up at restaurants is already highly popular. Alibaba-backed Ele.me and Tencent-backed Meituan are the leading companies in China's Online Food Delivery sector. Delivery Hero, Just Eat and Takeaway.com, Deliveroo and Glovo are market leaders in Europe. Notably, there is a variety of start-ups and scaleups competing one against each other.

Fierce competition results in thin margins as companies rush to try to poach customers from each other. Network effects are crucial for winning over leadership markets. Another popular strategy is acquisition, to bundle strength and drive smaller players out of the market. Famous examples are Just Eat, who acquired HungryHouse, SkipTheDishes, Hellofood, Pizzabo, Menulog, Deliverex, Clicca e Mangia, Food2u, and AlloResto to dominate several European markets. New market entries can only be successful with a strong market position and high funding.

Selected key players in Online Food Delivery

Start-ups ²	
Established players	

1: Key player overview does not represent the entire market landscape 2: Companies founded in ≥2008

Figure 13: Players in Online Food Delivery (Statista Digital Market Outlook, 2020)

Being a commodity-based business, companies are trying to differentiate themselves by integrating other services (such as Grocery or Pharmacy delivery) or by introducing sustainability options. New features and data-driven innovations are designed for user experience optimization (the usage of data to personalize profiles, recommendations) or digital tracking along the process from the preparation to the final delivery. Another topic is the integration in an IoT environment: it is expected that food delivery apps will add virtual assistant systems that enable voice-ordering. Finally, smart assistants and wearables will be equipped with online food ordering features.

Optimizing the user experience is strongly connected to the delivery process, which is why we predict to see more innovation with regard to new delivery methods. Companies are experimenting with self-driving cars, drones and robots to make transportation easier and more convenient. As the innovation leader within this area, many companies in the U.S. are testing autonomous vehicles. An example is Domino's, who developed a self-driving pizza delivery robot and a delivery drone, or Ford, who put up a self-driving van delivery in cooperation with Postmates. In China, Ele.me is working on a pilot project using food delivery drones in Shanghai's Jinshan Industrial Park

5.3 Focus: trends in Italy

Even if ordering food at home via digital apps was a growing trend before 2020, the Covid-19 pandemic and the subsequent lockdowns have consolidated this habit. Indeed, at the beginning of 2020, Italian National Institute of Statistics (Istat) added meals' home delivery to the list of products that make up the reference basket for the detection of consumer prices, thus representing how this type of service is one of the major components of Italian households' spending. At the end of 2020, data show that Food-delivery alone generated in Italy a turnover of 706 million (+ 19% on 2019). This service now represents between 20% and 25% of the whole home sector and establishes itself as essential in the eyes of the Italians. In the second quarter of 2020, during the first wave of the Covid-

19 pandemic, the market underwent a strengthening of its territorial presence and reached 100% of Italian cities with more than 50,000 inhabitants and almost two thirds of Italians. (data from National market observatory of online food delivery in Italy, 2020).

The 2020 lockdowns have indeed dropped the barriers to the use of the e-commerce channel (and digital payments) and have convinced even the most reluctant retailers to enhance the online offer. This has thus exacerbated an already existing preference towards the online medium (Jiang et al., 2013; Rezaei et al., 2016c), and an explosive growth of Internet access and habituation.

However, with comparison to the global trends, Italy lags in terms of users accessing the service through platforms. Indeed, Italian users still prefer Restaurant-to-Customer Deliveries and thus make use of more traditional means (phone calls), whereas, on average global level, the number of users of both Restaurant-to-Consumer and Platform-to-Consumer are comparable.

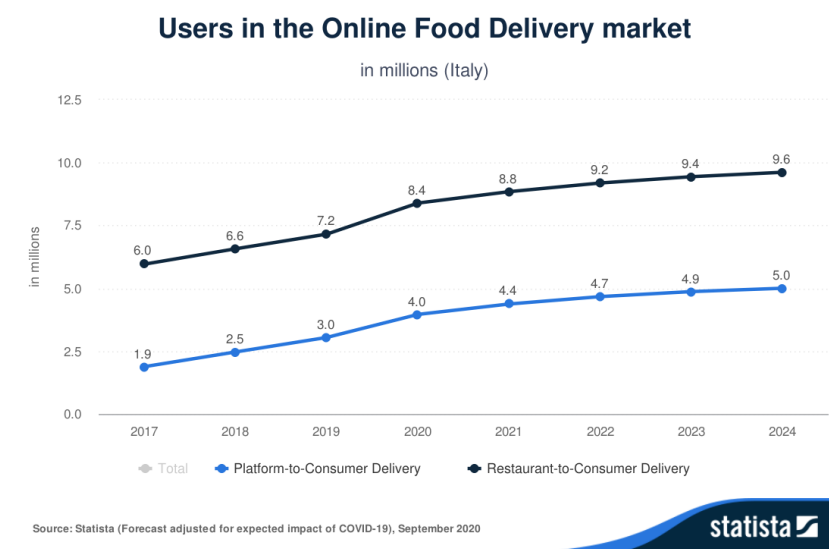


Figure 14: Users in Online Food Delivery market in Italy (Statista Digital Market Outlook, 2020)

This can be explained in terms of platforms' reach (which today are only available to one third of the population), especially in the Sud area and the least populated cities. Other influencing factors are internet penetration (69.7%, below European average of 76.8% - 2019 data) and smartphone penetration (43,5%, below European average of 68.5% - 2019 data).

Considering the Platform-to-Consumer provider (National market observatory of online food delivery in Italy, 2020) identifies the most preferred services. The survey conducted in summer 2020 highlights the predominance of JustEat, from which the 73% of respondents placed at least an order in the previous 12 month. Following Deliveroo (39%), Glovo (32%) and UberEats (12%). Differences in the adoption rate mainly depends on coverage. Just Eat is the provider with the highest territorial presence (in 2020, it reached over 1,200 cities with more of 16,500 restaurants present in the platform).

With reference to customer discovery (National market observatory of online food delivery in Italy, 2020) offers a complete overview of evolution of consumption and preferences of Italians, though a careful analysis of the "food mood". These "moods" are emotions and occasions, which guide the

choices of Italians when they order food at home. Results show that the population prefer to place an order in a situation of serenity, happiness, satisfaction or even a source of joy and positive momentum in less pleasant situations. In the former case, the order is placed during the weekend and shared with relatives and friends; in the latter it is made during working days and consumed alone.

This analysis has been completed by the introduction of the most ordered type of foods by Italians, in a spectrum that goes from tradition to overseas specialties, symptom of both the bond of Italians with their culinary origins and the desire to experience something new.

5.4 Field specific research

Insights and conclusions on the use case of food delivery have been derived by multiple inputs. Thus, the multiple steps of the secondary research will be described here.

5.4.1 Questionnaire

First, given the first objective of validating the proposed model for categorizing affordances (being either Sensory or Experiential related), a questionnaire has been conducted.

As stated in 2.7, the objective of this research was to test the model proposed by a previous research jointly conducted between Politecnico di Torino and Milano. Indeed, in that study affordance indicators are grouped to the characteristics of the system, as proposed by (Roskos, 2017). Then, these characteristics are associated either to the Sensory or to the Experiential Affordance. Consequently, this results in the affordance indicators being part of a certain characteristic been associated to one of the affordance types. However, this distinction did not derive by any on-field research and instead was derived by the perception of a single user. Thus, the scarce primary research constituted a strong limitation to the validity of results, since the study of affordance evaluates perceptions, which are subjective by nature.

Consequently, in the first objective of this work was to expand the sample of interviewees to obtain an empirical analysis that can support the validity of the previous study and provide objective evidence of the results.

The questionnaire has involved 65 respondents, all being Italian users of online food delivery services. It has been delivered using an online medium (Google form). Respondents have been asked to associate the affordance indicators either to their interaction with the Artefact or with the Service. Indeed, recalling the definition given by the previous study, Sensory Affordance derives from the interaction with the Artefact (it being the instrument through which the service is delivered – the smartphone itself or the installed app), whereas Experiential Affordance derives from the interaction with the Service.

The questionnaire was constituted by 46 questions (one for each affordance indicator identified). For each question, the respondent was given a short description of the meaning of the affordance

indicator, so that the asymmetries due to interpretations were reduced. Similarly, a short explanation of “Artefact” and “Service” was given. The following explanations have been provided:

- Artefact: “Everything pertaining the mean used to interact with the service – smartphone/pc; app/webpage”.
- Service: “Everything pertaining the steps needed to obtain the intended result when ordering via food delivery apps”.

These definitions were voluntarily chosen to be simple and straightforward, Indeed, being the target respondent a generic user of the platform, no assumptions could have been drawn with regards to the level of education and capacity to relate to the research-specific problem. The same logic was adopted to the definition of affordance, which instead was not even mentioned to respondents. Indeed, assuming none of the user will be familiar with this concept, we decided not to provide specific details.

When answering, respondents were given the option to either chose one between “Service” and “Artefact”. They were also given the possibility to choose none of them, whenever the association to either one or another was not clear to them. They were not allowed to express more than one choice per question.

5.4.2 Semantic research

This research conducted in parallel with an internship in Glovo (Foodhino SRL). Thus, data and information were made available for this research. The investigated material was reports and comments on orders.

The analysed reports are 17. They all are user-discovery research conducted by the provider, in order to evaluate the experience of the user with features of the app or to detect those badly affecting the user experience. These reports referred to interviews and user observations, conducted by the company between February and June 2020. This research material used in this study was derived from a larger batch of available sources, by searching keywords which could have been useful for this research (such as “experience”, “interaction”, etc.). The analysis was restricted to reports on customers’ experience, while information was also available for the restaurant and the rider. After having identified the relevant reports, these were studied by identifying keywords and lexical affinity.

Additionally, a dataset of 6402 comments on orders have been revised. These comments refer to 5 weeks (8 September 2020 – 19 October 2020) bad ratings on received order. The dataset was studied by extracting keywords, which can represent the same concept or the same emotion. The resulting information was revised to find patterns, descending form frequency of the finding or relative association to other similar/dissimilar concepts or sentiments.

The objective of this research was to complete the customer discovery and then to refine the proposed model. Indeed, results from this round of research will be used to refine the content of the model and to provide insights on behaviours in the case of European / Italian users. Indeed, as mentioned earlier, no existing literature has been found studying behaviours’ predicting factor in the European or Italian context. Thus, to render this work more coherent with the sociodemographic

context in which it is conducted, a deep dive on the specific behaviour has been considered necessary.

5.4.3 Interviews

Another round of research was constituted by interviews.

These interviews were conducted through an online medium (Google Meet), because of the pandemic situation which has not allowed to organize them otherwise. Participants have been selected from the personal network. Moreover, participants were selected from the network of Mirko Franceschi, another student conducting the same research and in collaboration with whom the results of this research will be shared. All participants were selected according to their education and work experience. Indeed, previous knowledge on the topic was a prerequisite.

Participation was confirmed through email (see Appendix 2). Interviews were conducted between the 17th and the 30th of January 2020 and involved 16 people, aged between 17 and 51. The following information about respondents were collected. Names and other demographics will not be displayed for privacy reasons.

Table 3: Interviewees' list

Participant	Age	Gender	Profession	Domicile
P1	47	M	University lecturer	Milano
P2	50	M	University lecturer	Milano
P3	28	F	Business developer	Milano
P4	31	M	Business developer	Milano
P5	25	F	Student	Udine
P6	26	M	Entrepreneur	Milano
P7	23	F	Consultant	Verona
P8	27	F	Marketing Manager	Milano
P9	25	F	Student	Torino
P10	22	F	Manager	Conegliano
P11	25	M	Student	Loreto
P12	25	M	Student	Termoli
P13	30	F	Freelancer	Ascoli Piceno
P14	26	M	Manager	Susegana
P15	48	M	Manager	Ascoli Piceno
P16	55	M	Manager	Ascoli Piceno

The interview was divided in subsequent activities. Indeed, the aim of these interviews was to complete the users' knowledge of users on design-specific characteristics of the service.

In the first part of the interview, interviewees were asked to complete the list of affordance indicators, according to their experience with the service. Thus, by brainstorming and, respondents were facilitated in the identification of the missing affordance indicators. This served to provide a complete and comprehensive list of these indicators. Moreover, this passage was necessary to integrate the precedent list of indicators, proposed in the precedent study.

Secondly, interviewees were asked to complete the list of functional modules and then to arrange affordance indicators in each of these modules. This served to create an association of the affordance indicators to the functional modules. Indeed, no previous literature was found describing the architecture of the service, neither on the affordances of this service. Thus, the purpose of this investigation was to reduce the subjectivity of the association. Again, the functional modules identified in the previous study served as an input for the identification of the modules.

5.4.4 Focus groups

A further round of validation of the model was conducted through focus groups. This step has considered necessary, given the need to complete the study in a more specific sociodemographic context, as explained in **Errore. L'origine riferimento non è stata trovata..** Moreover, this step has served for investigating more specific areas and driving questions in a direction which could fit better the need of this work.

For this purpose, two focus groups have been conducted. Both have been performed though an online medium (Google Meet), because of the pandemic situation which has not allowed to organize them otherwise. Participants have been selected from the personal network and thus they are people directly or indirectly known from the author of this work. Participation has been confirmed though email (see Appendix 3). Their demographics have been traced though a specific form (released via Google Form), which also served to trace the frequency of use of the service.

The first focus group was conducted on the 9th of November 2020 and involved 6 people, aged between 17 and 48. The following information about respondent have been collected. Names and other demographics will not be displayed for privacy reasons.

Table 4: Focus group 1: Participants' list

Participant	Age	Gender	Profession	Frequency of ordering	Used platfom	Domicile
P1	27	F	Demand planner	Once or twice a month	Glovo, JustEat, Uber Eats	Milano
P2	48	M	Freelances	Never	None	Reggio Calabria
P3	27	M	Designer	Once or twice a month	Glovo, JustEat, Uber Eats	Milano
P4	17	F	Student	Less than once a month	Glovo	Torino
P5	26	M	PhD	Less than once a month	Glovo	Torino
P6	31	M	Product developer	Never	None	Firenze

During this focus group, participants were asked to evaluate their experience during their interaction with digital services, specifically food delivery and online shopping. No prior knowledge or experience with these services was required. The aim of this focus group was thus to validate the hypothesis on the similarities of perceptions with both services.

The focus group was divided in two moment. In the first part users were asked to evaluate and describe their experience with food delivery, in the second part with e-shopping. In both parts, participants were asked to discuss around the same questions and topics, so that it was possible to confront answers. During each part, the investigation was meant to analyse the three moments of interaction (before, during and after) and to validate the relevance of predicting factors in their experience with both services.

The second focus group was conducted on the 14th of December 2020. It involved 8 participants, aged between 19 and 51. The following information about respondent have been collected. Names and other demographics will not be displayed for privacy reasons.

Table 5: Focus group 2: Participants' list

Participant	Age	Gender	Profession	Frequency of ordering	Used platfom	Domicile
P1	24	M	Office worker	Less than once a month	Glovo, Just Eat	Torino
P2	27	F	Office worker	Once or twice a month	Just Eat, Foodracers,	Pordenone
P3	28	M	Freelance	Once or twice a month	Just Eat, Foodracers, Everli (ex supermercato24),	Pordenone
P4	40	F	Teacher	Once or twice a month	Glovo, Just Eat	Torino
P5	23	F	Student	Once or twice a month	Glovo, Just Eat	Augusta
P6	49	M	Office worker	Once or twice a month	Alfonsino	Salerno
P7	19	F	Student	Less than once a month	Glovo, Uber Eats	Milano
P8	51	F	Office worker	Once or twice a week	Glovo	Torino

During this focus group, participants were asked to evaluate their experience during their interaction with food deliveries. No prior knowledge was required. However, differently from the previous one, all participants were required to have had previous experience with the service (they needed to have had experiences with Glovo, JustEat and the similarly). Indeed, given the results from the first focus group, the contribute of those who had already used the service was considered more valuable and insightful. The aim of this focus group was to validate the model and identify the main driver for using the service and the key satisfaction criteria. Thus, participants were asked to discuss on specific questions, aimed at verifying the influence of each predicting factor to their experience with online food delivery services and share their personal experience.

The focus group was divided in two phases. In the first part, users were asked to evaluate the influence of predicting factors on their experience with food delivery. In the second part, participants were asked to identify the main value proposition they identify in this type of service.

5.5 Architecture of the service

In accordance with the methodology proposed in the previous study, a fundamental step for the evaluation of affordances is to define the actors and architecture's details of the service.

Indeed, to proceed with the analysis of the Affordances, the functional nature of the artefact itself must be reconstructed (Maier J. R., 2009). Affordance analysis is a fairly complex problem, as it is required to analyse and evaluate the perception of a relationship. To overcome this problem of greater complexity, an approach is to bring us back to a less complex problem, as described in (C. Chen, 2015) trying to give an evaluation of something less abstract, that is the elements from which the perception of affordance originates, called affordance indicators.

5.5.1 Definition of the actors

When using an aggregation service like Just Eat or Deliveroo, the customer can decide between a variety of restaurants that are near the delivery location (GPS located or by defining an address). The food is then usually chosen in an eCommerce-like shopping set

Most Online Food Delivery services offer a personalized account, so customers have to login or register with their user data before or after the checkout. Additionally, coupon codes can be entered for a discount. After the checkout, the customer needs to choose a payment method. At the end, customers are informed how long the delivery will take, based on the address and the capacity of the restaurant.

The restaurant: For restaurants, the new model offers an additional source of revenue and a higher utilization rate of existing kitchen facilities, as well as the chance to build relationships with a new pool of customers.

The customer: Here, the advantages are convenience, greater choice, and more restaurants than previously were available for meal delivery. Customers can access a portfolio of restaurants that previously served meals only on their premises. The customer also benefits from the ability to track delivery in real time.

The deliverer: The deliverer (also known as rider) is in charge for picking up and delivery meals. The rider will be followed on the map and will be compensated according to the efficiency (number of delivered orders) of his/her work. Thus, the objective is to maximize the revenues he/she generates.

For the purpose of this study, the viewpoint has been the customers has been considered, so that to consider the affordances of the artefact / digital service they interact with.

5.5.2 Flux diagram and definition of the architecture

In order to retrace the user journey and to reconstruct the architecture of the system behind the service, a flux diagram has been produced. The UML (Unified Modeling Language) has been used for the construction of the flow diagram.

This flux diagram has served to identify the functional modules of the service. Indeed, having the flow diagram as input, it is possible to build the architecture of the digital system, which can be

represented through a block diagram. The diagram shows how the system works and how the various modules interact with each other at the level of functions and information exchange. The definition of the architecture serves to identify the links between the different modules that make up the system and to identify the elements within each module.

In this study, the representation has been restricted to the modules which directly or indirectly effect the users or with which he/she interacts. Thus, the modules that describe the service from the viewpoint of the restaurant or the deliverer has not been considered. Similarly, these modules which pertain to the activity of the service provider (such as marketing, operations, etc.) have not been considered. This approach follows (Voss & Hsuan, 2009) according to which services can be considered bundles of functional modules. Each module is a specific configuration of functional elements and either represents the possibility to consume over time or reflects the ability of choosing the desired service level according to its consumer (in this case, the customer, the restaurant, or the deliverer).

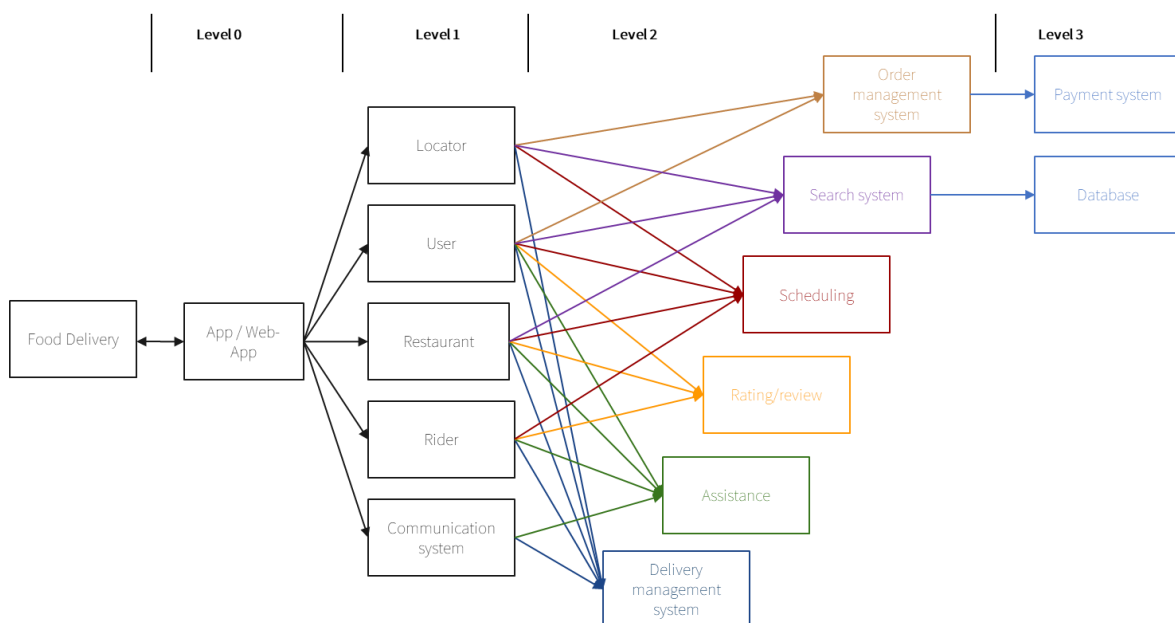


Figure 15: Food delivery service: function tree

These functional elements have first been presented in a function tree, which reflects the hierarchical order that is established between the affordances.

Then, the relationships among the functional module will be represented through a block diagram which represents the architecture of the service.

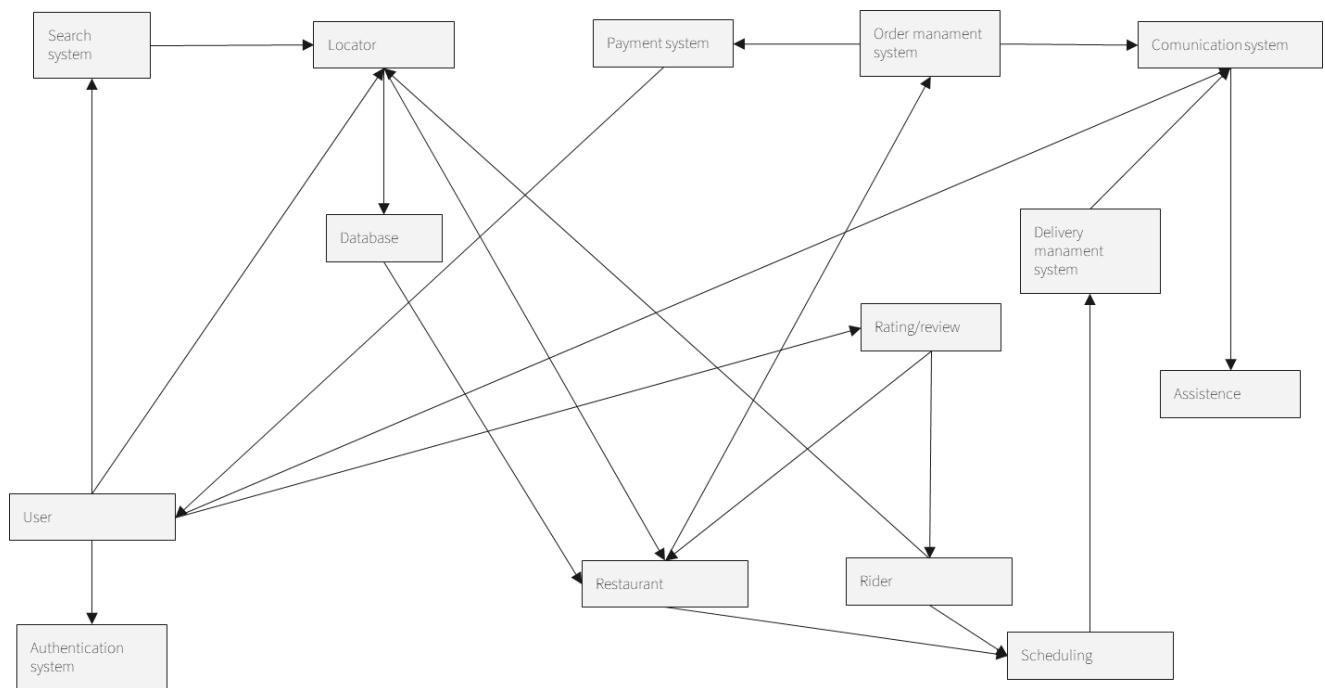


Figure 16: Food delivery service: architecture

5.6 Affordances of the service

Having the flux diagram as an input again, the affordance indicators have been identified. Finally, starting from the functional structure of the system, affordances were expressed in such a way that they were relations (Maier J. R., 2009, Evans, 2017). The definition of the Affordances was made coherently to the one presented in (Chenyi Chen, 2015) and according to the criteria described within (Evans, 2017).

The starting point for this research will be represented by the affordances and affordance indicators identified by in the previous study, according to the method he proposed and the scribed in the previous chapter.

Table 6: Affordance indicators (E. Perpignano, 2020)

Affordance Indicators
Navigation system
Site map
Search function
Results ordering
Menu
Email
Sms
Notification
Chat
Telephone
Order status
Multilanguage
GPS
User account
Systems settings
Payment
Help desk
Maintainance
Order scheduling system (restaurant)
Order scheduling system (rider)
System performance

Table 7: Affordance (E. Perpignano, 2020)

Affordance
Affordance into ask an order (A1)
Affordance into interaction with restaurant (A2)
Affordance to refer a menu(A3)
Affordance into track order (A4)
Affordance into search restaurant (A5)
Affordance for map positioning (A6)
Affordance in delay order solution (A7)
Affordance to system performance (A8)
Affordance into ordinary maintenance (A9)
Affordance in user Account (A10)
Affordance with data (A11)
Affordance with payment (A12)
Affordance into delivery order (A13)
Affordance into pick order from rider (A14)

6 Findings and results

Given the multiple scopes of this work, the field-specific research has been conducted pursuing multiple aims. Thus, in presenting the relative findings, subsequent phases will be described. Each phase aims at responding to each of the research question previously described.

In the first phase, by studying the results from the questionnaire and the interviews, the method for analysing the digital affordances will be tested and completed. Indeed, as explained in the previous section (2.5) the previous study proposes the distinction between Sensory and Experiential affordances. The definition of the architecture, the identification of the affordance indicators and the description of the affordances follow, as explained in the method (2.7). Hence, this test aims at evaluating the validity of the proposed method and at detailing it.

In the second phase, the model proposed for the identification and formalization of user needs will be refined. Following the progressive approach described in (4.1), the model will be consequently adjusted to integrate feedbacks from the users, collected through the semantic analysis on Glovo' reports, the interviews, and the focus groups.

In the third phase, the main results for engineering design will be synthesized and critically analysed. This passage will provide a contribution to the formalization of an affordance-based method for the design of digital artefacts.

6.1 Digital affordance

The first phase involved the testing of the proposed method for classifying affordances. As explained in the 4th step of the method described in 2.7, affordance indicators are classified into the characteristics of the system, as proposed by (Roskos, 2017). Then, these characteristics were associated either to the Sensory or to the Experiential Affordance. Consequently, this resulted in the affordance indicators, as part of a certain characteristic, being associated to either one of the affordance types. Thus, the previous study takes the characteristics of the system as cluster to the association of the affordance indicators to Sensory and Experiential Affordance. It is the belonging to the characteristic which defines the type of affordance an indicator can be referred to.

To test the model, a preliminary investigation on the proposed association has been conducted. A t-test was carried out to verify the identification of patterns in the distributions of the affordance indicators being part of the same characteristic of the service. Then, because of the result of this initial test, the analysis has involved the identification of a long list of affordance indicators and their clusterization in functional modules. Finally, subsequent tests have been carried out to identify the association affordance indicators – type of affordance in which patterns were more markedly identifiable.

6.1.1 Association to the characteristics of the system

The first validation step was to evaluate the responses from the questionnaire. As explained 2.7, in the in the previous study, affordance indicators are grouped to the characteristics of the system, as proposed by (Roskos, 2017). Then, these characteristics have been associated either to the Sensory or to the Experiential Affordance. Consequently, this resulted in the affordance indicators being part of a certain characteristic been associated to one of the affordance types.

During the test, respondents were asked to associate the affordance indicators either to their interaction with the Artefact or with the Service. Then, the indicators were grouped in the characteristics of the system, as proposed in the previous study. This served to evidence patterns in the distribution of responses, according to the proposed distinction, as explained in the previous chapter.

The responses of the questionnaire are reported in the Appendix **Errore. L'origine riferimento non è stata trovata..**

To test this association, a T-test has been conducted. In particular, a two-sample t-test (a.k.a. the Student's t-test) has been performed. The formula is reported below.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{s^2(\frac{1}{n_1} + \frac{1}{n_2})}}$$

In this formula, t is the t-value, x1 and x2 are the means of the two groups being compared, s2 is the pooled standard error of the two groups, and n1 and n2 are the number of observations in each of the groups. For the purpose of this work, x1 and x2 will be the mean of the group responding "Artefact" and "Service" respectively for the characteristic of the system (Functionality, Communication, Accessibility, Administration, Instrument).

Comparing the calculated t-value against the values in a critical value chart, it was possible to test the following null hypothesis:

H0: there is no significant difference between the averages of "Artefact" and "Service" in the distributions of responses for each system feature.

In case the null hypothesis was rejected, it could have been possible to conclude that the two groups are in fact different and thus the association characteristic of the system - type of affordance proposed in the previous study was in fact correct. Otherwise, the association could have not been considered proven from a statistical standpoint and thus it could have not been concluded that the groups are significantly different.

Results are shown in the following charts.

Table 8: T-test 1: results

	Functionality		Communication		Administration		Accessibility		Tools	
	Artefact	Service	Artefact	Service	Artefact	Service	Artefact	Service	Artefact	Service
mean	28,27	36,09	28,50	33,00	45,00	20,00	32,80	31,20	49,25	14,00
st.dev	22,06	22,29	10,82	11,95	24,73	24,73	19,46	20,14	3,20	3,56
variance	486,62	496,89	117,14	142,86	611,33	611,33	378,70	405,70	10,25	12,67
n	11	11	8	8	4	4	5	5	4	4
Tvalue	0,827		0,789		1,430		0,128		14,727	
Tdes	2,086		2,145		2,447		2,306		2,447	
	H0 NOT rejected		H0 NOT rejected		H0 NOT rejected		H0 NOT rejected		H0 rejected	

As summarized in this table, the null hypothesis is rejected only in the case of Tool, which thus is the only characteristic of the system which presents a pattern, as in the association proposed in the previous study. Functionality, Communication, Administration, Accessibility do not present any relevant tendency. The fact that only Tools passes the test can be spoiled by considering that the characteristic in question is the only one with purely back-end indicators (thus without user - artefact interaction). Therefore, this feature will be excluded in subsequent evaluations.

At a closer look, the affordance indicators within each characteristic result to be significantly diverse one to another, which resulted in the characteristic to be defined in a broad manner. Thus we derived the incapacity of the user at identifying a precise pattern (association to either the Sensory or the Experiential sphere) for all the indicators in the same characteristic. This result can be interpreted by considering that the association Characteristics of the system / Type of affordance is not a correct representation of the users' perception. Thus, we will proceed by associating the affordance indicators to either sphere not passing by the characteristics of the system but choosing a lower level of granularity instead. This may help in reducing the differences within each category, which may hinder the observability of patterns.

6.1.2 Affordance indicators and functional modules

To proceed with a further validation of the method in the precedent study, it was first necessary to reconcile the architecture detail of the service. Indeed, as postulated in the proposed methodology (see 2.7), it is essential to reconstruct the affordances and affordance indicators of the analysed service.

The interviews have served to reach this goal. Indeed, as previously indicated, one of the objectives of the interviews was to identify the complete list of affordance indicators of the service.

The starting point for building the final list of affordance indicator was the research conducted in the precedent study. Indeed, in the joint research, a preliminary list of indicators was provided, as further detailed in 5.6.

The following is the final list of affordance indicators. As visible, the list is more extensive and thus aims at representing and capturing and representing all the relevant affordances of the service.

Table 9: Long list affordance indicators

Affordance indicators									
Multilingual settings	Filters	Restaurant information	Rider information	Rider Localization	Promotional codes	Notes on the order	Order status	Email	Rating to restaurant
Text dimension modification	Results ordering	User account	Sharing	User Localization	Payment methods	Chart editing	Countdown to arrival	Sms	Rating to rider
Vocal commands	Favourites	System settings	Help desk	Restaurant Localization	Other accounts' comments	Finalization of the order	Add review to the order	Notifications	Rating to customer care
Sounds feedback	Orders' history	Colours e fonts			Communication evaluation	Chat	Other users' likes	Telephone	

The second objective of the interview was to complete the list of functional modules. The integrations are specular to those of the affordance indicators. Of significant importance the addition of the “User system; “Resturant system” and “Rider system” which reflect the ability of users to understand the service process and thus the actors involved, as further detailed in 5.5.1. In addition, interviewees proposed to make a distinction between the moment of order management (which refers to the customer completing and submitting his/her order) and delivery management (which refers to the subsequent activities from placing the order to receiving it at home). Again, this represents the ability of users to understand role and responsibilities of the various actors during the phases of the ordering process.

Table 10: Functional modules of the service

Functional modules										
User	Search	Restaurant	Rider	Locator	Payment	Order Mgm	Delivery Mgm	Communication	Rating/review	Scheduling

The final objective of the interviews was the association of the affordance indicators to the various functional modules. This associations were made by considering the frequency of association affordance indicator – functional module. This analysis, despite simplistic, was the only available option for drawing conclusion. Indeed, being the interviewees 16, the sample does not lead itself to statistical studies.

User	Search	Restaurant	Rider	Locator	Payment	Order Mgm	Delivery Mgm	Communication	Rating/review
Multilingual settings	Filters	Restaurant information	Rider information	Rider Localization	Promotional codes	Notes on the order	Order status	Email	Rating to restaurant
Text dimension modification	Results ordering			User Localization	Payment methods	Chart editing	Countdown to order arrival	Sms	Rating to rider
Vocal commands	Favourites			Restaurant Localization		Finalization of the order		Notifications	Rating to customer care
Sounds feedback	Orders' history							Telephone	Add review to the order
Colours e fonts								Chat	Other users' likes
User account								Sharing	Other accounts comments
System settings								Help desk	Communication evaluation

6.1.3 Association to the functional modules of the service

Considering the results from the T-test described in the previous section, it can not be concluded the characterization proposed in the precedent study is verified. The goal of this passage will then be to identify clusters within which the affordance indicators can be grouped so that it could be possible to associate these clusters to either the Sensory or the Experiential Sphere. The purpose is to maintain the notion provided in the joint research and to find a correct level of granularity to cluster the indicators and make the various associations.

To accomplish this objective, the results from the questionnaire have been further analysed. As explained, during the questionnaire each respondent was asked to associate each affordance indicator to either Service of Artefact. Thus, by having reshuffled the indicators in new clusters, it has been possible not to lose information and still identifying clusters which refer to either one or another type of affordance.

For a didactic purpose, we propose the association of the affordance indicators to their functional modules. This choice derives from the exigence of identifying less broad cluster, within which the identification of patterns could have been more easily and naturally achieved. On the other hand, following (Maier, 2009), we can admit that the identification of the affordances is complementary to the design of the functional nature of the system. Indeed, the affordances of a device are the set of all potential human behaviours, that the device might allow, and, unlike functions, may or may not be associated with a goal. Also, even when a goal is specified, affordances may or may not support it

reaching. In fact, some affordances may be undesirable and clash with the goal (what we call “negative affordances”). But, while affordances are dependent on what operations the human is capable of executing in general, it isn’t always easy to reckon and identify the “possible actions” of the user. Using function helps to focus the search, as it is backward reasoning. However, once a design or a conceptual design is developed, affordances clearly have a role to play in investigating undesirable possible actions, perhaps leading to designs that are safer and easier to use.

Hence, having identified the affordance indicators and having produced the association to their functional modules, we could test whether the indicators in the same module refer to the same type of affordance.

The test has been conducted through a T-test, as explained in 6.1.1.

Comparing the calculated t-value against the values in a critical value chart, it was possible to test the following null hypothesis:

H0: There is no significant difference between the averages of "Artefact" and "Service" in the distributions of responses for each functional module of the system.

In the event that the null hypothesis is rejected, it could be concluded that the two distributions are in fact different and that there is therefore a tendency in the association of indicators being part of the same functional module. Otherwise, the association could have not been considered proven from a statistical standpoint and thus it could have not been concluded that the groups are significantly different.

Results are shown in the following chart:

Table 11: T-test 2: results

	User		Search		Localization		Payment		Order management		Delivery management		Communication		Rating/ Review	
	Art	Serv	Art	Serv	Art	Serv	Art	Serv	Art	Serv	Art	Serv	Art	Serv	Art	Serv
mean	7,14	57,71	17,25	47,00	50,33	14,67	46,00	17,00	14,33	50,67	57,00	8,00	26,86	34,29	43,86	21,00
st.dev	4,22	4,15	5,38	6,68	13,28	13,28	11,31	9,90	0,58	0,58	2,83	2,83	10,72	12,43	7,97	7,94
variance	17,81	17,23	28,92	44,67	176,33	176,33	128,0	98,00	0,33	0,33	8,00	8,00	114,81	154,57	63,48	63,00
n	7	7	4	4	3	3	2	2	3	3	2	2	7	7	7	7
Tvalue	22,601		6,936		3,290		2,728		77,075		17,324		1,197		5,377	
Tdes	2,179		2,228		2,776		4,303		2,776		4,303		2,145		2,179	
	H0 rejected		H0 rejected		H0 rejected		H0 NOT rejected		H0 rejected		H0 rejected		H0 NOT rejected		H0 rejected	

As summarized, the identification of a pattern is indeed proven for all the functional modules, with the only exception of:

- Payment system: the presence of only two indicators reduces the effectiveness of the test

- Communication system: being built in the same way as the characteristic "Communication" in the previous model, it shares its criticalities (cognitive difficulty in associating with a sphere and consequent referability to only one of the types of affordance in analysis).

Despite this result better allows for the identification of patterns, it should be noted that its applicability is limited. Indeed, this proposed characterization is modeled on the specific use case of this work. Thus, this hinders its generatability and the capacity to apply the finding to alternative use-cases.

6.1.4 Association to the affordance dimensions

To overcome the limits of the previous association, a further test was conducted. In this passage, the affordance indicators have been clustered into alternative categories, which have been taken from previous literature.

The analysed literature works propose numerous categorizations of the affordances, which indeed have been considered to classify the long list of affordance indicators of this work. More precisely, the exercise of classifying the affordance indicators has involved multiple iteration of identifying a categorization – associating the affordance indicators – testing (as explained in 6.1.1).

In this section the most satisfying result will be presented.

The affordance dimensions selected have been derived from the work of (Shao et al., 2020). In this work, affordances are of three types:

- Interactivity affordance: Users' perception of communication and interaction with others actively, reciprocally and synchronously. Interactivity is a multi-dimensional construct that includes three dimensions: active control, two-way communication and synchronicity (Bao et al., 2016; Tan et al., 2018). Active control represents users' ability to voluntarily participate in communications (Liu and Shrum, 2002). It indicates that the users are aware of what they are doing and what they are perhaps going to do and are able to conduct actions and make decisions by themselves (Hsia et al., 2014). Two-way communication describes the bi-directional flow of information between users (Liu, 2003). Synchronicity refers to the extent to which users believe that the technology promptly responds to their requirements (Liu, 2003).
- Information affordance: Users' perception of information creation, storage, transformation and exploitation. This type of affordance is divided into two dimensions of argument quality and source credibility (Sussman and Siegal, 2003). Argument quality refers to the extent to which individuals perceive the received information as complete, consistent and accurate. Source credibility represents individuals' perceptions regarding the credibility of information sources (Lu et al., 2014; Shen et al., 2016).
- Navigation affordance Users' perception of location convenience, ease of use and appearance friendliness. Navigation refers to individuals' perceived ability to locate themselves and move around the platform easily for certain purposes. Reasonable navigation can clearly display the

functions of products, enhance user's comprehension and guide users to search for their required information quickly (Sundar, 2008).

These definitions then served to the association of the affordance indicators to one of these dimensions of affordance.

The following clusterization resulted:

Table 12: Categorization of affordance indicators (Shao et al., 2020)

INFORMATION	INTERACTIVITY	NAVIGATION
Promotional codes	Payment system	System settings
Other users' likes	Finalization of the order	Filters
Other users' comments	Notes on the order	Results' ordering
Restaurant's information	Chat	User account
Rider locator	Email	Chart editing
Rider information	Help Desk	Favourites
Countdown to order arrival	Sharing	Orders' history
Rating to customer care	Notification System	
Rating to rider	Telephone	
Communication evaluation	SMS	
Add review to the order	Colours and fonts	
User localization	Text dimension modification	
Restaurant localization	Vocal commands	
Order status	Sounds Feedback	
	Multilanguage settings	

Hence, having identified the affordance indicators and having produced the association to their affordance dimension, we could test whether the indicators in the same dimension (navigation, interaction, information) refer to the same type of affordance.

The test has been conducted through a T-test, as explained in 6.1.1.

Comparing the calculated t-value against the values in a critical value chart, it was possible to test the following null hypothesis:

H0: There is no significant difference between the averages of "Artefact" and "Service" in the distributions of responses for Navigation, Information, Interaction

In the event that the null hypothesis is rejected, it could be concluded that the distributions are in fact different and that there is therefore a tendency in the association of indicators being part of the same dimension. Otherwise, the association could have not been considered proven from a statistical standpoint and thus it could have not been concluded that the groups are significantly different.

Results are shown in the following chart:

Table 13: T-test 3: results

	Naviation		Interactivity		Informarion	
mean	11,17	53,50	27,00	35,20	48,07	16,53
st.dev	6,53	7,03	13,97	15,16	9,48	9,38
variance	42,70	49,36	195,11	229,73	89,78	87,98
n	12	12	10	10	15	15
Tvalue	15,28		1,26		9,16	
Tdes	2,07		2,10		2,18	
	HO rejected		HO NOT rejected		HO rejected	

The Interactivity dimension does not pass the test, symptom of the user's cognitive difficulty in tracing the interaction with these indicators exclusively to the senses (artefact) or to the experience (service).

6.1.5 Final considerations

From a preliminary study of the categories of the model proposed in the previous study, it has emerged that it further needs to be detailed. In particular, the result does not conform to the hypothesis on the association of the various affordance indicators to the categories of the system proposed by (Roskos, 2017). Thus, we proposed diverse categorizations in the attempt of identifying clusters better suited to represent the correspondence affordance indicators – types of affordance. The most satisfying proposal involved the classification of the affordance indicators in the dimensions proposed by (Shao et al., 2020). The result however does not comply with the hypothesis in the case of communication / interactivity indicators, for which there is in fact an overlap of the types of interaction (experiential and sensory) and therefore of the types of affordances. Thus, the divergence in the interpretation of these indicators needs to be deepen investigated.

6.2 User-discovery map

The second step of the validation process involved the refinement and validation of the proposed model. As previously mentioned, the construction of the model has followed a progressive approach. For such a reason, the validation process has been fundamental, to integrate customer discovery and then to adjust the model accordingly.

The validation approach followed multiple phases, each of which contributed to deepen the knowledge on the user and refine the model accordingly. Results from the analysis are here reported following a chronological order. This serves to follow the progressive evolution of the model.

Subsequently, the hypotheses underlying the proposed model were tested. This test was conducted as a pervasive activity, throughout the whole empirical part of this study. Indeed, the following results are a factorization of the results from the interviews (16 participants) and the two focus groups (6+8 participants). The overall sample is thus constituted by 30 people. They were selected so that the sample was equally partitioned by gender (50% - 50%), representative of different ages groups (33% 18-25; 40% 25-35; 26% 35-50) and different residence (47% of them from Milan/Turin). The construction of the sample has been an effort to represent in the most realistic way the population of adopters of food delivery services. Indeed, this is coherent with the results from the Statista Consumer Survey, whose represent the following demographics for Italian users: gender (50,6% male); age (15% 18 -24, 21% 25 -34, 25% 35 -44).

6.2.1 Goal orientation

The first phase of this research was to crystallize user discovery. This involved understanding their goal when making use of this type of service. Indeed, understanding the goal of the user is fundamental for the affordance analysis, since it must contemplate the user's goal and it needs to be thought of as goal-oriented (Scarantino, 2003; Brown, 2005; Pucillo et Cascini, 2014).

In October 2020, a report on bad reviews and ratings on the previous four months orders has been used to evaluate the users' understanding of the service.

Results show that most of bad ratings are due to problems with the food and not with the overall service. The most common issues are missing products (2,1% of orders) or wrong products (0,8%). This may be due to the restaurant-side interface of the application, which renders difficult the reading and tracking of all the features of the order.

Interestingly, among the most common issue, "quality" was the one with the highest rate of misinterpretation from the users. Indeed, users refer to "Poor quality", "Incorrect temperature" and "Tasted bad" with an identical meaning. Thus, these three issues are all associated to products arriving cold at destination. Indeed, words such as "freddo", "freddi", etc. have been revealed 317 times out of 6402 comments, indifferently associated to food-related or service-related issues.

This can be interpreted by considering that people misinterpret food-related and service-related issue (they do not get if the issue is due to the store or due to the delivery service). Indeed, it is reasonable to believe that people interpret their perception of the experience according to the goal: accomplish the task (have food). This is confirmed by users, according to which "when we order food to be delivered at home, there is no way out. If the food is not good, that is all you get" (interview conducted in May 2020 by Glovo). Further confirmation comes from literature. Indeed, it has been found that consumers access food delivery apps to order "food" differently than they do compared to when purchasing commodity products. Commodity products ordered using mobile apps can be easily returned, whereas food orders cannot. (Cho et al. 2019). Moreover, evidence show that service

quality not only strengthens food quality but also reinforces perceived value. The explanation of this finding is that the food, not the service, is the main purpose of customers using OFD service. Although e-service quality is not the object that fulfils customer's need, it will impact the perception of food quality (Suhartanto 2018).

6.2.2 Adjustments on the content

(Grill-Spector & Kanwisher, 2005) have shown that product images have a positive impact on the perception of trust, enabling consumers to increase their willingness to purchase products in an e-commerce environment. Product photos are an important way to help consumers enhance their product understanding (Jiang & Benbasat, 2004).

In the case of food delivery, photos are the most powerful and decisive element: "I look at the photo, much more than anything else", "the image is what fuels hunger", "the image is what captivate attention" (From multiple analysis from Glovo; 2019-2020). This result is further validated by Global Content Operations Manager, according to which "Photos reduce uncertainties from the users, which is more willing to buy" and have effects on the business the conversion rate – CR - is higher for stores with higher number of photos.

Considering the conversion rate, it has also emerged that the number of restaurants increase users' willingness and trustworthiness to adopt the service. It has indeed found that wherever only 15 to 35 stores are available, the conversion rate will be between 10% - 22%. The probability to have conversion rate in this range is 44%. Instead, in case of 70+ stores, conversion rate is between 21% - 30%. The probability 70 stores is 52%. Indeed "Customer feel more secure they have picked the best option when they have more choice".

Similar conclusions can be derived by the food types available. "The user starts to use the service because he/she wants to try a specific restaurant (typically seen with big multinational chains)", states the Operations Manager Glovo. "The user continues to use the service as long as it finds all the options that are relevant to him" confirms the Growth Marketing Manager Glovo.

Again, these results are coherent with literature. Online retailers who have offered a wide variety of products and selections seem to be more successful (Christian & France, 2005). Consumers expect online retailers to offer a wide range of product variety online (Jarvenpaa & Todd, 1996). (Szymanski & Hise, 2000) indicated that wider assortment of products may be attractive to customers and e-satisfaction would be more positive when online stores offer superior product assortments. Online marketing research also shows that consumers shop online for the benefits of the available product variety and that a wide product selection contributes significantly to greater website satisfaction, better attitudes toward online shopping, and greater store loyalty (Bansal et al. 2004; Koo 2006; Lim and Dubinsky 2004).

Finally, online rating and reviews serve to increase the reliability and trustworthiness of the platform. "I think the ratings could have an impact on my habits when using Glovo: I would be more likely to experience restaurants I have never ordered before"; "I think the ratings help a lot. It increases the safety perception more than the other elements"(from Glovo market research 2018). The Director of

Product at Glovo confirms: “It is not a matter of rating per se. It is the sense of cocreation of value that creates trust. Indeed, users pay more attention to the number of reviews rather than the average rate. This is what really drives trust and ultimately conversion”.

Given that the correlation between content and trust has emerged to be significantly important from a user standpoint, we propose to integrate the model by representing this association.

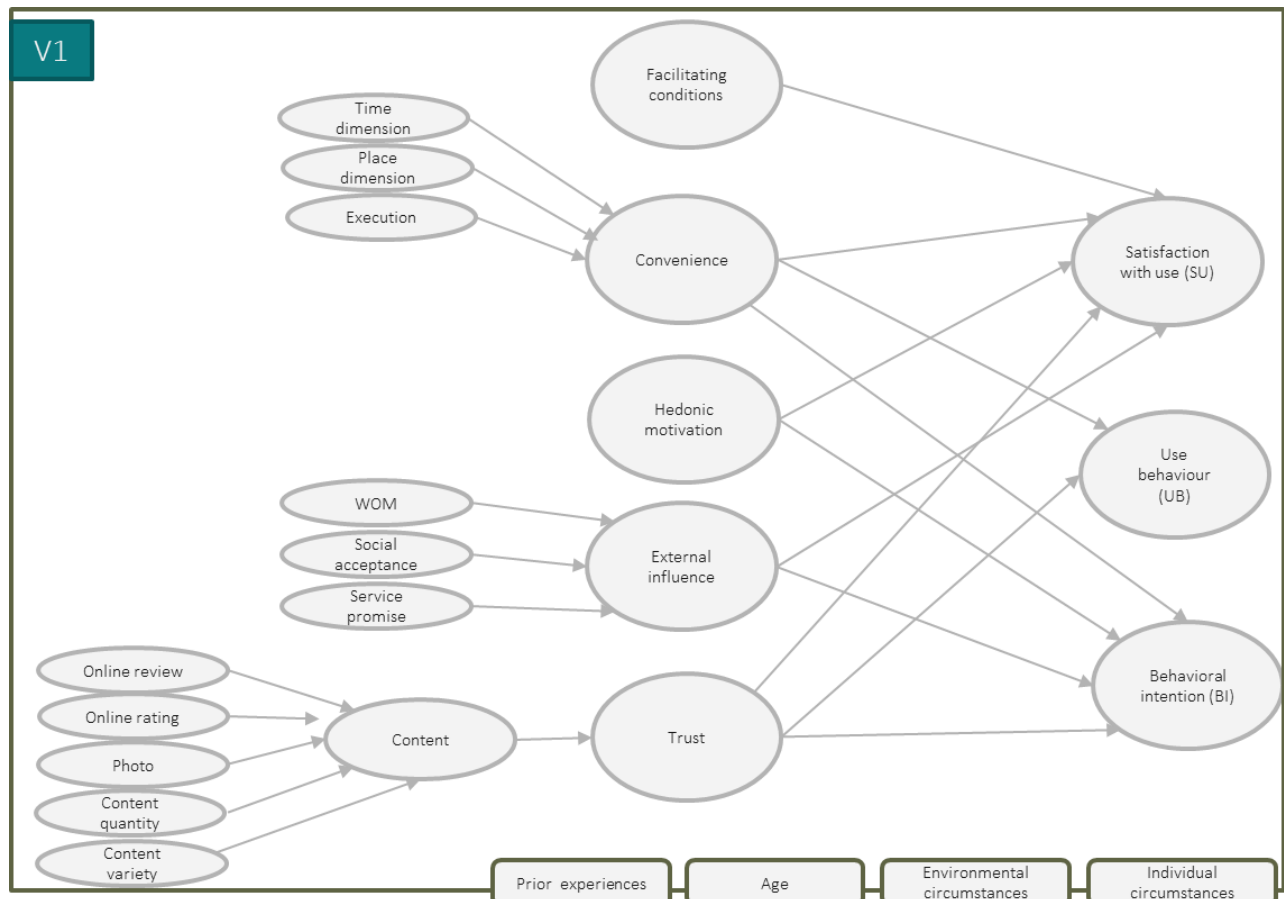


Figure 17: User-discovery map: Version One (V1)

The first focus group provided further evidence on the role of content in the formation of trust. Indeed, despite this focus group confirmed the role of the rating/review system in sharing information among users and thus in the formation and maintenance of trust, the same did not apply to photos. According to participants, photos (and in general content generated by the service provider) are not trustworthy. They all agreed photos are representations filtered by the company, and thus they do not fully represent reality. Indeed, they mentioned the poor descriptive power of the images displayed on the various platforms and delivery providers. Moreover, they admitted looking for more realistic version of the dishes they will be likely to consume by navigating through other platforms (such as TripAdvisor or Instagram). This result can be explained considering that the mentioned alternative platforms in fact collect photos (and other relevant information) generated and shared by other users. Similar to what discovered for ratings and reviews, these photos help in

decreasing the asymmetries between the provider and the user and thus contribute to the formation of trust.

For such a reason, the category “Content” was then split in two sub-categories (namely, user-generated and company-generated content). Indeed, previous researchers have categorized information that influences consumers into user-generated (Pavlou & Dimoka, 2006) and firm-generated (Cheung, Lee, & Rabjohn, 2008; Dellarocas, Zhang, & Awad, 2007; Z. Liu & Park, 2015) types.

The relationship between Company-generated Content and Trust was maintained. This is in accordance with the results from literature ((Z. Liu & Park, 2015; Cheung et al., 2008), which identifies other forms of “content” other than photos as concurrent to the formation of trust. As an example, various information on the rider (Name, Phone number, etc.) reduce uncertainties on the delivery process and therefore increase the perceived control over the delivery process. In general, these extra pieces of information are considered as credible, useful, rich, and relevant.

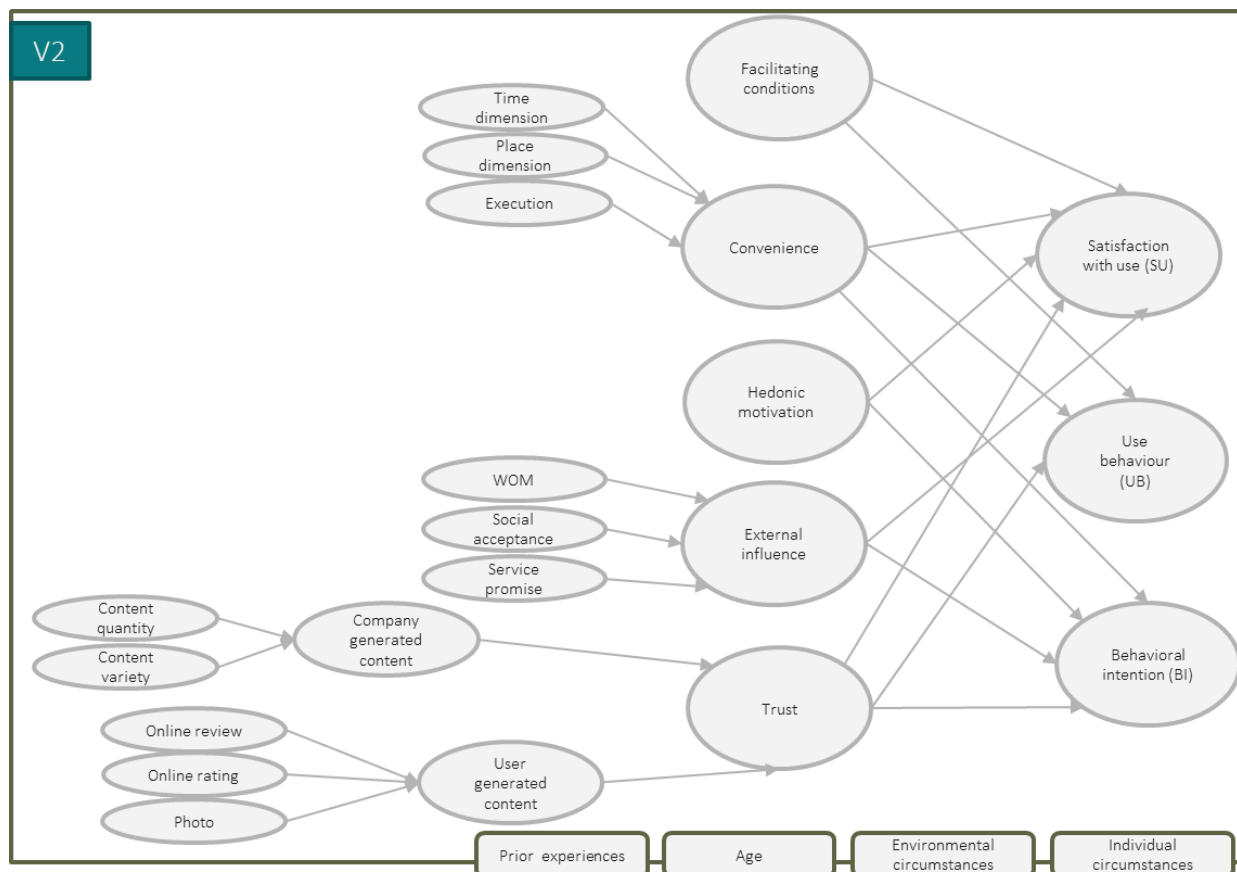


Figure 18: User-discovery map: Version Two (V2)

6.2.3 Factors' clustering and converging

The last refinement step involved the identification of main clusters in which to categorize factors. Indeed, a model that provides good prediction while using the fewest predictors is preferable (Bagozzi 1992), as soon as it facilitates understanding (Venkatesh et al. 2003).

The clustering resulted from the analysis conducted through the second focus group described 5.4.4. Participant were asked to discuss on the main drivers for they use of online food delivery services. Their responses have been recorded and subsequently analysed. The result demonstrated that three main drivers for behaviour and satisfaction with the use of food deliveries exist. These are hedonistic motivations, convenience and trust.

Hedonic motivations: worlds and concepts such as “pleasure”; “transgression”; “leisure”; “treat”, but also “weekend”; “curiosity”; “experience”; “try something new” indicating the influence of this factor as a driver for using and being satisfied because of the service. Indeed, users engage with this type of service when they are in social situations or in case they want to enjoy something new or pleasant.

Trust: this theme refers to the ability of the user to understand and track what it is happening with his order. Thus, users associate this concept to “safety”, “visibility”, “certainty”.

A separate discussion is deserved for the dimension of Convenience.

Today, mobile services allow convenient access to services wherever and whenever the customers wish to use services, and convenience has been reported as a major attractor for mobile technology use in addition to task fulfillment (Anckar and D'Incau 2002; Carroll, Howard, Peck, and Murphy 2002; Carroll, Howard, Vetere, Peck, and Murphy 2002; Mick and Fournier 1995). Mobile services are instant, and people appreciate the rapid access to services compared to the alternatives. Furthermore, mobile services often seem to relate to efficiency, es. they require less effort or time spent and thereby make life easier by streamlining activities, an important characteristic in an age when people have increasingly limited time resources (Hoffmeister and Oudghiri 2004).

In the case of food delivery convenience means control and transparency on the order. Time must be reliable, so that customers can organize their everyday life accordingly. Timely orders matter for users, which indeed explain “I want to know when I will start eating. I want to know when my food will be at my place”; “I want to know if my order is underway because I do not see any courier on the map and is late”; “I just want to know if my order will arrive” (source: multiple field interviews conducted by Glovo between 2019 and 2020).

Furthermore, a correlation between the users' activity on the app and their rating to the experience has been shown. Indeed, customers with high activity levels during ongoing orders are more likely to give a negative rating (either to store or courier).

With regards to features of the app, the progress bar and the GPS map to follow the courier become extremely important for the users, especially in situation of hurry or stress. For instance, users dislike the presented time frame within which the order will be delivered, given that it does not provide them accurate information. Instead, they would like to see the daytime at which the order will be received. Moreover, the progress bar must represent and confirm their mental model, so that they

can feel secure everything is under control. For instance, users dislike the “Being prepared” phase for they breakfast’ or sweets’ order, since they understand this food has been prepared before they placed the order (source: multiple field interviews conducted by Glovo between 2019 and 2020).

Because of these results, the model has been revised so that the identifying factors could converge into these three macro-categories. This passage has served to render it more parsimonious and to identify relationships among the identified factors.

In particular, the following relationships have been highlighted:

- Facilitating conditions: according to feedbacks from the focus group, facilitating conditions do not directly influence behaviour and satisfaction. Therefore, despite being fundamental for a satisfying experience, users trust their ability to navigate the service on their own. Nevertheless, facilitating convenience are considered as a prerequisite, which increase the perceive convenience and trustworthiness of the service itself. Indeed, users believe facilitating conditions will provide relevant, complete, and useful information (they *trust* facilitating conditions), to reach their goal in the most seamless (*convenient*) way.
- External influence: the focus groups highlighted the relevance of external influence in the decision of making use of this type of service, especially for people aged over 40. Indeed, these age groups typically fear the use of an online medium, whereas generation X or Z are more used to it. More specifically, word of mouth (WOM) and service premise influence the intention to behave in a certain way and create standards for satisfaction. However, the effect is indirect and impact on the perceived trustworthiness of the service in a way in which the most positive the influence, the higher the perceived trust. Moreover, external influence impacts on the hedonic motivations. Indeed, the desirability and curiosity about the service is often mediated by the pressure of the social context.

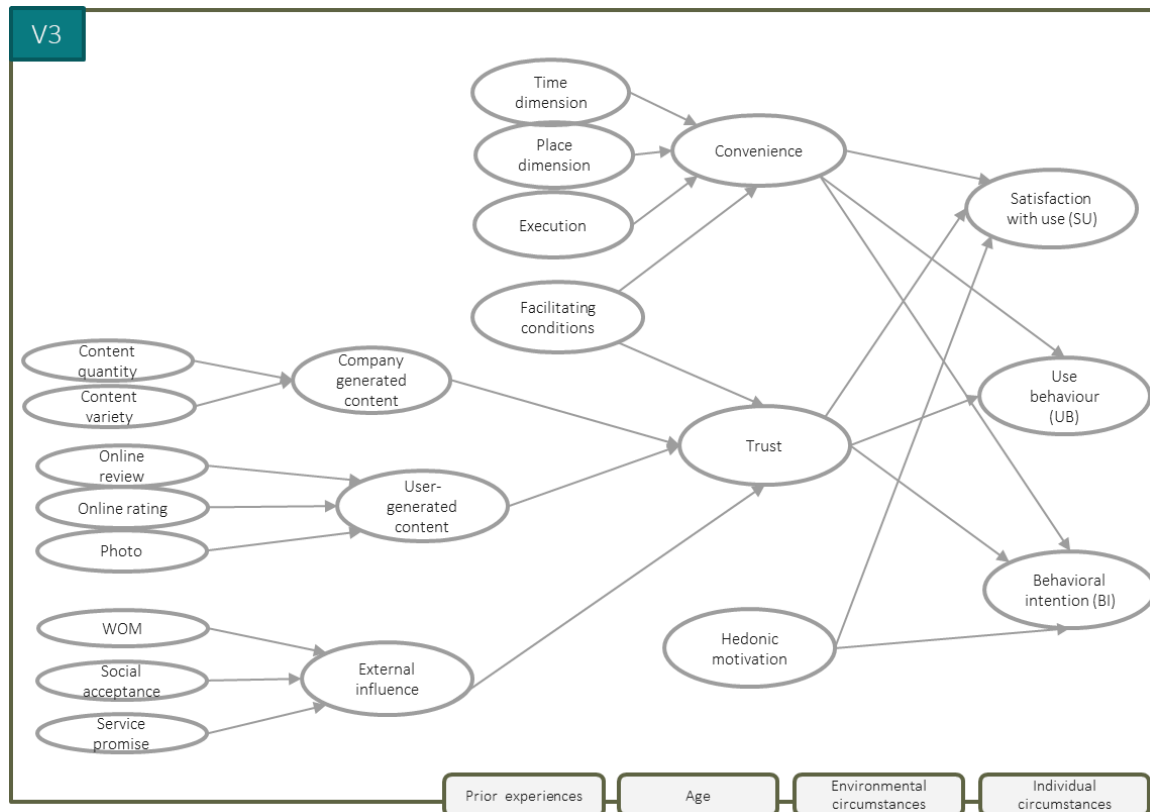


Figure 19: User-discovery map: Version Three (V3)

6.2.4 Hypotheses testing

The empirical results generally supported the predictive validity of most of the proposed factors. This, in turn, confirms the robustness of the theoretical foundation for the current model and the relevance of the constructs introduced, along with these from the UTAUT2 theory.

More specifically, the results confirmed convenience to be the most influenced factor, predicting BI, UB and SI. Indeed, food delivery services provide more flexibility in ordering food with respect to traditional means. Accordingly, users expect the service to represent this convenience through the interface and the feature of the app, which should provide all the relevant information to ensure the “time” and “place” convenience of the service. Thus, the convenience-orientation drives behaviour during use (those seeking convenience will regard more features such as order tracking or order scheduling). Finally, users are satisfied when the service is coherent with their expectations in terms of “time”, “place” and “execution” of the delivery (es. Food arrives at a time which is coherent with the provision). In the light of the above, hypothesis **H3**, **H5**, **H9** are said to be confirmed.

As for trust, this construct was the main driver for BI and UB. Indeed, users typically try to overcome asymmetries with regards to the restaurant and/or the rider, and indeed they seek to receive relevant information. Considering the restaurant, they engage with ratings and review that lower their uncertainties; they make use of other platforms (Instagram, TripAdvisor) to receive relevant information on the food they will be likely to eat. On the other hand, they are pleased to receive relevant information of the rider (name and photo, phone number, ratings and position). This might be due to the image media proposes of this category (typically, they are represented as European

non-Communion workers, violent and prone to robberies). And, while for the restaurant this result can be interpreted under the light of the goal-orientation (people need to trust that their goal – receiving food – will be achieved), for the rider it is the innate need of security which leads people to demand trustworthiness. It is here worth noticing that the initial version of the model did not represent the association Trust – Behaviour Intention. Indeed, retrieving the theoretical foundation for the current model, no previous literature has been found confirming this match. However, H1 postulated the affection of external influence to behaviour intention. And, since in the last version of the model (V3) external influence is considered to be responsible for the formation of trust, then it can be deducted it indirectly affect BI and SU (through trust). In accordance with our findings, indeed, it is the social pressure they are exposed to which render them more anxious (especially, with regards to the rider). Moreover, it has emerged the importance of WOM and shared experiences to decrease cognitive barriers in forming the intention to behave. This is of peculiar relevance for those users with limited previous online experience and aged over 40. In this sense, we can conclude that **H1** and **H4** are supported. On the contrary, **H6** has not been confirmed. Despite this result being not adherent to previous literature, it can be explained by considering that satisfaction is uniquely referable to the fulfilment of the goal. And, being trust ancillary to the fulfilment of the goal, then it does not have a direct influence in use satisfaction. The same considerations could apply to the relation External influence – Trust, proposed in **H7**, which is thus not supported. However, these arguments warrant further investigation.

With regards to hedonic motivation, the findings support its relevance in predicting BI. Indeed, users form their decision to interact with the platform because of the fun and pleasure derived by the use. Thus, users typically engage with the service to experience new or non-conventional cuisines and to enjoy. This feeling has proven to be of particular relevance in the months of lockdown, whenever a meal at home was the only whim one could indulge in. Moreover, this effect has proven to be significantly stronger in case of low experience with the service or during the weekend (referable as a declination of the environmental circumstances). In the light of the above, **H2** is supported. On the contrary, hedonic motivation has not emerged to be relevant to the prediction of satisfaction with use. Researchers should be cautious of involving hedonic motivation in situations or conditions (type of user, previous experience) where utilitarian outcomes completely outweigh the hedonic outcomes (Tamilmani et al., 2019). We can therefore conclude **H8** is not supported by the results of this work.

Finally, the role of facilitating conditions has not been fully captivated. Indeed, while users expect facilitating elements to be working properly and responsively, the engagement to these elements do not result in any satisfaction. Instead, they lead to dissatisfaction in case of poor service quality (such as, long waiting times before receiving feedback, uncomplete information, low support). This result is coherent with previous research (Lee et al., 2019), which attribute it to the advancement of smartphones and ICT technology that have stabilized app implementation to the extent that consumers face few difficulties in using them. Thus, **H10** is not supported.

6.3 Engineering design

In this phase, the results presented in 6.1 and 6.2 were synthesised in order to provide useful insights for the engineering design. This result, despite being far from either studying or proposing an affordance-based method for the design of digital artefacts, constitutes a contribution for directing further studies.

6.3.1 Generalization of previous findings

Taking on the classification of the affordance indicators into the 3 categories Interactivity, Navigation and Information (as explained in 6.1.4) derived from the work of (Shao et al., 2020), it is possible to prioritize and guide the design process. Indeed, given the results of the research by (Shao et al., 2020), the affordances of Interactivity and Navigation are those that influence user satisfaction the most (together they explain more than 62% of the variance), which in this model is the intermediate psychological consequence of the interaction user – artefact.

Notably, information affordance is of greater importance to high-experienced users, consistently with the previous research findings, suggesting that veterans use technology for utilitarian purposes (Venkatesh et al., 2003, 2012; Giannakos and Vlamos, 2013), and exhibit a greater tendency to seek accurate, relevant and up-to-date information. In contrast to veterans, low-experienced users pay more attention to navigation affordance, confirming the results from (Venkatesh et al., 2003, 2012) in the development of the UTAUT and UTAUT2 method. This type of users focuses more on the effort expectancy and ease of use during the early stage of information technology usage. The uniformity of these result is of particular interest, given the linkage UTAUT2-based theories and affordance-based method we propose in this study. Thus, it stresses the importance of detecting some characteristics of the user to then derive the type of affordance he/she is more interested in.

Therefore, it is suggested to prioritize the development of the various type of affordances. This can be of a particular interest in case of limited resources in the design process of new or updated solutions. Moreover, this could be the case of start-ups or little enterprises, whose resources are indeed limited for definition. And, given the abundance of start-ups in the mapping of key players in food delivery presented in 5.2, it can be argued that this result could indeed be useful for directing the service development.

With reference to the relevance of navigation affordance, the result can be explained by considering the exponential growth in technological development, especially in the digital world, which today promotes fast products and very frequent updates. This shifts user demands from mere performance (which is assumed to be adequate) to an increase in ease of use, aesthetics and additional affordances (navigation components). Regarding information accessibility, platform affordances provide and disseminate credible, high-quality pieces of information and remove those inaccurate and misleading. This result is in line with the findings of this research, according to which hedonic motivation and facilitating conditions are not capable of predicting satisfaction with use. Indeed,

researchers should be cautious in situations or conditions (type of user, previous experience) where utilitarian outcomes completely outweigh the hedonic outcomes.

6.3.2 Externalities in affordance

Recalling the considerations described **Errore. L'origine riferimento non è stata trovata.**, it has deduced that users perceive similarities in their experience with food deliveries and online shopping. This led to hypothesize that, if it is true that the user perceives online services as similar, then affordances designed for these services must be the same. Thus, we can conclude for the existence of externalities in affordances.

The starting point for testing this hypothesis has been the long list of affordances, as resulted from the conducted interviews. Then, the identified affordances have been compared to those of online shopping services.

To conduct this exercise, the following clarifications need to be made:

- Type of service: food delivery (providers such as Glovo, UberEats, etc.); e-shopping (both marketplaces - es. Amazon - and company's private channels - es. Zara online)
- Product: for food delivery is food; for e-shopping is item
- Order: for food delivery is food (order placed); for e-shopping is shopping cart (order placed)
- Provider: the one in charge for the provision of the product (for food delivery is restaurant, for e-shopping is e-commerce owner)
- Delivery owner: the one in charge for the delivery of the product (for food delivery is rider, for e-shopping is delivery agency)
- Review the order: act of checking the product before placing the order
- Edit the order: act of modifying the order after it has been placed

Table 14: Comparison of affordances: Food delivery VS e-Shopping

Affordance	FOOD DELIVERY	E-SHOPPING
Affordance into searching (A1)	X	X
Affordance into navigating (A2)	X	X
Affordance into discovering the product (A3)	X	X
Affordance in composing the order (A4)	X	X
Affordance into reviewing the order details (A5)	X	X
Affordance into interacting with the provider (A6)	X	X
Affordance into interacting with the delivery owner (A7)	X	X
Affordance into editing the order (A8)	X	X
Affordance into tracking order (A9)	X	X
Affordance in delivery time estimation (A10)	X	X
Affordance for map positioning (A11)	X	X
Affordance in order-related issues resolutions (A12)	X	X
Affordance in interacting with customer care (A13)	X	X
Affordance to system performance and reliability (A14)	X	X
Affordance into ordinary maintenance (A15)	X	X
Affordance in user profile navigation (A16)	X	X
Affordance with data protection and sharing (A17)	X	X
Affordance with payment processing (A18)	X	X
Affordance into picking order (A19)	X	X
Affordance into reordering (A20)	X	X
Affordance in ratings orders and riders (A21)	X	X
Affordances with promotion tools (A22)	X	X
Affordance in external-order related issues (A23)	X	X

The results confirmed the hypothesis. However, it needs to be pointed out that these affordances are enabled by different affordance indicators, thus generating different grades of satisfaction with use and different use behaviour. This has particularly emerged during the first focus group, during which users admitted being used to some affordances in food delivery (such as receiving push-up notification with relevant information on the order delivery, or the “following the courier” option)

and expressed the desire of having this granular and up-to-date information to delivery even in the case of other online shopping experience. Despite being just an observation, we propose to further investigate this result and conduct further research on the topic. Designer could indeed benefit from this result, by assessing those services whose interpretation could be uniform and consequently detecting the relative affordances. Thus, they could leverage on previous experience with affordance indicators on one service to then derive the design of the same indicator on the other.

Conclusion

Interest in applying the concept of affordance within design approaches has been growing in recent years. Nevertheless, the literature on the subject is still scarce and has limited focus on the case of digital artefacts. Moreover, in previous works the identification of affordances prescind the elicitation of user information and this inhibit the capture of user needs with affordance-based approaches.

This work wanted to support the emerging literature and research that aims to formalize an approach to the design of digital artefacts. Thus, in this document the interaction between a user and an artefact within a digital system was studied, with the aim of detailing the notion of digital affordance and of formalizing the role of the user in the affordance-based design methods.

To reach this goal, a previous conceptualization of digital affordance was tested, to verify its objective validity and to emphasize the role of both sensory and experiential perception. In parallel, a user-discovery map was proposed, so that to identify the users and to provide complete information on what affordances they want the artefact to have. This in the end resulted in the indication of some notes for the engineering design.

Indeed, in the previous joint research by Politecnico di Torino and Milano, digital affordance is conceived as the set of two classes of affordances: the sensory and the experiential. The evaluation of the affordance is based on the notion of “affordance indicators”, which are then categorized into the system characteristics, following (Roskos, 2017). The results of the precedent study were hence tested trough the administration of a questionnaire, which not confirmed the categorization. Thus, after having detailed the previous study, a new categorization into Navigation, Information, and Interactivity affordances it was proposed, following the results of (Shao et al., 2020).

In parallel to this, primary and secondary research was conducted, in the attempt of proposing a user-discovery map which could be used for the identification of affordances in the digital systems. To this purpose, three moments of interaction (pre, during and post) were linked to Behaviour Intention (BI), Use Behaviour (UB) and Satisfaction with Use (SU). Indeed, following (Vyas et el. 2006), affordance is “in interaction” and thus it is: responsible for explaining the interaction (UB) with the artefact; guided by goal-orientation (BI); evaluated though usability (SU). Therefore, by adjusting the UTAUT2 theory (Venkatesh et al., 2012), a model for linking behaviour predicting factors to BI, UB and SU was proposed. The study was carried out on the use case of online food delivery.

The model and the related results would like to provide support to designers and highlight how affordance represents an added value for the usability of the artefact. Moreover, it aims to empathise the role of the user in affordance-based evaluations of digital systems.

This work, despite being limited to the analysis of a single use case, is offered to improve and enrich the research works on affordance applied to digital artefact. Thus, the results could serve to further detail the notion of digital affordance and to suggest an innovative approach for the identification of the role of the user, based on the notion of affordance.

Limits of this study and further research

To test the conceptualization of digital affordance, it was necessary to recall previous literature of affordance (Shao et al., 2020). The result of the test on the categorization of the affordance does not comply with the hypothesis in the case of communication / interactivity indicators, for which an overlap of the types of perception (experiential and sensory) exist. Thus, the findings of this work should be further tested and detailed to evaluate their validity.

Moreover, the hypotheses underlying the proposed user-discovery map were not tested through a measurement scale, thus no conclusions were derived by quantitative data. Additionally, the sample with which these tests were conducted is limited (it is constituted by 30 users) and thus it needs to be further expanded to ensure validity to the results we derived from a qualitative assessment.

Finally, taking on the identification of externalities in affordance, the analytical approach proposed for the analysis was constructed on the feedback of a single user. Thus, given that affordance evaluates perceptions, and these elements being subjective by nature, it would be necessary to expand the sample of respondents to obtain an empirical analysis that can support the validity of the results and provide objective evidence of the conclusions.

Appendix

1. Interviews' results

Modalità di navigazione	COUNTA di Mod	Struttura di navigazione	COUNTA di Stru	Interfaccia grafica	COUNTA di Inter	Funzione di ricerca	COUNTA di Fun
Servizio	2	Servizio	4	Servizio	10	Servizio	28
Artefatto	64	Artefatto	61	Artefatto	56	Artefatto	38
	0		0		0		0
Filtri	COUNTA di Filtri	Ordinamento dei risultati	COUNTA di Ord	Recensioni dei ristoranti	COUNTA di Rec	Foto	COUNTA di Foto
Servizio	13	Servizio	14	Servizio	52	Servizio	54
Artefatto	53	Artefatto	52	Artefatto	14	Artefatto	11
	0		0		0		0
Menu	COUNTA di Men	Informazioni sul rider	COUNTA di Info	Preferti	COUNTA di Pref	Email	COUNTA di Em
Servizio	55	Servizio	56	Servizio	24	Servizio	31
Artefatto	11	Artefatto	6	Artefatto	39	Artefatto	24
	0		0		0		0
SMS	COUNTA di SMS	Chat	COUNTA di Cha	Telefono	COUNTA di Tele	Sistema di notifiche	COUNTA di Sist
Servizio	25	Servizio	32	Servizio	23	Servizio	18
Artefatto	34	Artefatto	27	Artefatto	43	Artefatto	47
	0		0		0		0
Commenti sugli ordini	COUNTA di Com	Valutazione della comunicazione	COUNTA di Val	Condivisione	COUNTA di Con	Stato dell'ordine	COUNTA di Stat
Servizio	45	Servizio	42	Servizio	16	Servizio	56
Artefatto	20	Artefatto	23	Artefatto	50	Artefatto	10
	0		0		0		0
Posizione in real time del rider	COUNTA di Pos	Countdown del tempo rimanente alla consegna	COUNTA di Cou	Impostazioni multilingua	COUNTA di Imp	Account utente	COUNTA di Acc
Servizio	59	Servizio	60	Servizio	8	Servizio	15
Artefatto	7	Artefatto	6	Artefatto	58	Artefatto	51
	0		0		0		0
Codici promozionali	COUNTA di Cod	Impostazioni di sistema	COUNTA di Imp	Sistema di pagamento	COUNTA di Sist	Help Desk (Servizio assistenza clienti)	COUNTA di Help
Servizio	38	Servizio	11	Servizio	55	Servizio	47
Artefatto	25	Artefatto	55	Artefatto	10	Artefatto	18
	0		0		0		0
Sistema assegnazione ordine	COUNTA di Sist	Sistema assegnazione consegna	COUNTA di Sist	Sistema di previsione della domanda	COUNTA di Sist	Calcolo del costo di spedizione real time	COUNTA di Cal
Servizio	47	Servizio	48	Servizio	48	Servizio	54
Artefatto	18	Artefatto	17	Artefatto	15	Artefatto	10
	0		0		0		0
Gestione dell'autenticazione	COUNTA di Ges	Geolocalizzazione utente	COUNTA di Geo	Editing carrello	COUNTA di Edi	Conclusione dell'ordine	COUNTA di Con
Servizio	28	Servizio	36	Servizio	16	Servizio	15
Artefatto	38	Artefatto	30	Artefatto	50	Artefatto	51
	0		0		0		0
Assegnazione rating al ristorante	COUNTA di Ass	Assegnazione rating rider	COUNTA di Ass	Assegnazione rating assistenza clienti	COUNTA di Ass	Modifica grandezza testo	COUNTA di Mod
Servizio	37	Servizio	38	Servizio	34	Servizio	4
Artefatto	29	Artefatto	28	Artefatto	32	Artefatto	62
	0		0		0		0
Comandi vocali	COUNTA di Com	Feedback acustici	COUNTA di Fee	Cambio di colori e font	COUNTA di Can	Storico ordini	COUNTA di Stor
Servizio	5	Servizio	5	Servizio	3	Servizio	6
Artefatto	61	Artefatto	60	Artefatto	63	Artefatto	12
	0		0		0		0
Informazioni sul Ristorante	COUNTA di Info	Note aggiuntive sull'ordine	COUNTA di Note				
Servizio	16	Servizio	5				
Artefatto	3	Artefatto	14				
	0		0				

2. Invitation to interview

Ciao!

Grazie per la disponibilità e per aver accettato di prendere parte all'intervista che si terrà lunedì 25 gennaio alle ore 21.00, nell'ambito del mio progetto di tesi magistrale. Puoi accedere alla chiamata direttamente da questo [link](#).

Il lavoro di ricerca è condotto congiuntamente dal Politecnico di Torino e di Milano ed è seguito dai professori Francesca Montagna e Gaetano Cascini. Lo scopo della tesi è quello di valutare l'esperienza prima, durante e dopo l'interazione con i servizi digitali, nell'intento di definire una base teorica e delle linee guida per il design dei servizi stessi.

Durante questa intervista approfondiremo la tua valutazione l'esperienza legata ai servizi di food delivery. Essendo una ricerca condotta nell'ambito di un progetto di tesi, garantiamo che i tuoi dati e l'esito della discussione non saranno in alcun modo utilizzati a fini commerciali.

La durata della chiamata sarà di 45-60 minuti.

Resto disponibile per eventuali domande o chiarimenti. In più, se trovi il progetto interessante o vuoi sapere di più sulla mia tesi, possiamo tranquillamente parlarne ed approfondire a seguito dell'incontro!

Grazie ancora per la disponibilità.

A presto

Martina

3. Invitation to focus group

Ciao!

Grazie per la disponibilità e per aver accettato di prendere parte al focus group che si terrà oggi 14 dicembre alle ore 21.00, nell'ambito del mio progetto di tesi magistrale. Puoi accedere alla chiamata direttamente da questo [link](#).

Il lavoro di ricerca è condotto congiuntamente dal Politecnico di Torino e di Milano ed è seguito dai professori Francesca Montagna e Gaetano Cascini. Lo scopo della tesi è quello di valutare l'esperienza prima, durante e dopo l'interazione con i servizi digitali, nell'intento di definire una base teorica e delle linee guida per il design dei servizi stessi.

Durante questo focus group approfondiremo la tua valutazione l'esperienza legata ai servizi di food delivery. Non è richiesta alcuna conoscenza specifica dell'ambito, il tuo ruolo sarà unicamente quello di darci i tuoi pareri e di raccontarci la tua esperienza durante l'utilizzo di questo genere di servizi. Come step preparatorio, ti chiedo di compilare il form che trovi [qui](#).

Essendo una ricerca condotta nell'ambito di un progetto di tesi, garantiamo che i tuoi dati e l'esito della discussione non saranno in alcun modo utilizzati a fini commerciali.

La durata del focus group sarà di 45-60 minuti e Samuele Colombo, dottorando del Politecnico di Torino, sarà il moderatore.

Resto disponibile per eventuali domande o chiarimenti. In più, se trovi il progetto interessante o vuoi sapere di più sulla mia tesi, possiamo tranquillamente parlarne ed approfondire a seguito dell'incontro!

Grazie ancora per la disponibilità.

A presto

Martina

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