

# A new approach to improve coping strategies to surgery in children

Alberto Guillén<sup>1</sup>, Luis J. Herrera<sup>1</sup>, Oresti Baños<sup>1</sup> Pedro L. García-Saura<sup>2</sup>,  
Antonio Muñoz<sup>2</sup>, José F. Guillén<sup>2</sup>

1.Computer Technology and Architecture  
University of Granada

Granada, Spain

2.Hospital Clínico San Cecilio  
Granada, Spain

**Abstract.** The coping strategy applied before surgery is very important regarding the way in which the anesthesia is applied. Increasing the familiarization of the patient with the medical environment can mitigate the fear to "the unknown". This paper presents an application that has to be used with a real toy so the patients can learn concepts about the hospitalization and anesthesia procedures. The information is provided in a transversal manner folded between video-games. The paper presents as well the concept of "ViAI" games that combine Virtual concepts and reAI environments in an complementary way. The whole design process has been supervised by specialists in the pediatric and anesthesia areas so the results of its application on real patients seem promising.

coping strategies, paediatric, apps, "ViAI" games, tutakaboo©

## 1 Introduction

The anxiety, stress and pain before a medical procedure are important elements to be controlled in order to reduce postsurgical complications and better recovering times [1,2]. However, very few research is being done in those aspects, one of the reasons is because are subjective variables that depend on the patient context, gender, age and other complex variables [3].

This difficulties even become harder when dealing with pediatric patients due to the limitations in communication and emotion awareness and control, setting a barrier for the communication and evaluation of the variables cited.

Nonetheless, there are some research works that aim at reducing those levels by applying simple methods such as playing music [4] and the combination of visual distraction and cognitive activity that are showing good results [5]. As specialists say, even for a small amount of patients it is better to do something than nothing. However, it is important to analyse and study properly what to do because sometimes, saying "don't worry" could communicate fear as it is stated in [6]. It is important to be aware that there are significant differences

depending on who communicates information, it is not the same that parents talk to patient than if anesthesiologists do [7].

As a conclusion in [8] states that if there is more stress before inserting a needle there will be more pain and that the use of visual distraction procedures should be a must in order to control anxiety and stress in pediatric patients for both invasive and non invasive procedures.

Unfortunately, Information Technologies (IT), as far as we know, are not being applied to this research field and, up to the date the apps available for pediatric purposes are listed below:

1. Local Authority Child Health Profiles for England: provides a snapshot of child health and well-being for each local authority in England using key health indicators, which enables comparison locally, regionally and nationally. <https://itunes.apple.com/gb/app/local-authority-child-health/id603478634?mt=8>
2. Pedi Quickcalc: is an up-to-date medical calculator for pediatrics, giving you instant access to weight-based drug dosing, IV fluid rates, and weight conversions. <http://www.pediquikcalc.com/PediQuikCalc/Welcome.html>  
item PEDI Stat: is a rapid reference for RNs, paramedics, physicians and other healthcare professionals caring for pediatric patients in the emergency or critical care environment. <http://www.qxmd.com/apps/pedi-stat-for-iphone-android>
3. PALS Advisor: is used during pediatric advanced life support codes. This decision-engine assesses patient characteristics and guides advanced resuscitation. <https://itunes.apple.com/gb/app/pals-advisor/id667813486?mt=8>
4. Pediatric OnCall: provides to you healthcare professionals all the basic and daily needed important tools. <https://play.google.com/store/apps/details?id=com.pediatriconcall>

This paper presents an app for mobiles devices (mobile phones, tablets and phablets) that has a triple mission: 1) to distract by playing 2) to familiarise the patient with the hospital environment and staff 3) provide information to doctors saving time. The approach proposed in this paper also presents the benefits of combining visual distraction with cognitive activity and music which has been proven to be very positive [5].

The proposed procedure defines a new category of games because it is based on the product Tutakaboo © (Mi Refugio Infantil S.L. <http://mirefugioinfantil.com/>) Fig. 1 that combines Virtual elements with reAl elements, defining a new category: "ViAl" games. The difference between games using Augmented Reality is that the game also is done in the reality without the need of a device to perform interaction.

## 2 Proposed solution: Tutakaboo© Hospital games suite

The software designed uses Vuforia© and Unity© to recognise printed tags distributed all over the real structure which is built using triangles. Depending



**Fig. 1.** Tutakaboo's © logo

on the tag recognised, the app presents a variety of minigames that are useful for the doctors.

The solution also includes a web backend that allows a server to configure several parameters for each game and also allows doctors to monitorise the evolution and progress of the patient. Subsections belows describe each aspect in detail.

## 2.1 App side

The contents of the app are aimed to reduce the anxiety of the patient by making more familiar and friendly the environment and to speed up the anesthesia procedure by obtaining information beforehand and by relaxing the patient trough breath control. Concretely, there are five games:

1. Hospital game: that includes three subgames: paint, jumping beds and pipes.
2. Bite test
3. Blow the balloon
4. Show your emotions (faces)
5. Puzzle (Cognitive distraction)

**Hospital info game** The aim of this game is to introduce the patient with the Hospital's staff and with some concepts that will be involved during his time of hospitalization. At first, a generic image of the building is presented Fig. 2 where all the action will be carried out and then, the nurse presents herself Fig. 3 and proposes the player to draw a paint so it can be printed and sticked to the patient's bed so it will be special and unique.

Once the player has finished his paint, he receives a positive feedback and continues with the game with the appearance of a new character: the orderly Fig. 5. He explains that he has to move the patients around the hospital and that is difficult so he wishes it could be as easy as jumping on the clouds... which is not. The game appears Fig. 6 and the player has to move left or right in order to jump from one cloud to another. A counter is set and the aim is to achieve as much jumps as possible.

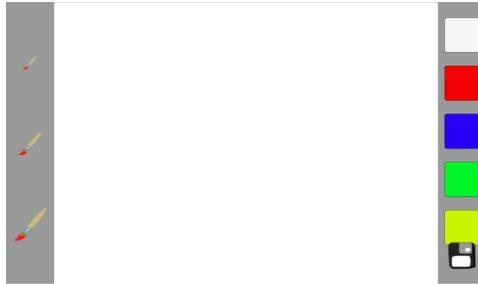


**Fig. 2.** Tutakaboo's ©representation of tthe hospital in the app



**Fig. 3.** Tutakaboo©Nurse showing a dialog box that presents the first game.

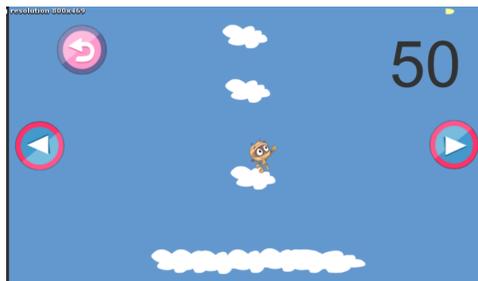
In the last sequence, the character Fig. 7 that represents the anesthesiologist, explains that he has to introduce a white liquid into the mummy so it falls slept and doctors can cure him but sometimes it is a bit difficult to find out the way and asks the player for some help. A classical pipes game is presented to the player that has to connect random pipes so the white substance reaches the mummy Fig. 8.



**Fig. 4.** First game where the patients can draw a flag that can be placed in the bed. Tutakaboo©.



**Fig. 5.** Character that introduces his role of moving beds around the hospital and a presents a new game. Tutakaboo©.



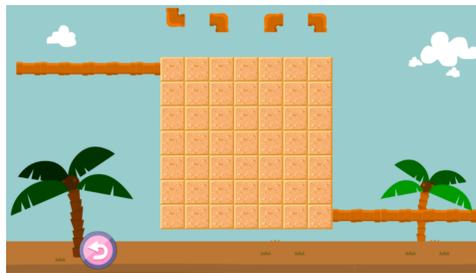
**Fig. 6.** Jumping game where the mummy has to jump from one cloud to another. The game is infinite and the number of jumps is stored. Tutakaboo©.

**Ballon game** This game is loaded at any time when the patient finds the tag in the tutakaboo structure and it consists in blowing to the microphone of the device so a balloon can get filled of air. If so, the mummy will elevates but if the player blows too much, the balloon can explode.

The game is simple but little kids enjoy seeing the balloon getting bigger and older patients have the challenge of keeping the mummy in the air without



**Fig. 7.** The doctor character that introduces the next game . Tutakaboo©.



**Fig. 8.** The patient has to connect one extreme of the pipe (upper left corner )with the other (lower right corner) using the pieces of pipes that arrive as indicated. The time required to finish and number of retrials are stored. Tutakaboo©.

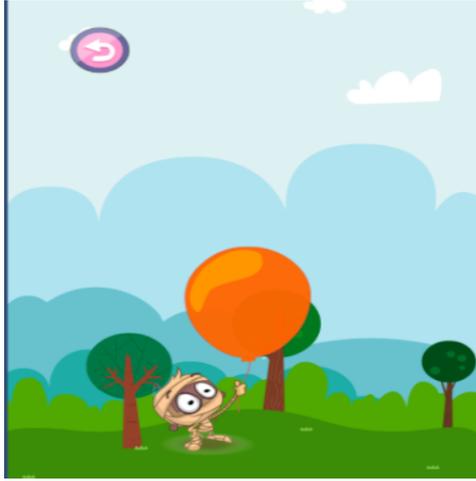
exploding the balloon. Furthermore, the fact of maintaining a constant blow can help the patient to hyperventilate reducing cardiac rhythm and relaxing.

**Bite test** An important aspect that has to be observed by the anesthesiologist is the Mallampati [9] classification in order to see if it is possible to carry out tracheal intubation.

The app shows the positions in which the patient has to put the mandible and then it requests the patient to take a photo of himself doing the same positions.

Once the photo is taken (with the help of the parents or the staff at the hospital), it is uploaded to the server for further analysis, saving a lot of time for anesthesiologists and reducing the time the patient feels observed and analysed. Thus, the anxiety and fear is, at less, not increased.

**Show your emotions (Faces)** In this game, the mummy is represented and below the patient can seek for different facial expressions (mouth and eyes) to change the face of the mummy. The objective of the game is that the patient can express or externalise the way he feels through the mummy, giving a clue about its emotions that a regular anxiety score would be unable.



**Fig. 9.** The mummy is grabbing a balloon that has to be inflated by blowing to the microphone of the device. The time and number of trials (because the balloon can explode if it is blown too much) are stored. Tutakaboo©

**Puzzle** As commented above, cognitive actions can help to forget about anxiety and stress so, a puzzle can help to this. Furthermore, it is specially useful for patient with limited mobility or energy. The default theme is the mummy although it can be changed.

## 2.2 Server side

The doctors and supervisors can study the behaviour of the patient and modify several parameters of the app using a back-end webpage. This backend allows the administrator user to configure the difficulty of the games and to make more friendly the app by setting the right names and gender of the Hospital suite. The strings that are shown to the patient can be modified in case a concrete Hospital has a special feature to be commented.

The server stores the sessions started so it is possible to check the frequency and the number of times the patient has been playing.

Thanks to this architecture, the doctors can study which patient is more nervous or calm and even reschedule the surgery order.

## 3 Conclusion

There are many research to be done regarding how to develop coping strategies and how to deal with pain, anxiety, stress and fear before hospitalisation. Concretely, this task becomes even more difficult to analyse when dealing with pediatric patients because of the difficulty to establish communication and the

capability to understand abstract concepts. This paper has presented a new tool which is based on a new way of playing that provides the patient fun and entertainment and, at the same time, introduces the staff at the hospital and the path the patient will follow. The design has been supervised by highly qualified specialists that will supervise the empirical phase that has to come. The software also is able to obtain some objective and quantitative values that can help to determine the anxiety or stress levels from a new perspective in comparison with classical surveys.

## Acknowledgment

The work in this paper has been supported by CEI-Biotic project CEI2015-MP-V11

## References

1. A. Palese, M. Cecconi, R. Moreale, and M. Skrap, "Pre-operative stress, anxiety, depression and coping strategies adopted by patients experiencing their first or recurrent brain neoplasm: An explorative study," *Stress Health*, vol. 28, no. 5, pp. 416 – 425, 2012.
2. J. Guillén-Perales, A. Luna-Maldonado, M. Fernández-Prada, J. F. Guillén-Solvas, and A. Bueno-Cavanillas, "Calidad de la información en el proceso del consentimiento informado para anestesia," *Cirugía Española*, vol. 91, no. 9, 2013.
3. C. on Psychosocial Aspects of Child and F. Health, "The assessment and management of acute pain in infants, children, and adolescents," *Pediatrics*, vol. 108, no. 3, pp. 52 – 58, 2001.
4. H. L, N. AS, L. Y, and et al, "Music to reduce pain and distress in the pediatric emergency department: A randomized clinical trial," *JAMA Pediatrics*, vol. 167, no. 9, pp. 826–835, 2013. [Online]. Available: +http://dx.doi.org/10.1001/jamapediatrics.2013.200
5. M. V. Dogan and L. Senturan, "The effect of music therapy on the level of anxiety in the patients undergoing coronary angiography," 2012.
6. C. M. McMurtry, C. T. Chambers, P. J. McGrath, and E. Asp, "When "don't worry" communicates fear: Children's perceptions of parental reassurance and distraction during a painful medical procedure," *Pain*, vol. 150, no. 1, pp. 52 – 58, 2010. [Online]. Available: <http://www.sciencedirect.com/science/article/pii/S0304395910001132>
7. A. V. D. TORO, P. L. G. SAURA, J. M. CONTRERAS, M. G. JIMÉNEZ, and C. G. PUGA, "Programa corto de interacción entre paciente pediátrico, padres/cuidadores y anestesiólogo," in *X Congreso Nacional de Anestesia Pediátrica*, may 2014.
8. M. C. M. Navarro, "Utilización de un sistema de videodistracción para disminuir la ansiedad y el dolor en niños durante la venopunción en un servicio de urgencias pediátricas." Ph.D. dissertation, Universidad de Autónoma de Madrid, 2014.
9. S. R. Mallampati, S. P. Gatt, L. D. Gugino, S. P. Desai, B. Waraksa, D. Freiburger, and P. L. Liu, "A clinical sign to predict difficult tracheal intubation; a prospective study," *Canadian Anaesthetists' Society Journal*, vol. 32, no. 4, pp. 429–434, 1985.