Assignment on Human-Computer Interaction

Course Essay

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September 16, 2025

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1 Introduction

Human-computer interaction is a discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use and the study of the major phenomena surrounding them [1]. It is really common to see optimized software and detailed applications that are not able to meet human needs and indeed not used as they could. As Winograd wrote in his book [2]: to design software that really works, we need to move from a constructor's eye view to a designer's eye view, taking the system, users, and context together as a starting point.
This implies that, during the development of a product, reflect about the user and the final context in which the product is going to be used is fundamental, since the same product placed in different contexts or in the hands of different users, may require distinct characteristics and design choices. The aim of this text is to identify and analyze two products, one physical and one digital, from the perspective of HCI.

2 Selection of Products

In order to have a comprehensive overview of some HCI concepts, two heterogeneous products have been chosen as case studies. The intentional choice of one physical and one digital product allows the observation of different types of interaction in different contexts and with different users. Specifically, the analysis contrasts a simple physical artifact with a more sophisticated digital system, in order to highlight different dimensions of usability and user experience. The following subchapters present the two products by clarifying their purpose of use, main functionalities, and primary end users, which will serve as a basis for the subsequent HCI analysis.

2.1 Digital product

- **Purpose of use:** The chosen digital product is Microsoft Teams, a well-known platform for communication in study and work contexts.
- **Main functionalities:** Microsoft Teams allows users to perform a variety of activities, such as organizing calls, managing calendars, sharing screens with colleagues, and co-editing files.
- **Primary end users:** Students, teachers, or workers who need to collaborate on the same project from different locations.

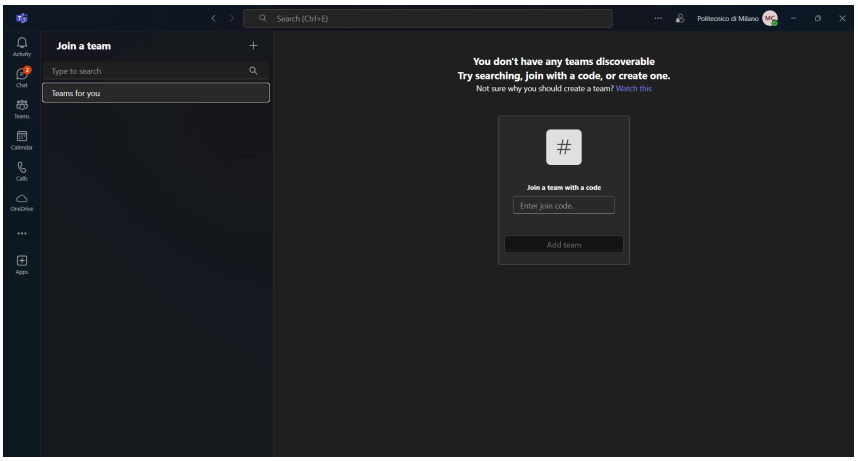

Figure 1: Microsoft Teams

2.2 Physical product

Figure 2: Air Fryer

- **Purpose of use:** The chosen physical product is an air fryer, a household appliance intended for rapid cooking with reduced use of oil compared to traditional frying methods. It can be compared to a small oven, but it is faster and requires less power.
- **Main functionalities:** The air fryer allows users to set the cooking temperature and a timer through analog knobs. It is equipped with a removable basket and two lights (red and green) that indicate when the product is switched on and when the desired temperature has been reached.
- **Primary end users:** Private users, including families who aim to have a healthier way of cooking and students or workers who have less time to cook.

3 Key HCI Concepts and Applications

3.1 Definition of the concepts

Human-Computer Interaction (HCI) is based on some central concepts that allow for an in-depth analysis of both digital and physical products. The first concept we analyze is the context of use: it includes the characteristics of the users, the tasks to be performed, and the technical, physical, and social environment in which the system is employed [3]. Without a thorough understanding and study of this context, the evaluations and decisions made during the implementation phase may be inaccurate. For example, we might think that all ATMs, which serve the same role of allowing us to withdraw or deposit money, should have the same characteristics. Instead, ATMs designed for the interior of banks are different from those designed for the street, which are different from those designed for airports, and so on.

The second fundamental concept is the User Interface (UI), that is, the part of a system with which a user must interact in order to operate the product. It may be composed of input and output devices and of the different interaction techniques [1].

Interaction in HCI is often described as a dialogue between the user and the system. Similar to a conversation, it is structured in turns, in which the user performs an action and the system provides a response [1, 3].

We then move on to the concept of usability, which has been formalized by ISO 9241-11 as the capability of a system to enable users to achieve specified goals with effectiveness, efficiency, and satisfaction in a particular context of use. This definition clarifies that usability is not an intrinsic property of a system, but depends on its concrete use.

Finally, the concept of User Experience (UX) expands the definition of usability by including emotional, cognitive, and social aspects of interaction. ISO 9241-220 emphasizes that UX comprises usability, accessibility, and the avoidance of risks, aiming to ensure globally positive experiences [1, 3].

3.2 Application to the digital product

The context of use of Microsoft Teams is typically educational or work-related, where the end users are students or workers who need tools for remote collaboration. The user interface is presented as a platform that combines chat, video calls, and document sharing, but also calendar and community.

Considering that the average user is a student/worker who is not necessarily an expert in computers, the evaluation of usability focuses on elements such as ease of use, notification management, and interface consistency. For example, the possibility of scheduling meetings directly from the calendar reduces organization time and increase efficiency.

The Interaction with the platform takes place in different and combined forms: during a meeting, for example, the user can share the screen, speak, and at the same time use the chat, creating a multimodal dialogue with the system and with the other participants.

3.3 Application to the physical product

Regarding the air fryer, the context of use is the domestic one, typically associated with those who want to prepare meals quickly, often while doing other daily activities. For this reason, the average user is represented by the private customer: students, workers, but also parents with little time available and numerous commitments. The user interface, in this case, consists of two knobs, one for the timer and one for setting the temperature, and two indicator lights that provide feedback on the status of the machine.

Interaction is based on simple operations: plugging in the power cord to turn on the machine, setting the temperature and the timer, and finally inserting the food. In terms of usability, the air fryer is effective in allowing the quick preparation of food with minimal effort from the user. From the point of view of user experience, the experience is characterized by the simplicity of the object and by the perception of a healthier diet, an element that goes beyond the mere functionality of the device.

4 Discussion

4.1 Design and intended interaction

Starting with the air fryer, the design has been kept as clean as possible, including only two analog knobs. The simple design was intended to be accessible to all types of users. This intention can already be observed in the power-on method, which was deprived of any on/off button: it is enough to plug in the cord, after which the green light turns on to indicate that the machine is working correctly. The use of analog knobs also allows people who may have difficulties with a digital interface, such as elderly users, to operate the device, further expanding the number of potential customers.

Moving then to Microsoft Teams, the user interface presents a side bar with 8 icons: Activity, which shows the user's recent activities; Chat, where textual conversations can be seen; Teams, where it is possible to see the groups one belongs to or eventually create or join new ones; Calendar, which shows the account's calendar and allows events to be created for specific dates; Calls, which makes it possible to see past calls or start new ones; finally, Options and Apps, which allow external applications to be connected.

4.2 Strengths and weaknesses

Browsing a bit on the Internet, it seems that the biggest problems with air fryers are not so much in the modes of use, but rather in the ease of cleaning and in the difficulty of the opening mechanism, which sometimes can also causes food to fall out [4]. In both cases, this model seems to address the problems well, considering that the method of extracting the basket is easily understandable and that the rounded shapes help in cleaning. During a first use, it was immediately noticeable that the timer knob clashes with the functioning of the machine: it is an analog knob which, once turned, continues to tick even if the plug is removed (and therefore it is assumed that the machine is off), and it rings once the spring is completely unwound; even by turning the knob in the opposite direction, it is not possible to reset the timer. This highlights how even apparently minor design choices can strongly affect the overall user experience, as also confirmed by online discussions where users compare different models in terms of reliability and satisfaction [5].

As for Teams: given the large number of functions that the application offers, the design is quite complex. At first glance, the user has the impression of being unsure how to proceed. For example, many people use the app only to make calls and are not interested in having such a complicated design: perhaps it would have been better to include a clearly visible button to start an instant call and then share the link, without the need to schedule it via the calendar. At the same time, it is

precisely this complexity that sets the application apart from other video call services (such as FaceTime or its direct competitor Google Meet). However, tailoring the experience to different user profiles could be a valuable improvement. Recent studies have indeed shown that, although Teams offers a rich environment for collaboration, issues remain related to meeting stability, file management, and interface navigation, with a direct impact on the user experience [6].

4.3 Challenges in human-centered design

Even when adopting a human-centered approach, the result is not always guaranteed to be good design. ISO 9241-210 highlights the importance of understanding the context of use, involving users throughout the process, and improving solutions iteratively [3], but in practice there are several obstacles.

A first problem is the diversity of users. Not everyone has the same skills or expectations, and a system that works well for some may turn out to be complicated for others. Teams, for example, is appreciated by more experienced users who take advantage of all the integrated functions, but it can seem complex and dispersive to those who only want to start a quick call [1]. Conversely, the air fryer, with its analog knobs, is simple to use for anyone, but this very simplicity limits the possibility of customizing the experience, such as canceling a timer or achieving the same level of precision that could be found in a digital version.

Another difficulty comes from the compromises that designers must face. There are often constraints of time, budget, or compatibility with existing infrastructures, and it is not always possible to implement the ideal solution [2]. Even when user feedback is collected, it often happens that not all needs can be satisfied in the same way.

Finally, user experience changes over time. A product that initially seems innovative and efficient may appear outdated after only a few years, because users' expectations and technological standards evolve. This makes it difficult to guarantee a design that remains effective during years.

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