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MEDICAL DECISION MAKING IN SELECTING DRUGS USING COMPUTER-GENERATED VIRTUAL ENVIRONMENTS

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ABSTRACT
Introduction: Many people rely on non-prescription drugs therapy to treat common medical conditions. Health technology can be a valid support to help people in selecting and choosing an appropriate treatment.
Aim: This study examined how common people make their decisions to select a non-prescription drug, evaluating comprehensibility and satisfaction of a virtual tool that could propose and sell different types of non-prescription drugs therapy.
Methods: Fifty voluntary participants were enrolled to conduct both the experiment with the virtual tool and a short structured interview which included comprehensibility and satisfaction questions, about the task performed.
Results: All participants performed the task quickly and easily. Most of them focused their attention only on specific cues (91%) of the drugs, namely side effect (61%) and doctor's advice (39%). Moreover participants evaluated the tool as comprehensible and satisficing.
Conclusion: The use of non-prescription drugs therapy shift different responsibilities onto the individuals. A dedicated virtual tool can represent a valid support to help people in these type of decisions. These findings have implications both for the cognitive psychology that studies the cognitive process behind the choice and the selection of a drug and for technology and computer science that studies how to create concrete support for improve people's quality of life.
KEYWORDS: Decision making, health outcomes, health technology, virtual task, cognitive psychology, psychology

I. INTRODUCTION

Nonprescription drug therapy is an increasingly important element of everyday-life contexts and it is becoming tightly woven into the self-care system for several common health problems [1-6]. Clearly, it is important for both patients and healthcare providers to discuss how nonprescription drug therapy are chosen and used because there is evidence that patients can be often uncertain about these type of treatment that are being consumed [3; 5-6].

Furthermore, in line with this, it is important to understand how the process of choice works and which strategies plays a role in this process.

Nowadays, there are several modalities to study people' preferences and to evaluate habits and choice styles [7]; one of these is offered by technology, especially by virtual technology [8-9] which is becoming more and more popular in psychological sciences [10]

II. COMPUTER-GENERATED VIRTUAL ENVIRONMENTS

Computer-generated virtual environments have reached a high level of usability in several area of psychology. In recent times, the creation of virtual environment simulations (VES) has reached a sophisticated level in terms of graphic display and interaction with the user [8-9]. In psychology VES may be used to create realistic scenarios which simulate the real situations in the real world. Moreover, these virtual situations may be designed to reflect natural situations.

What do we mean by VES? One definition is that it is a state of affairs, a depiction of objects or a space which has no physical basis. In this environment people can interact or even touch these objects [10-11]. The ontology of a VES includes its actors or players, an environment or geometry in which the actors behave and a set of rules of behavioural dynamics attached to the actors [11]. In essence a VES requires three differentiable components: the motion input or interactive control devices, the simulated environment itself and the rendering of the environment.

There are a number of ways in which using a VES may be beneficial. Using a VES gives one the opportunity to eliminate or control for unwanted cues while preserving the attention on the study-stimulus [11]. VES also allows one to look at the dynamics and behavioural aspects of learning and encoding. Another benefit of VES is the ability to create specific environment for specific application.

There are however a number of barriers to using VES [9]. Many researchers are skeptical regarding the validity of obtained results under such artificial conditions. One remedy for this appears to be bringing experiments in which the performance of subjects in a particular task in compared in both VES and equivalent ecological task. Another remedy is to clarify and deep the results that can be obtained in a VES task with other measures like questionnaires or interview or observational methodologies.

III. AIM

In a previous published study [5], we have evaluated the role of VES in supporting people's choice for selecting different type of nonprescription drug therapy. Using the previous architecture [5], we proposed a new virtual task in a new community of people with the intent to evaluate the level of comprehensibility and satisfaction of the task through a short semi-structured interview.

IV. METHODS

A. Participants

The analysis was based on semi-structured tests devised in Java language with 50 participants. Tests were conducted by a cognitive researcher trained into this research (SR, first author). Participant signed an Informed Consent to declare their participation to this experiment.

The research was conducted in Milan (Northern Italy) with the collaboration of the University of Milan and at the Catholic University of Sacred Heart of Milan from January 2014 to April 2014. Participants were not remunerated. They voluntarily participated in the tasks and showed great

enthusiasm, viewing their participation as a contribution to the quality of their medical assistance.

B. The VES Task

The data treated here consist of test results which track information lookups and decisions in a hypothetical situation in which participants were asked to pretend to assume a nonprescription drug therapy. The interviewer read the instructions to each participant and also explained the aim of the test. Each experimental session lasted approximately 15 minutes.

Each subject was placed in front of the touch-screen and trained on how to manage each single task. A personal computer ran a Java Virtual Machine which recorded all the data. Tests were conducted on a touch-screen-based interface programmed in Java language in order to facilitate the interaction with dynamic information provided by the computer.

Each subject was placed in front of the touch-screen and trained on how to manage each single task. A personal computer ran the Java Virtual Machine which recorded all the data.

As well described in the original paper of the VES Task [5], the test began similarly by asking participants to choose between hypothetical nonprescription drugs commonly available in a Pharmacy. Participants were invited to explore a 6 x 2 matrix displaying in each of the two rows the two alternative treatments (Drugs 1, Drugs 2) and in each column, six treatment features: price, doctor's advice, daily dose, availability, brand and side effects. There were no constraints on how participants should look up feature information even if there was a constraint on the number of possible features looked up.

Fig 1. The VES task

After the exploration phase, we asked participants how they evaluate this test in terms of comprehensibility and satisfaction in selecting drugs and make an appropriate by the following questions:

-How much did the tool support your process of choice? (support)

-How much was the tool clear and comprehensible? (clearness)

-How much were you satisfied in using this tool? (satisfaction)

Answers were given on a 10-point scale from "not at all" to "completely." The level of support, clearness and satisfaction were measured according to the scores given by participants.

V. RESULTS

Characteristics of participants are given in Table 1. The sample included 31 (62%) female and 19 (38%) female, the mean age was 25 (range 21-32; SD=1,5).

To investigate the level comprehensibility and satisfaction, we considered three factors: the ability to perform the task choice, the type of information that people considered before choosing the treatment and the results from the short structured interview.

About the first point, all the participants (100%) were able to use the tool and perform the VES task from the beginning to the end with the selection of one or more appropriate nonprescription drugs.

About the type of information, the 91% (46 out of 50 participants) of participants looked at only specific pieces of information revealing a clear preference for smaller information sets to act upon. Participants probably focused on those subsets of medical products that mostly captured their interest because more known and used in case of need without a deep attention for differences and similarities among drugs. The cue of the highest interest was again side effects, followed by the doctor's advice. Side effects was explored in the 61% of times, and doctor's advice was explored in the 39% of times.

Finally, about the interview's questions, participants showed a high level of support, clearness and satisfaction with the tool, reporting highly satisficing interactions with the instrument and a clearness in usability with ratings of 8 or 9 on the 10-point scale, where 8 and 9 represented a very high degree of support, clearness and satisfaction (see Fig. 2).

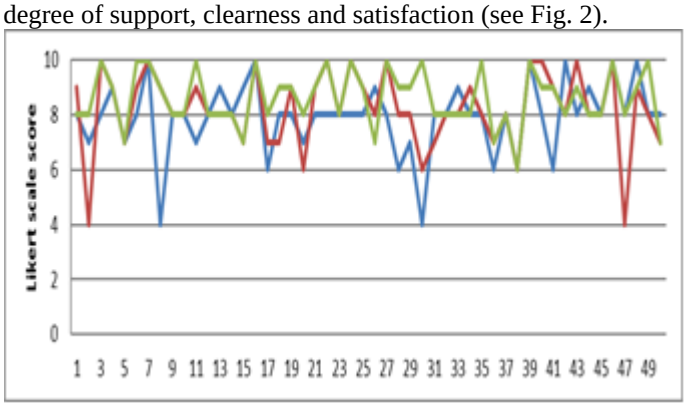

Fig.2. Tool evaluation expressed by participants
Legend: green: support
red: clearness
blue: satisfaction

VI. DISCUSSION

The aim of this study was to investigate how common people judged a virtual device as an appropriate tool make medical decisions for selecting a non-prescription drug. We analysed three factors: the ability to perform the task choice, the type of information that people considered before choosing the treatment and the results from the short structured interview. For this study, we designed naturalistic environments in which participants had to choose common non-prescription drugs therapy for common health problems, frequently experienced by people.

We observed that all the participants were able to perform the task revealing a direct expression of comprehensibility and clearness of the device. Moreover, we observed that, during the experiment, participants consulted very little information at their disposal, confirming

preliminary data published before [5]. Two features were systematically explored: side effects in the 61% of times, and doctor's advice in the 39% of times. The process of choice was also very quick reflecting the use of some smart strategies (eg. cognitive heuristics) that helped participants in selecting the most important pieces of information easily [5-2]. The behaviour of participant in performing the task in a such way can represent a direct indicator of clearness and comprehensibility of the tool.

Finally, the semi-structured interview confirmed our initial hypothesis showing that participants evaluated the tool as highly clear, understandable and they reported highly satisfaction in the task.

This is a preliminary and exploratory study, and the present findings require further investigation. The study has several limitations. First, the size of our sample, composed of 50 participants, is clearly a small sample not highly representative of certain group of population like elderly people that might be have more difficulties in performing a VES task. Second, we acknowledge that the choice of a non-prescription drug can be affected by other variables not examined in this study such as past experience, the opinion of other people, and commercial advertisement.

Last but not least, there were limitations in using this type of methodology. We tried our best to design a tool that could reveal real-life situations with very common treatment used in Italy. Nonetheless, we may expect different outcomes in real situations.

VII. CONCLUSION

Even though this research does not claim absolute generalisations, we can describe some interesting findings in a context-bound sense that come from an active process of reflection given by the experimental phase and quantitative data analysis.

First, the use of VES have the potential to support the ability of individuals to judge and participate in decisions concerning their self-care. Second, the education to cooperation, along with the entire team of health professionals, technicians and computer specialists, will permit to overcome problems of communication and obstacles, so that the use of VES technology will help people in choosing the more appropriate drug for specific health-problems. Finally, the future research in psychology, especially cognitive psychology, should work together with technology and computer science to find new strategies to improve the education of society regarding appropriate use of non-prescription drugs.

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