Animation on How to Take Medicines: A Study of Electronic Patient Leaflets in Brazil

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Abstract. Animation has been proved to facilitate content learning. However, in Brazil the electronic Patient Information Leaflets (e-PILs) do not employ animation, but static images, to show medicine usage to patients. By considering animation a beneficial communication resource to PILs, a study was conducted with 80 participants on comprehension and simulated tasks of using the medicines: vaginal cream, insulin syringe, inhaler and nasal spray. The results ratified the assumption, however, suggest that (a) participants' perception of their understanding and task performance are related to their satisfaction with the animation, and (b) there is a gap between users' understanding of medicine animation and their task performance when using a medicine. Recommendations are proposed based upon the literature and the outcomes of the study.

Keywords: Animation · Medicine usage · Comprehension · Task performance

1 Introduction

In Brazil, patients may access information about medicines in printed leaflets or in electronic ones. The latter is referred to as e-PIL (electronic Patient Information Leaflet) and is made available by the Ministry of Health in the governmental medicine database *Bulário Eletrônico* (www4.anvisa.gov.br/BularioEletronico/). However, information on medicine usage in the Brazilian e-PILs is shown through static images in the same way as printed PILs. Thus, technological resources of digital media, such as animation, are not employed to represent medicine usage in e-PILs, despite their contributions to content learning [1–3]. Figure 1 shows a detail of an e-PIL presenting a static pictorial sequence on using a medicine, which is the same used in printed version.

The graphic representation of animated instructions may vary in pictorial style (e.g., design in 2D, 3D), represented participants (e.g., agent, object), camera position (e.g., zoom, close shot); and text position (e.g., caption, labels for parts of the image) [4]. Regarding animation on medicine usage, emphasis on graphical representation of the steps should also be considered for satisfactory content learning. This is particularly relevant to the manipulation of objects, such as syringes and dosing devices which require special attention from patients so as to prevent misuse or dosage error.

For the information content, it can be procedural (steps) and non-procedural, such as warnings and introductory information [4]. Among the non-procedural content, inventory information is of relevance, as it is the necessary material or components to undertake a task [5], as for example an insulin bottle, syringe, and alcohol for hygiene,

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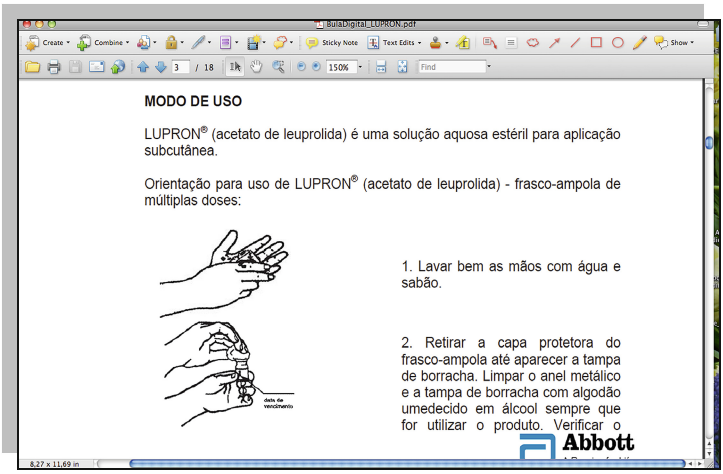

Fig. 1. Detail of an e-PIL presenting the same images as for the print format

which are necessary to take an insulin injection. The inventory information, together with the depiction of the steps to be carried out, may also aid to build a mental representation of the task. This regards the action plan one develops to perform a task [6]. Thus, lack of accuracy and/or of completeness in the representation of procedural and non-procedural contents may jeopardize their comprehension and/or the task performance.

As for learning contents, studies show that animation facilitates cognitive processes and motivates learners [7], as well as promoting visualization of processes and procedures [8]. Accordingly, it can be said that the animation is appropriate to convey a sequence of steps to be performed, as it is the case in medicine usage. Mayer and Moreno [1] proposed principles to design animation as an instructional tool based upon the Cognitive Theory of Multimedia Learning [9]. This theory considers that the human cognitive system has two subsystems acting in an integrated manner to enhance information processes: the verbal (processes auditory stimuli) and non-verbal (processes visual stimuli). Hence, Mayer and Moreno's [9] animation principles mainly advocates that audio/narration and animation (moving images) should be employed simultaneously, and convey the same messages in a coherent manner to promote learning.

Thus, medicine usage represented through animation (image and audio) may ease comprehension and therefore may support task performance, contributing to the medical treatment of patients. Having this as a premise, a study was conducted in Brazil to verify the effectiveness of animation on comprehension and on task performance of using medicines, which are available in the *Bulário Eletrônico*. This study intended to meet the demand for information design research on animation conveying instructional messages in health care, particularly on medicine usage in e-PILs in Brazil.

2 The Research Design of the Study on Animation of Medicine Usage

Four e-PILS of medicines varying in their way of use (i.e., pharmaceutical presentation) were selected for the study: (a) insulin syringe, (b) vaginal cream, (c) nasal spray and (d) inhaler. An animation was produced to for each medicine, based on the literature recommendations. The animated images were in drawing style, employed arrows to stress the actions, and color to emphasize particular parts of the images. The images next are screenshots of the animations vaginal cream and inhaler (Fig. 2).

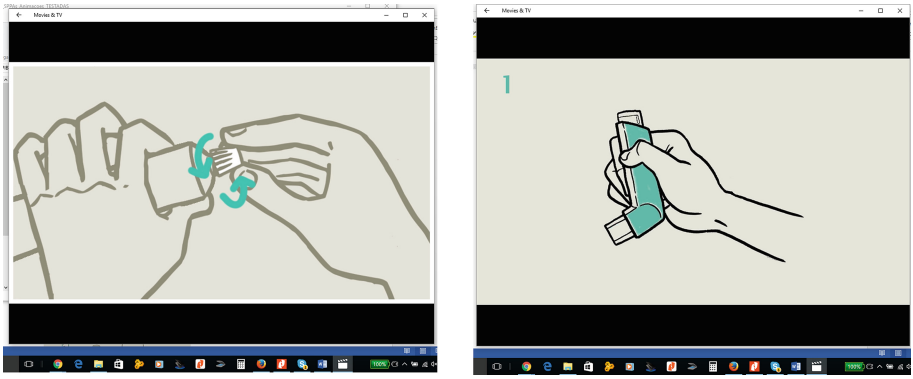

Fig. 2. Screenshots of the animations tested (vaginal cream and inhaler). Source: The author's archives.

The animations were tested with a total of 80 adult participants varying in gender and age, being 20 participants per medicine animation. The animation of the vaginal cream medicine was tested with women only, due to the nature of the task. The dependent variables (X) were comprehension of the animations and participants' task performance. The independent variable (Y) was the animations of the medicines' usage. Participants were equally divided into two groups: (a) Comprehension (40 = 10 participants per medicine animation) and (b) Simulated medicine usage (40 = 10 participants per medicine animation) as shown in Table 1.

Table 1. Participants' distribution across groups and medicine animations tested

Medicine animation	Group (a) comprehension	Group (b) simulated medicine usage	Total
Vaginal cream	10	10	20
Insulin syringe	10	10	20
Nasal spray	10	10	20
Inhaler	10	10	20
Total	40	40	80

The animated procedural pictorial sequence of each medicine was presented to the participants, individually and in isolation. For the comprehension test, participants were asked to watch the animation, and then, to answer questions related to the steps represented and to their level of satisfaction with the animation they watched. For the task performance test, participants were asked to watch the animation, and then, to use the medicine in a simulated manner. They were informed that they could watch the animation as many times as they considered necessary, and were encouraged to verbalize their actions during task performance. Afterwards, they were asked to answer questions related to their performance and to their level of satisfaction with the animation. The data was collected through observation and recorded in written protocols by the researchers.

Due to the limited number of participants per medicine animation, the results were analyzed qualitatively only. However, figures are considered herein to indicate possible trends in the responses.

3 Results and Discussion

Overall, the results indicated that most participants understood (fully or partially) the medicines' usage represented by the animations, and performed the simulated tasks satisfactorily. All 80 participants (N = 40 for comprehension and N = 40 for simulated tasks) agreed that audio and animation together helped them to understand and to perform the tasks on the medicines usage. This is in line with the Cognitive Theory for Multimedia Learning [9]. When asked what could be improved in the animations, participants' main suggestion was to enhance clarity of the audio, followed by the animation's presentation speed (e.g., faster for the insulin injection and slower for the inhaler). The results on each medicine animation per group are summarized next.

Comprehension. The results showed that all participants (N = 40) believed they had a high degree of comprehension of the tasks, and were satisfied with the animations. The majority of the participants (N = 9 out of 10) answered the questions on how to use an insulin syringe properly. However, when asked to explain the task, few participants mentioned how to pinch the skin (N = 3 out of 10) and to angle the needle to inject insulin (N = 2 out of 10). Similarly, the animation on how to use a vaginal cream was fully understood by more than half of the woman participants (N = 6 out of 10). It is worth mentioning that all of the participants (N = 10) answered the questions on how to attach the applicator to the cream tube in a satisfactory manner.

Differently, the results of the animation on how to use nasal spray show that 9 out of 10 participants did not fully understand the represented task. When asked to describe the task, most participants did not mention the steps shaking the nasal spray bottle and positioning the head down when spraying the medicine. However, participants satisfactorily understood how to angle the nasal spray bottle to avoid touching the nose bone (N = 5 out of 10), and to breath via the mouth after spraying (N = 8 out of 10). Figure 3 shows a screenshot of the step of the nasal spray animation. The animation on how to use an inhaler produced similar results. It was partially understood by all 10

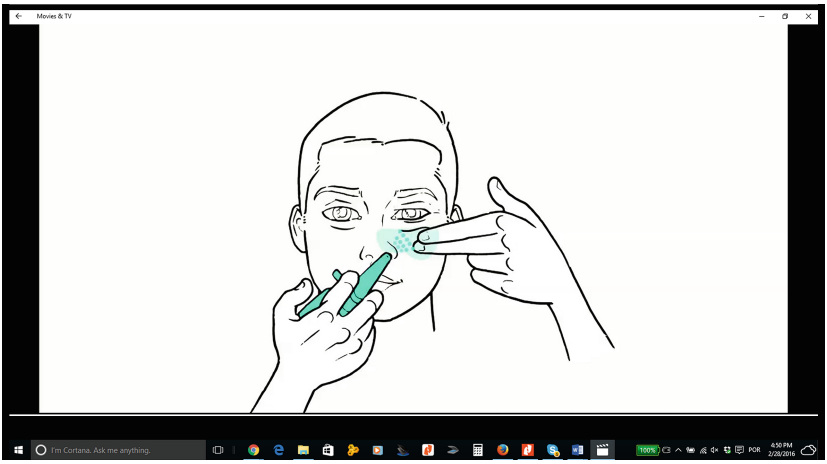

Fig. 3. Screenshot of the step showing how to angle the nasal spray bottle. Source: The author's archives.

participants. Their main difficulty regarded the animated step of positioning the inhaler bottle in between the lips. On the other hand, 8 out of 10 participants fully understood the steps of exhaling air from the lungs before inhaling, and holding the breath for 10 s when inhaling.

Task performance. All 40 participants completed (fully or partially) the tasks of using the medicines in a simulated manner and most of them responded positively when asked if they had succeed in performing the steps represented in the animations. Nevertheless, the majority of participants have not mentioned the hygiene procedures and the inventorial content when explaining the procedures after they had performed the tasks. Also, errors occurred when participants undertook each one of the tasks of the medicines' usage.

Participants (N = 10) made errors in simulating the use of the insulin syringe, mainly regarding measuring the glucose level (N = 7). Rubbing the insulin bottle against the hands and positioning the bottle correctly to withdraw the insulin with the syringe were also not properly done by the participants when carrying on the task. Similarly, the results on how to use vaginal cream show that 8 out of 10 woman participants made errors, which were mostly related to hygiene procedures (e.g., wash the hands before the task).

As for the task of using a nasal spray, 9 out of 10 participants made errors. The most frequent errors were to shake the nasal spray bottle before using the medicine, to properly angle the bottle so as not to touch the nose bone, and to put the head down to spray the medicine. Participants also suggested to improve the illustrations of the animation and to reduce the number of represented steps as they found there were too many steps, making it difficult to remember them all. Likewise, errors occurred when participants (N = 7) conducted the task of using an inhaler. These errors were related to

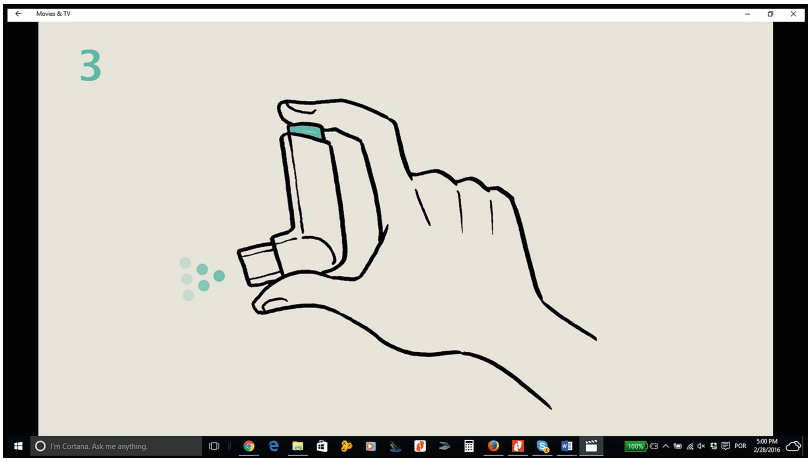

Fig. 4. Screenshot of the step showing how to press the inhaler to release the medicine. Source: The author's archives.

shaking the inhaler before using it, pressing the inhaler bottle to release the medicine (Fig. 4), exhaling air from the lungs before inhaling, and holding the breath for 10 s when inhaling.

By comparing the results of comprehension to those of simulated tasks, discrepancies were found. Participants performed better in the comprehension test. This suggests that understanding a procedural animation of medicine usage may not lead to success in task performance. Thus, there may be a gap between understanding and performance in medicine usage.

Despite the drawbacks in the comprehension of the animations tested and in task performances, all 80 participants considered that they had understood and successfully performed the tasks. They also found the animations satisfactory. These results indicate participants' misperception of their understanding and task performance, as they seem not to realize the occurrence of errors.

Moreover, the inventorial content was not mentioned by several participants when asked to describe the procedures in all animations tested. This is perhaps, because (a) the inventorial content is not a step (procedural content) and/or (b) it is displayed at the very beginning of the animations, which may make recalling inventorial content difficult. This indicates that participants' perception and recall of different kinds of contents in procedural animation may play a role on task comprehension and description. However, these issues are beyond the scope of this study, demanding further investigation.

Despite the above-mentioned concerns, the results on comprehension and satisfaction are aligned to the literature on the beneficial effects of animation in motivation and learning [1, 2, 7], and in the visualization of processes and procedures [3, 8].

Furthermore, the outcomes of this study suggest that some aspects are not fully accounted for in research on procedural animation: the time presentation speed; the presentation of inventorial content; and the relation between task performance and

comprehension. Thus, it is pertinent to consider not only what but also how to represent medicine usage through animation to reach effectiveness in communicating procedures.

4 Conclusions and Some Recommendations

Although the qualitative approach of the study does not allow generalizations, the results make it possible to conclude that animation facilitates the understanding and the use of medicines. In addition, the study's outcomes suggest that (a) participants' perception of their understanding and task performance are related to their satisfaction with the animation, and (b) there is a gap between users' understanding of medicine animation and their task performance when using a medicine. These findings call for future studies.

Taking into account the findings presented herein together with the literature, the following recommendations are proposed with view to improve the design of animation of medicine usage for e-PILs in Brazil:

1. Present both procedural and non-procedural contents in medicine animation, as this may facilitate users' information processing and their action plan to carry out the tasks
2. Consider users' satisfaction with an animation and their understanding together with their task performance, to decide on how to represent medicine usage
3. Consider users' information needs regarding the presentation speed and the use of emphatic devices in the animation
4. Present information through audio text and animated images in an integrated manner, as this promotes comprehension
5. If inventorial content is represented in medicine animation, make sure that users' understand it and recall its communicational role (e.g., comprehension test)

Needless to say that the above-mentioned recommendations are not meant to supplant the verification of the success of the animation in communicating medicine usage and supporting task performance. Thus, the recommendations for medicine animation are intended to aid the designers' decisions, and should be tested with users to guarantee their effectiveness.

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