LUDICON
*Recibido 23 Nov. 2025* *ReCIBE, Año 14 No. 3, Dic. 2025*
*Aceptado 24 Nov. 2025*

# Rediseño de Emotion4Us: un videojuego para apoyar la conciencia emocional de las personas con discapacidad intelectual.

# Redesigning Emotion4Us: A video game for supporting emotional awareness of people with intellectual disabilities

Andrea Rivas Gómez[1]
Antonio Ramos Gonzalez[1]
Marisela Hernández-Lara[2]
Brayan Ivan Perez Ventura[1]
Ana I. Martínez-García[2]
Karina Caro[1]

[1] Autonomous University of Baja California (UABC), Ensenada, BC, México.
rivas.andrea@uabc.edu.mx,gonzalez372576@uabc.edu.mx, brayan.perez56@uabc.edu.mx, karina.caro@uabc.edu.mx
[2] CICESE, Research Center. mhernandez@cicese.edu.mx, martinea@cicese.mx

**Resumen.** La conciencia emocional es fundamental para el desarrollo socioemocional, ya que facilita la autorregulación, mejora las habilidades sociales y promueve el bienestar general. Sin embargo, para las personas con discapacidad intelectual, comprender y gestionar las emociones puede resultar difícil. Estudios muestran que los videojuegos serios pueden ayudar a desarrollar estas habilidades, principalmente al enseñar nuevos conceptos mientras el entretenimiento es un objetivo secundario, a menudo mediante estrategias de gamificación. Aunque algunas investigaciones destacan sus beneficios, estos videojuegos no están diseñados explícitamente para promover la conciencia emocional. Emotion4Us es un videojuego serio diseñado para fomentar la conciencia emocional en personas con discapacidad intelectual, utilizando estímulos positivos para reforzar comportamientos deseados con base en la teoría de la autodeterminación y el marco MDA (Mecánicas, Dinámicas y Estéticas). Este artículo aborda el proceso de rediseño y presenta los resultados de dos sesiones de validación con psicoterapeutas y docentes de educación especial, centrándose en el potencial del videojuego y las áreas de mejora. Concluimos con una discusión sobre el trabajo futuro y una reflexión sobre los requisitos para una implementación exitosa del videojuego.

**Palabras Clave:** Conciencia emocional, discapacidad intelectual, juegos serios.

**Abstract.** Emotional awareness is crucial for social-emotional growth, as it facilitates self-regulation, enhances social skills, and promotes over- all well-being. However, for people with intellectual disabilities, under- standing and managing emotions can be difficult. Studies show that se- rious video games can help develop these skills, mainly by teaching new concepts while entertainment is a secondary goal, often using gamifica- tion strategies. Although some research highlights their benefits, these games are not explicitly designed to promote emotional awareness. *Emo- tion4Us* is a serious video game designed to promote emotional aware- ness in individuals with intellectual disabilities, utilizing positive stimuli to reinforce desired behaviors based on self-determination theory and the MDA (Mechanics, Dynamics, and Aesthetics) framework. This paper dis- cusses the redesign and shares results from two validation sessions with psychotherapists and special education teachers, focusing on the game's potential and areas for improvement. We conclude with a discussion of future work and a reflection on the requirements for a successful imple- mentation of the video game.

**Keywords:** Emotional awareness, Intellectual disabilities, Serious games.

## 1 Introduction

Emotional awareness—defined as the ability to identify, understand, and de- scribe one's own emotions and those of others—is a vital skill in social-emotional development, promoting emotional self-regulation, social adaptation, and over- all well-being. However, for individuals with intellectual disabilities, recognizing, expressing, and managing emotions can present significant challenges. These dif- ficulties can impact their communication, learning, and ability to participate in everyday social situations fully [1].

Research indicates that serious video games can help develop various skills in individuals with intellectual disabilities [2]. The primary goal of these games is to support the development of specific skills, such as improving learning or

understanding new concepts, with entertainment as a secondary goal [3]. Ad- ditionally, these types of games typically use gamification [18], which can be defined as the strategic application of game-design elements and principles to non-game settings, such as education, to boost user engagement, motivation, and behavior.

Some studies show how these games aid skill development in these popula- tions [2, 4]. However, they have not been designed to foster emotional awareness. Similarly, technology aims to support the recognition and identification of emo- tions. Still, most efforts focus on other groups, such as people with autism [5] or Attention Deficit / Hyperactivity Disorder (ADHD) [12]. Further research is needed to investigate how we can design serious games that support the emo- tional awareness of individuals with intellectual disabilities.

*Emotion4Us* is a serious video game designed as a support tool to promote emotional awareness in people with intellectual disabilities. It utilizes reinforcers, such as positive stimuli, to increase the likelihood of desired behaviors associ- ated with emotional learning. These mechanisms are based on the principles of positive reinforcement, which have been proven effective in behavioral change, especially in educational and family settings [6]. This study presents the re- design of *Emotion4Us* and discusses the results of two validation sessions with psychotherapists and special education teachers of individuals with intellectual disabilities.

## 2 Related work

Several serious video games support the development of emotional awareness in diverse populations. This includes neurotypical individuals as well as those with developmental disorders. These video games are beneficial in enhancing emotional awareness and other cognitive skills [7, 5]. For example, EmoTEA
[5] is a serious game designed to teach children with autism how to identify and express emotions, incorporating tangible user interfaces and emotion recognition technology that uses facial expressions. An evaluation of EmoTEA with three children with autism and two psychotherapists showed that the system is a helpful tool for teaching emotion-related concepts.

Recent research has shown promising results for multimodal serious games in enhancing emotional skills. Löytömäki et al. [12] conducted a study using the Emotion Detectives (ED) game with children who have autism spectrum disorder, ADHD, and developmental language disorder. The intervention group (n = 30) showed significant improvements in four of six emotion discrimina- tion tasks after two months, with these benefits maintained at the one-month follow-up. Similarly, Kirst et al. [13] evaluated Zirkus Empathico (ZE), a parent- assisted serious game, with 82 children on the autism spectrum aged 5-10. While a six-week program did not produce lasting changes in empathy and emotion recognition, ZE improved emotional awareness, emotion regulation, and reduced autism symptoms in the medium term. The study highlights the importance of addressing one's own emotion processing alongside recognizing others' emotions for comprehensive intervention.

### 2.1 The Emotion4Us Videogame

*Emotion4Us* is a video game designed to support the emotional awareness of people with intellectual disabilities. It was initially designed for people with Down syndrome[3], but we decided to rename it to target other disorders related to intellectual disability, beyond Down syndrome. The following are the main features of *Emotion4Us*:

- **Customization:** Therapists can tailor the game to meet the individual needs and preferences of the player, making it easier for them to start. Per- sonalized features include names, reinforcements, emotions, and the number of trials.

- **Visual and auditory stimuli:** The video game interface features visual and auditory stimuli, such as bright colors, music, and videos or anima- tions. To facilitate skill generalization, images depicting different emotions are presented in two formats: animated characters and real people.
- **Reinforcement:** At the end of each activity, the player earns digital stars as a reward for their progress (partial reinforcement). After completing all ac- tivities, the player receives a digital trophy (final reinforcement). Therapists can customize the reinforcements based on the player's preferences.
- **Emotions:** The emotions available in *Emotion4Us* are happy, sad, angry, bored, tired, scared, in addition to the feeling of pain.
- **Interaction model:** The video game incorporates tactile interaction, a nat- ural method for people with intellectual disabilities to engage [8].

Each available emotion in *Emotion4Us* is practiced through the following four activities:

- **Activity 1. Bring the image into the frame.** The player must drag the image that matches the emotion displayed on the screen.
- **Activity 2. Show an emotion situation.** The video game shows a sce- nario in which an emotion is expressed, provides a brief explanation of the scene, and asks the player to choose from three options indicating which emotion is shown.
- **Activity 3. Imitate emotion.** The player must mimic the emotion that is being displayed. The device's camera is turned on, allowing the player to see themselves on the screen and try to replicate the emotion shown on the right side.
- **Activity 4. Create emotion.** The player demonstrates the chosen emotion by adjusting the eyes, mouth, and eyebrows on the screen. They need to drag these elements to a designated area to form the selected emotion.

[3] Originally named as Emotion4Down.

The features of Emotion4Us are based on self-determination theory [14], which states that humans have three innate psychological needs: competence, autonomy, and relatedness. On the one hand, reward and personalization me- chanics fulfill the basic needs of competence by incorporating challenges, ac- tivities, and positive feedback, and autonomy by enabling users to customize elements and activities. The MDA framework (Mechanics, Dynamics, and Aes- thetics) [19] explains how game mechanics foster improvement and progression, which is expressed through pleasure, challenges, and expression. In Emotion4US, progression mechanics include level advancement and rewards. Digital stars and trophies act as direct rewards, while feedback on activity accuracy reinforces engagement.
The *Emotion4Us* video game was designed using a user-centered approach
and has been previously evaluated (as Emotion4Down) with two individuals with Down syndrome [17], indicating its potential to support emotional awareness in this population. The evaluation also highlighted the need to update the user in- terface (UI) of the video game in accordance with the latest design standards and to enhance the user experience (UX) for individuals with intellectual disabilities. In this paper, we explain the redesign process of *Emotion4Us*.

## 3 Methods

The first step in redesigning *Emotion4Us* was to analyze its current video game design using Nielsen's usability heuristics [9]. Next, we reviewed the design guide- lines for UX and UI available in the literature. Then, we redesigned *Emotion4Us* in accordance with the UX/UI guidelines. Finally, we validated the new design with experts in intellectual disabilities. Next, we describe each stage of the design process.

1. **Analysis of the *Emotion4Us* design and heuristic evaluation:** At this stage, we analyze the current design of the video game's interface to identify usability issues and guide its redesign to become more user-friendly. We used Nielsen's ten usability heuristics [9] to identify usability problems, which are ten general principles or broad usability rules for interaction design. The process for conducting the heuristics evaluation was as follows: Two mem- bers of the research team reviewed the video game, guided by its functional requirements. Each member received a checklist detailing each heuristic for evaluation. After individual assessments, the team held a meeting to discuss the results, reach a consensus that combined all findings, and outline the main suggested changes to the app.

2. **Review of literature design guidelines:** We then conducted a literature review to identify the existing interface design guidelines that could serve as references for the new interface design proposal.
3. **Redesign proposal:** After reviewing the current design of the video game and the design guidelines, we created a design proposal for the *Emotion4Us* interface. This proposal was turned into a medium-fidelity prototype using the Figma design tool.
4. **Validation sessions with experts:** To validate the redesign proposal, two validation sessions were conducted with a psychotherapist and a special ed- ucation teacher.

## 4 Analysis of the Emotion4Us design, heuristic evaluation and design guidelines

Table 1 presents the main results of the heuristic evaluation, highlighting the main changes suggested to improve the design of the video game.

**Table 1.** Results of applying Nielsen's Heuristics to the actual version of *Emotion4Us*.

| **Nielsen's Heuristics** | Yes | Partly | No | **Suggested changes** |
|---|---|---|---|---|
| H1. Visibility of System Status | | X | | Redesign the menus to display all the options clearly. |
| H2. Match between the System and the Real World | X | | | Provide more details about each activity and emotion. |
| H3. User Control and Freedom | | X | | Add the 'Go Back' and 'Exit' options. |
| H4. Consistency and Standards | | X | | Check spelling and grammar, fix inconsistencies between fonts and sizes. |
| H5. Error Prevention<br>H9. Help Users Recognize, Diagnose, and Recover from Errors | | X | | Improve error messages and alerts when the user fails to select the correct option. |
| H6. Recognition rather than Recall | X | | | Review heading labels for consistency and visibility. |
| H7. Flexibility and Efficiency of Use | | X | | Enhance customization menus to simplify this process for therapists. |
| H8. Aesthetic and Minimalist Design | | X | | Evaluate the color palette. |
| H10. Help and Documentation | | X | | Add help buttons. |

Based on the heuristic evaluation, several areas for improvement were iden- tified. The most common issues included:

- Lack of visibility in system selections, making it unclear which emotion was chosen.
- The user controls lacked options to return to the main screen at any time.
- Interface inconsistencies with visual elements that did not follow principles of consistency or minimalism, such as margins, styles, typography, and ani- mations.
- Limited feedback for incorrect actions.
- No user support or help guides included in the instructions.

These findings played a crucial role in redefining the navigation structure, language used, and visual elements of the prototype.

We also reviewed the literature on accessible technology, inclusive design, and emotional learning tools for people with intellectual disabilities to identify design guidelines for this population. This review highlighted key design elements, including visual clarity, simple navigation, and immediate feedback. It also helped outline design considerations based on the work of [10, 11], including:

- Increase the contrast between text and background to improve readability.
- Avoid overusing bright or saturated colors, as they can confuse.
- Make the clickable areas larger.
- Limit the on-screen options to reduce cognitive load.
- Choose simple and clear fonts. Fonts with excessive detail can be difficult to read, especially for individuals with cognitive disabilities.

## 5 Redesign Proposal

Based on the findings from the heuristic evaluation and a review of design guide- lines from the literature, the *Emotion4Us* video game was redesigned. This new version incorporated accessibility guidelines focused on visual clarity, positive reinforcement, and the needs of the target audience. Priority was given to us- ing high-contrast visual elements, easily recognizable icons, short phrases, and consistent structures.

**Fig. 1.** Comparison between the original design and the redesign proposal of Emo- tion4Us, including the start screen, user preferences, emotion selection, and activity customization.

Figure 1 shows a comparison between the original design and the redesign proposal of *Emotion4Us*, including the start screen, user preferences, emotion selection, and activity customization. The main changes in the redesign include choosing a color palette and a specific font type, ensuring consistency in font styles and sizes. The new color palette maintains the original logo colors but adds a range of vibrant shades with slightly warmer tones that prevent oversaturation. Verdana Pro Condensed was chosen because Verdana is designed to be easy to read on screens, with proper letter spacing and a clear design. It is recommended for individuals with visual impairments and other disabilities [11]. Other updates include the navigation layout and the organization of elements.

Figure 2 illustrates the comparison between the original design and the re- design proposal for the four activities available in *Emotion4Us*. The main up- dates include a consistent design for each activity, maintaining text font types and sizes, the color palette, element organization, and navigability.

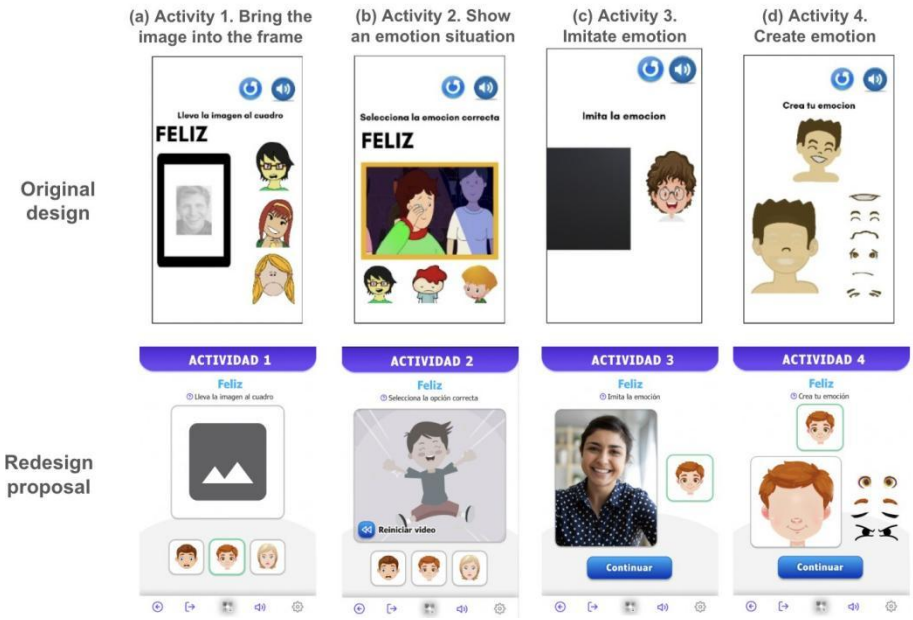


**Fig. 2.** Comparison of the four activities in the Emotion4Us video game between the original design and the redesign proposal.

In summary, the redesign proposal features a clear and simple interface with linear navigation and icons, adds user support through help features in each instruction, includes a navigation bar to facilitate user interaction, and incorpo- rates prompts and alerts for each status change and confirmation.

## 6 Design validation

We validated the redesign proposal with experts who work with individuals with intellectual disabilities. Next, we outline the methods and results of the design validation sessions.

### 6.1 Methods

We conducted two validation sessions, one with a psychotherapist experienced in working with individuals with various developmental disorders, including in- tellectual disabilities, and another with a special education teacher who is also the mother of someone with an intellectual disability (Table 2).

**Table 2.** Details of participants of the design validation sessions.

| Session | ID | Occupation | Genre | Age of Experience | Duration |
|---|---|---|---|---|---|
| 1 | P1 | Psychotherapist | F | 4 years | 02:01:37 hrs |
| 2 | P2 | Special education teacher and mother of a daughter with an intellectual disability | F | 20 years | 01:06:31 hrs |

The procedure for the design validation sessions was as follows. First, we out- lined the project's goals. Then, guided by the research team, each participant interacted with the medium-fidelity Figma prototype of *Emotion4Us*. Next, we discussed each feature of the video game using the think-aloud method. At the end of each session, we thanked the participants for helping us validate the video game design. All sessions were recorded on video, and the collected observations and comments were transcribed and analyzed qualitatively, allowing us to iden- tify areas for improvement.

### 6.2 Results

The validation sessions showed that the redesign proposal could help individuals with intellectual disabilities become more emotionally aware. Next, we list the main results of the validation sessions.

- **Overall design.** Both participants agreed that the new design was clean and consistent. They liked the color palette, the design line, font type, element organization, and navigation. Some of the participants' comments included:

  *"The colors of the interface are very nice; I don't find them overly saturated."* P1.
  *"The instructions are easier to follow and the screens are not over- loaded with information"* P2.

- **Language and instructions.** Both participants suggested replacing the word "patient" with "user" or "student," noting that "patient" might be seen as a medical term with negative connotations for people with intel- lectual disabilities, as P1 commented: *"Don't refer to certain users as pa- tients; change it to another term, such as person or user."* Additionally, P1 recommended changing the word "bring" to "move" in activity 1 for clar- ity. Conversely, P2 proposed changing the menu label "manage patient" to "student information" or "user information." Finally, P2 suggested changing error messages from "try again" to "You did well, but we can do better" to encourage and motivate users to attempt the activity again.
- **Customization and difficulty levels.** Both participants expressed a desire to specify the duration of the situation video in activity 2. They also noted that the video should have the option to pause or change if the situation is unclear. Both suggested that it would be helpful to include the pictures users take in Activity 3 across the other three activities. Lastly, participants indicated that adding difficulty levels to each activity could help address users' specific needs. These levels should reflect the users' level of intellectual disability.
- **Navigation and menus.** Both participants recommended that the video game include an option to skip an activity if desired. P2 proposed adding a "mini guide" to the main menu or at the start, so that the person using the video game understands what each activity involves before configuring it, expressing: *"A guide or demo is needed to understand what the activities consist of before configuring them."*

## 7 Conclusions and Future work

This paper discusses the redesign of *Emotion4Us*, a serious video game designed to support emotional awareness in individuals with intellectual disabilities, and shares the results from two expert validation sessions. Findings indicate that the current design has great potential, but also reveal areas for improvement to make it accessible to diverse cognitive needs.

Future work will refine the video game's interface and navigation better to meet the needs of individuals with intellectual disabilities. We plan to evaluate usability with at least ten participants using the System Usability Scale (SUS), game experience with the Game Experience Questionnaire (GEQ), and emo- tional awareness through pre- and post-tests. These studies will offer insights into how the game fosters emotional awareness and interaction. Based on these results, we will develop a high-fidelity prototype of Emotion4Us in engines like Kotlin, featuring adaptive difficulty, tutorials, and customization to suit diverse abilities and preferences. We aim to create a transmedia narrative that utilizes multimedia resources, such as videos, to reinforce emotional learning beyond the game. All phases will follow strict ethical protocols, including adapted consent forms, data anonymization, and participation options that do not require video recordings to ensure users' privacy, autonomy, and comfort.

In conclusion, *Emotion4Us* represents a promising step forward in using dig- ital technologies for emotional support among populations with special needs. However, the success of the video game will depend on the continuous dedication to evidence-based improvements and collaboration among developers, therapists, family members, and users themselves.

**References**


1. Emerson, E., & Hatton, C. (2007). Mental health of children and adolescents with intellectual disabilities in Britain. The British Journal Of Psychiatry, 191(6), 493-499. https://doi.org/10.1192/bjp.bp.107.038729
2. Terras, M. M., Boyle, E. A., Ramsay, J., & Jarrett, D. (2018). The opportunities and challenges of serious games for people with an intellectual disability. British Journal of Educational Technology, 49(4), 690-700.
3. Dörner, R., Göbel, S., Effelsberg, W., & Wiemeyer, J. (2016). Serious games. Springer: Cham.
4. Hernández-Lara, M., Caro, K., & Martínez-García, A. I. (2024). Supporting the cognitive development of individuals with intellectual disabilities through a video game for emotional regulation. ReCIBE, Revista electrónica de Computación, Informática, Biomédica y Electrónica, 13(3), E7-11.
5. Garcia-Garcia, J. M., Penichet, V. M., Lozano, M. D., & Fernando, A. (2022). Using emotion recognition technologies to teach children with autism spectrum disorder how to identify and express emotions. Universal Access in the Information Society, 21(4), 809-825.
6. Rasmussen, Benjamin D. (2024) "Parental Strategies for Modifying Behavior: The Positives of Positive Reinforcement," Intuition: The BYU Undergraduate Journal of Psychology: Vol. 16: Iss. 1, Article 7.
7. Tsikinas, S. Xinogalos, S. (2018) “Studying the effects of computer serious games on people with intellectual disabilities or autism spectrum disorder: A systematic literature review”. Thessaloniki, Greece pp. 61–73 CA: University of Macedonia.
8. Kumin,L., Lazar, J., Feng, J.H., Wentz, B. and Ekedebe, N. (2012). A usability evaluation of workplace-related tasks on a multi-touch tablet computer by adults with Down syndrome. J. Usability Studies 7, 4 (August 2012), 118–142.
9. Taft, T., Staes, C., Slager, S., & Weir, C. (2016). Adapting Nielsen’s Design Heuris- tics to Dual Processing for Clinical Decision Support. AMIA Annual Symposium Proceedings, 2016, 1179–1188.
10. Kravets, A., Shcherbakov, M., Kultsova, M., Shabalina, O. (2015). Design of Mobile Applications for People with Intellectual Disabilities. Creativity in Intelligent Tech- nologies and Data Science. Communications in Computer and Information Science, vol 535. Springer, Cham. https://doi.org/10.1007/978-3-319-23766-4_65
11. Pailiacho-Mena, V. M., & Garcés-Freire, E. X. (2023). Tipografías que facilitan la accesibilidad. In Actas del Congreso de Investigación, Desarrollo e Innovación (pp. 91-95). https://doi.org/10.47300/actasidi-unicyt-2023-15
12. Löytömäki, J., Ohtonen, P., & Huttunen, K. (2023). Serious game the Emotion Detectives helps to improve social–emotional skills of children with neurodevel- opmental disorders. British Journal Of Educational Technology, 55(3), 1126-1144. https://doi.org/10.1111/bjet.13420

13. Kirst, S., Diehm, R., Bögl, K., Wilde-Etzold, S., Bach, C., Noterdaeme, M., Poustka, L., Ziegler, M., & Dziobek, I. (2022). Fostering socio-emotional compe- tencies in children on the autism spectrum using a parent-assisted serious game: A multicenter randomized controlled trial. Behaviour Research And Therapy, 152, 104068. https://doi.org/10.1016/j.brat.2022.104068
14. Ryan, R.M., & Deci, E.L.(2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. American Psychologist
15. Csikszentmihalyi, M.(1990). Flow: The psychology of optimal experience. Harper.
: 10.1037110003-066X.55.1.68
16. Hunicke, R.m LeBlanc, M., & Zubek, R. (2004). MDA: A Formal Ap- proach to Game Design and Game Research.https://users.cs.northwestern.edu/ hu- nicke/MDA.pdf
17. Hernandez-Lara, Marisela and Martinez-Garcia, Ana I and Caro, Karina. (2023).Using Emotion4Down: Evaluating the Design of a Serious Video Game for Supporting Emotional Awareness with People with Intellectual Disabili- ties.https://doi.org/10.1093/iwc/iwac044
18. Deterding, Sebastian and Dixon, Dan and Khaled, Rilla and Nacke, Lennart. (2011). From Game Design Elements to Gamefulness: Defining Gamification. https://doi.org/10.1145/2181037.2181040
19. Hunicke, Robin and LeBlanc, Marc and Zubek, Robert. (2004). MDA: A formal approach to game design and game research.

**Autores**

Andrea Rivas Gomez is a Software Engineering and Emerging Technologies student at the Autonomous University of Baja California. She currently collaborates with the Tech4Good Research Lab, where she participates in projects focused on inclusive design and technology with social impact. Her work centers on the creation and development of accessible and inclusive designs and software.

Antonio Ramos Gonzalez is a student of Software Engineering and Emerging Technologies at the Autonomous University of Baja California. He is passionate about mobile application development and interested in creating system-level applications. He is the lead developer of Emotion4Us, a system that aims to provide emotional support for people with intellectual disabilities.

Marisela Hernández Lara is a Computer Engineer graduated from the Autonomous University of Baja California. She received her Master's degree in Computer Science from the Center for Scientific Research and Higher Education of Ensenada, Mexico (CICESE Research Center). She is currently pursuing a PhD in Computer Science at CICESE.

Brayan Iván Pérez Ventura is a Software Engineering and Emerging Technologies student at the Autonomous University of Baja California. He has research experience at the Healthcare Robotics Lab in San Diego and currently works at the Tech4Good Lab on ML-based emotion recognition models.

Ana I. Martínez G. works as a researcher at the Center for Scientific Research and Higher Education of Ensenada B.C. Mexico. She works doing research on Human Computer Interaction in support of vulnerable populations. She received her Ph.D. in Computer Science from the University of Manchester, UK.

Karina Caro is an assistant professor at the Autonomous University of Baja California (UABC), Mexico, where she directs the Technology for Social Good Research Lab. She received her Ph.D. in Computer Science from the Center for Scientific Research and Higher Education of Ensenada, Mexico (CICESE Research Center).

Esta obra está bajo una licencia de Creative Commons
Atribución-NoComercial-Compartirlgual 4.0 Internacional.