Sober Puzzle

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The Sober Puzzle project was conceived with the aim of developing an innovative and easily accessible mobile application to help users assess their mental and physical state in a simple, quick and non-invasive way. In many everyday situations, such as after an evening of socialising with alcohol consumption or at the end of a particularly stressful or tiring day, it can become difficult to determine with certainty whether one is in the right mental and physical condition to deal with activities that require attention, reflexes and lucidity, such as driving, taking an exam or making important decisions. In such contexts, Sober Puzzle proposes a playful but functional alternative to perform a quick self-check, through a series of interactive mini-games designed to test essential cognitive and motor skills.

The application integrates tangible, haptic and audio interactions to engage the user on a multisensory level, exploiting the hardware capabilities of modern smartphones (gyroscope, vibration, camera, microphone). The mini-games offer targeted tests on reactivity, coordination, concentration and short-term memory, and were developed with a focus on both the technical aspect and the user experience. The project followed an iterative design process, with phases of needs analysis, prototyping and testing with real users, in order to ensure the effectiveness of the interaction and the meaningfulness of the test results.

Through an interdisciplinary approach that fuses principles of Multimodal Interaction, cognitive psychology and software development, Sober Puzzle is configured as a useful tool both at an individual level, for greater awareness of one's own condition, and at a social level, as a contribution to the promotion of safety and prevention in risk contexts. The project stands out for its ability to combine entertainment and usefulness, with the possibility of future expansion into educational, clinical or corporate areas.

Additional Key Words and Phrases: ACM, LaTeX, articolo, conferenza

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1 Introduzione

In recent years, the growing popularity of smartphones and mobile technologies has opened up new perspectives in the field of human-computer interaction, making immediate access to tools that can support the user in a wide range of everyday activities possible. Among these, a still little-explored field is that of self-assessment of one's psychophysical state in situations where mental clarity and motor skills may be temporarily impaired, such as following alcohol consumption, high-stress conditions or states of fatigue.

The Sober Puzzle project arose from this observation and the need to provide users with a simple, intuitive and immediate means of carrying out a preliminary check of their cognitive and physical condition. Unlike other tools geared towards medical or sports monitoring, this application aims to offer a more informal but functional experience, exploiting playful dynamics to engage the user and encourage spontaneous and recurrent use.

Based on the principles of Multimodal Interaction and developed through an iterative and user-centred approach, Sober Puzzle consists of a series of mini-games designed to test specific parameters related to mental alertness and motor control. The use of modern technologies such as React Native and Expo libraries allows the integration of sensors, haptic feedback, sounds and haptic interactions, creating a system that combines effectiveness, accessibility and engagement.

The aim of this report is to illustrate the design, development and validation of the application, articulated in several phases: from the definition of user needs, to the analysis of functionalities, up to the testing and optimisation phase. It will also discuss the theoretical and technical references underlying the design choices, together with the potential for future evolution of the system.

2 Related Works

The Sober Puzzle project is part of a rapidly evolving context, where digital technologies - particularly mobile applications - are becoming increasingly central in monitoring and supporting the mental and physical health of individuals. In this field, numerous tools have been developed for cognitive assessment, decision support and promoting awareness of one's mental state, but many of these are designed for clinical, rehabilitation or highly specialised environments. Rarely, however, has an application been conceived for everyday, generalised use, designed to be used quickly, intuitively and without professional mediation.

Numerous studies have shown that cognitive and motor skills are significantly influenced by transient factors such as fatigue, alcohol intake, stress or sleep deprivation [Cowan 2008]. Despite this, instruments for the assessment of such conditions often remain inaccessible, unfriendly or perceived as too "serious" to be integrated into everyday life. In this direction, the scientific literature on gamification - i.e. the use of game design elements in non-game contexts - has shown that the integration of playful dynamics can significantly increase the motivation, involvement and frequency of use of digital tools [Deterding et al. 2011].

In the field of Multimodal Interaction, recent studies have focused on multisensory interaction modes, which simultaneously exploit touch, audio and haptic feedback to increase the effectiveness of the user experience [Bakker et al. 2015; Benyon 2019]. In particular,

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the use of haptic feedback has proven useful for providing clear and immediate stimuli, especially in contexts where the user needs to focus on quick cues or when visual attention is reduced. This type of interaction is particularly suitable for tests related to reactivity and reflexes, such as those proposed in several Sober Puzzle mini-games.

Another area of focus is mobile-oriented apps for mental health and cognitive well-being, such as Peak, Elevate, CogniFit or Lumosity. These apps are based on cognitive exercises that assess memory, attention, problem-solving and mental flexibility. However, none of them are specifically designed to address the immediate need to assess one's psychophysical state in relation to temporary altered situations, such as alcohol consumption or post-work mental fatigue. Moreover, many of these apps focus on long-term cognitive training programmes rather than short, situational decision-oriented tests [Hardy et al. 2015].

On a technical level, the project is based on modern technologies for cross-platform mobile development, in particular React Native, which enables the development of high-performance applications with a single code base. The use of Expo libraries (Camera, Audio, Haptics, Sensor) allows easy access to smartphone sensors, thus enabling the integration of complex interactions in an efficient manner. The design is inspired by the international standards for user-centred design as defined in ISO 9241-210, which promotes an iterative process based on the analysis of real user needs and continuous usability evaluation.

Finally, the project also reflects the principles of Persuasive Technology [Fogg 2003], i.e. the use of technology to influence behaviour and decisions. Sober Puzzle, while not imposing constraints or diagnoses, is a persuasive tool insofar as it invites users to reflect on their mental and physical state, promoting a more responsible approach to everyday life and, in particular, to the prevention of risky behaviour.

3 Project Overview

3.1 Goals and Objectives

Sober Puzzle is designed as a personal, portable and easily accessible tool that allows users to test their psychophysical state through a playful, direct and rapid experience. The focus is on momentary altered conditions, which do not necessarily result from pathologies but can negatively affect decision-making and motor skills.

3.2 User Needs Analysis

The design of the Sober Puzzle application was strongly guided by a preliminary user research phase, aimed at understanding the habits, perceptions and needs related to the self-assessment of psychophysical state in contexts of possible mental alteration, such as those related to fatigue, stress or alcohol consumption. This need finding phase consisted of two main instruments: a quantitative questionnaire administered online and a series of semi-structured interviews conducted with a sample of young adults. The objective was to build an empirical basis to more precisely define the design direction of the app.

The survey, which gathered a significant number of responses, clearly revealed a widespread awareness among users of situations in which their mental clarity might be impaired. Many participants stated that they use alcohol with some regularity, particularly at weekends or in social contexts, and several admitted to making important decisions in moments of fatigue or inattention. Although some claimed to be able to self-regulate effectively, many acknowledged the objective difficulty in reliably assessing their psychophysical condition, especially in the absence of external cues or objective instruments.

A particularly relevant finding emerged when users were asked whether they would find an application capable of providing an indication, even a rough one, of their level of lucidity useful. A large majority said they were interested in, or at least curious about, the idea of being able to access, at any time, a quick and intuitive tool capable of offering feedback on one's mental state through simple activities or games. In particular, the idea of using cognitive mini-games was welcomed, both for their ability to test real abilities such as reactivity, concentration and motor control, and for the playful component that makes them less "invasive" than a formal or medical test.

In support of this quantitative data, qualitative interviews provided a more nuanced but equally useful insight. Many of the interviewees reported episodes in which they felt perfectly capable of dealing with a situation - such as driving, taking an exam or public speaking - only to realise in retrospect that their performance had been affected by a state of tiredness, stress or inattention. In some cases, the interviewees admitted that a small external signal would have been enough to make them think again, such as an app suggesting not to tackle a challenging task at that time.

A theme that emerged repeatedly was that of trust: many stated that they were more inclined to listen to a signal from a device or an application than to advice from friends or family. This aspect underlines the importance of the perceived neutrality of digital tools, which are not seen as "judgmental", but as impartial assistants.

The feelings that users would like to experience while using such an app are varied: some are mainly looking for a moment of challenge or entertainment, but many have indicated awareness as more important. The aim is not so much to obtain a "score" to compare, but to receive a clear and contextualised indication of one's state of mind, which can guide a more responsible choice. Interestingly, for some, even less pleasant feelings such as frustration or failure in a test can be a useful stimulus for reflection.

Another recurring observation concerned traditional campaigns on responsible drinking, which are often perceived as remote or ineffective. The users interviewed expressed the idea that a direct, personal and interactive experience could be much more effective in generating awareness than generic messages or advertisements. In this sense, an app like Sober Puzzle represents an opportunity to bridge the gap between information and lived experience by proposing a technological medium that puts the user at the centre and actively involves him/her.

In summary, the needs analysis phase confirmed the existence of a target group sensitive to the topic and ready to experiment new self-assessment tools. The project direction was therefore oriented towards the creation of an application combining the usability and involvement of digital games with the social relevance of a prevention and awareness tool. The information gathered represented a

fundamental starting point for the development of the app's functionality, communicative tone and interaction dynamics.

3.3 Questionnaire and Interviews Results

To view the results of the questionnaire and interviews, the following summary graphs were produced:

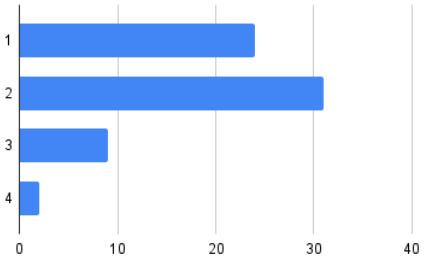

Fig. 1. "How often do you go out drinking?"

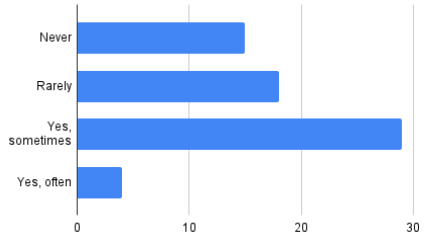

Fig. 2. "Have you ever made decisions or done important things even though you felt upset, tired or not very clear-headed?"

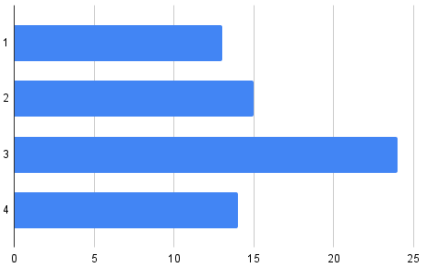

Fig. 3. "How often have you wondered if you were still lucid enough to drive or take important decisions?"

3.4 Psychological and Cognitive Capabilities

Psycho-cognitive skills represent the set of mental functions that enable human beings to perceive, understand, process and respond to internal and external stimuli. These skills underpin all daily activities, from the simplest, such as maintaining balance or responding to a visual stimulus, to the most complex, such as making critical decisions or planning long-term strategies.

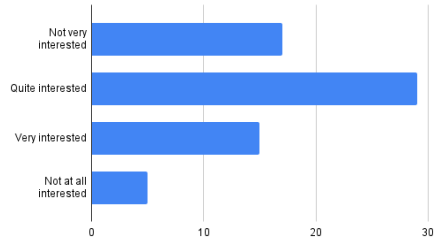

Fig. 4. "If there was a device that could assess your mental state at your fingertips, would you be interested in using it?"

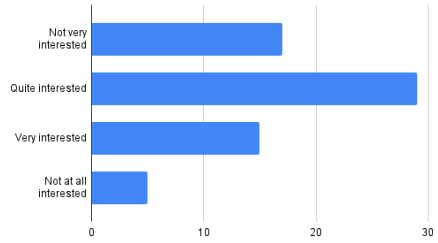

Fig. 5. "If there was a device that could assess your mental state at your fingertips, would you be interested in using it?"

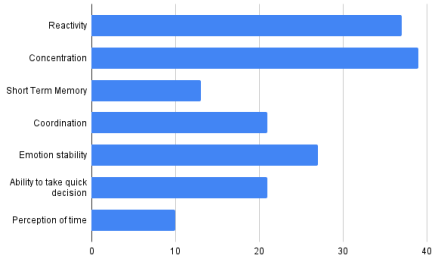

Fig. 6. Parameters that users would like to test in a mental state assessment app

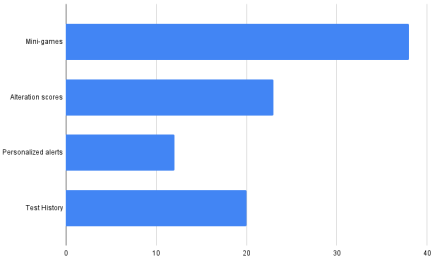

Fig. 7. Desired functionalities in a mental state assessment app

In the context of the Sober Puzzle project, the interest in these abilities stems from the realisation that they may be temporarily impaired in the presence of common factors such as fatigue, alcohol

consumption, emotional stress or lack of sleep. Such conditions, even if not pathological, can significantly impair mental clarity and increase the risk of errors or dangerous behaviour.

3.4.1 Main psycho-cognitive skills involved. Among the most relevant psycho-cognitive functions for self-assessment of the psychophysical state are the following:

- **Reactivity**: the speed with which a person is able to respond to a sensory stimulus (visual, auditory, tactile). It is closely linked to reflexes and motor readiness.
- **Concentration**: the ability to maintain attention on a task for a certain period of time, ignoring distractions. Its alteration is often one of the first signs of fatigue or mental impairment.
- **Short-term memory**: the ability to retain and manipulate information for a limited time, often in the order of a few seconds. It is essential for activities such as mental calculation, pattern recognition or handling instructions.
- **Motor co-ordination**: the ability to perform controlled and precise movements in response to external stimuli. It includes hand-eye coordination and postural balance.
- **Cognitive inhibition**: the ability to suppress automatic or instinctive responses in favour of more appropriate behaviour, a key element of impulsive control.

3.4.2 Why measure them? The assessment of psycho-cognitive abilities has traditionally found application in clinical, neurological and sporting settings. However, in recent years, interest has grown in tools that allow these abilities to be monitored in ordinary contexts as well, for the purposes of prevention, personal well-being and decision-making support.

In the case of Sober Puzzle, the measurement is not aimed at a diagnosis, but at generating awareness: through simple and quick tests, the user can compare his or her performance with habitual performance, recognise signs of fatigue or impairment and act accordingly, e.g. by avoiding driving or postponing a demanding activity.

3.4.3 How to measure them? The measurement of psycho-cognitive functions can take place by means of different types of tests, depending on the abilities to be assessed. In science, there are standardised tests such as the Reaction Time Test, the Trail Making Test, the Digit Span Test or the Stroop Test. These instruments, however, are often designed for professional use, are rigid and not suitable for everyday self-assessment.

Sober Puzzle takes an alternative approach: it turns measurement into a playful experience through short, intuitive mini-games that solicit specific mental and motor skills. Each mini-game is designed to collect meaningful data (e.g. response time, number of errors, movement accuracy) and compare them with personal or average benchmarks, giving the user concise but informative feedback.

This type of evaluation has two main advantages:

- **Accessibility and immediacy**: the user can take the test in minutes, wherever they are, simply using their smartphone.
- **Engagement and repeatability**: the playful experience encourages continued use of the app, allowing users to monitor their performance over time.

3.4.4 Limitations and Considerations. It is important to emphasise that tests of this kind, however useful they may be, are not a substitute for professional medical or psychological assessments. The results are intended as indicative indicators, designed to stimulate self-assessment and responsible behaviour. However, if well designed and calibrated, they can offer a sufficient level of sensitivity to signal altered cognitive states with good reliability.

3.5 Minigames and Their Functionality

At the heart of the Sober Puzzle app are a series of mini-games carefully designed to assess specific cognitive and motor skills that may be impaired in conditions of fatigue, stress or alcohol consumption. The use of short, intuitive and interactive games not only makes the experience engaging for the user, but also allows relevant data to be collected on the user's psychophysical condition in a short time and in a non-invasive manner. Function of the minigames

Each minigame is designed to test one or more mental or physical abilities. The main parameters assessed are:

- **Reactivity**: ability to respond quickly to visual, tactile or acoustic stimuli.
- **Motor co-ordination**: control of movement in relation to an external stimulus.
- **Balance**: ability to keep the body (and the device) stable.
- **Concentration**: ability to focus attention on a specific task.
- **Short-term memory**: ability to retain and recall information for a few seconds.
- **Phonatory coordination**: ability to articulate complex verbal sequences accurately and fluidly.

Simon Says. This mini-game is inspired by the classic game of memory and reflexes. The user must observe a sequence of colours that light up on the screen and repeat it by touching the colours in the correct order. As the game progresses, the sequence becomes longer and faster.

Tested parameters:

- Visual reactivity
- Short-term memory
- Concentration

Type of interaction: Touch, haptic and visual feedback

Keep It Steady. In this game, the user is asked to place the smartphone on his or her head and walk while keeping it as still as possible. The phone's motion sensor detects any wobble and assesses stability.

Tested parameters:

- Balance
- Motor coordination
- Postural control

Type of interaction: Tangible, via accelerometer

Hold Steady. This is a tactile reflex test. The device suddenly vibrates (without warning) and the user has to touch the screen as fast as possible. After a second pulse (a second vibration), he or she must release the touch. The reaction time and accuracy in the sequence are measured.

Tested parameters:

- Tactile reflexes

- Sensory coordination
- Motor inhibition ability

Interaction type: Haptic (vibration) and touch

Golf It. A small game of skill in which the user guides a ball through a course by tilting the phone. The objective is to get the ball into the hole without exceeding the limits of the course, while maintaining good movement control.

Tested parameters:

- Eye-hand coordination
- Fine motor control
- Attention and accuracy

Interaction type: Tangible (gyro sensor), haptic (vibration in response to speed)

Count It Up. In this visual memory test, moving objects are quickly shown on the screen. The user must count them and indicate the exact number after they have disappeared. The difficulty can increase with the speed and number of objects.

Tested parameters:

- Short-term memory
- Visual attention
- Calculation and estimation ability

Type of interaction: Visual and touch

Light It Up. A very simple but effective game: each time the camera flash is turned on, the user must quickly shake the phone. The system records the reaction time between the switching on of the flash and the motion detected.

Tested parameters:

- Visual responsiveness
- Motor timing

Type of interaction: Visual (flash) and tangible (movement)

Memento Imago. In this test, tiles are presented on the screen, some of which light up for a few seconds. Afterwards, the user has to remember and select only those tiles that were illuminated, but have now turned grey.

Tested parameters:

- Visual short-term memory
- Accuracy and selective attention

Type of interaction: Visual and touch

Tongue Twister. In this mini-game, the user has to repeat a tongue twister displayed on the screen, trying to pronounce it correctly in the shortest possible time. The app uses the microphone of the device to record the audio and applies a voice recognition system to assess the correctness and fluency of the utterance.

Tested parameters:

- Phonatory Coordination
- Phonological Short-Term Memory
- Concentration
- Cognitive Inhibition

Type of interaction: Audio-based (microphone) with visual and sound feedback

3.5.1 Functional Relevance In The App. These mini-games are not conceived as mere pastimes, but represent real lightweight diagnostic units, capable of providing useful feedback on the psychophysical state of the user. The app collects performance data and, without providing clinical diagnoses, reports any alterations in abilities compared to previous averages or personal parameters.

The features most appreciated by users, which also emerged during the testing and needs analysis phase, include:

- The possibility of receiving an immediate score or rating after each mini-game.
- Access to a history of tests performed, useful for comparing one's condition over time.
- The possibility of receiving customised alerts if results suggest a significant drop in performance (e.g. "you may not be fully lucid").

The app's playful approach is thus complemented by a functional and modular feedback system that leaves the user in full control of the experience, without being intrusive or prescriptive.

3.6 Design and Development

The design and development of the Sober Puzzle application is based on a careful integration between software and hardware components, with the aim of offering a fluid, immersive and sensorially stimulating user experience. Underlying the project is a philosophy that emphasises multisensory interactions, inspired by the principles of Multimodal Interaction, to increase user responsiveness and improve understanding of their cognitive states through play.

3.6.1 Technological Choices and Frameworks. The app is developed using React Native, an open source framework created by Meta that allows native mobile applications to be written with JavaScript and TypeScript code, enabling simultaneous deployment on Android and iOS devices. This choice ensured great flexibility and portability of the code, as well as the possibility of easily integrating external modules and specific libraries.

For interaction with the device's sensors, several Expo libraries were used, in particular:

- **Expo Camera**: for flash activation and control, used in games such as Light It Up;
- **Expo Haptics**: to generate customised vibration and haptic feedback in games such as Hold Steady or Simon Says;
- **Expo Audio**: to provide confirmation or alert sound signals to reinforce the interaction;
- **Expo Sensors**: to access the accelerometer and gyroscope, which are crucial in games that measure balance and coordination (e.g. Keep It Steady, Golf It);
- **Expo Speech Recognition**: to implement the voice recognition system in the Tongue Twister game, allowing the app to evaluate the accuracy and fluency of the user's speech;
- **React Native Gesture Handler**: to improve the precision of touch gestures and the responsiveness of the user interface.

The testing and debugging phase was mainly performed through Expo Go, a preview app that allows real-time testing of code changes on physical devices, without the need to recompile each time.

3.6.2 Interaction Design and User Experience. The most distinctive aspect of the application is the richness of the interaction modalities, designed to simultaneously engage multiple sensory channels. This approach is essential when trying to assess cognitive or motor conditions in real time, as it increases the accuracy and intensity of the experience.

Tangible Interaction. Tangible interaction involves the user's body and physical space, using smartphone sensors to detect movement, tilt and pressure. It is a very direct and intuitive type of interaction, suitable for games that involve the body or simulate physical activities.

Associated games:

- **Keep It Steady**: detects the user's balance while holding the phone on the head.
- **Golf It**: uses the accelerometer to simulate a game of motor skill.
- **Light It Up**: recognises the shaking of the phone as a response to a visual signal.

These games require real physical movements and offer a more immersive experience, increasing engagement and testing motor control and orientation.

Haptic Interaction. Haptic feedback represents a form of direct communication between the system and the user through vibration. It is particularly useful in situations where the user may not have full visual or auditory attention, allowing an immediate "haptic" response.

Associated games:

- **Hold Steady**: the game relies entirely on vibration as the initial and final stimulus to measure reflexes.
- **Simon Says**: uses short vibrations to reinforce the colour sequence.
- **Imago Memory**: uses haptic feedback as confirmation of correct or incorrect touches.
- **Golf It**: vibration signals sudden acceleration and deviation of the ball, improving perception of movement.

The use of haptic feedback was particularly appreciated during the testing phase, where it was found that visual interaction alone was not always sufficient to convey the outcome of user actions with clarity.

Audio-based Interaction. Audio interaction, although more subtle than other channels, plays a key role in orienting and supporting the user during the test. Short sounds, beeps and voice notifications help the user react to rapid events, increasing responsiveness and awareness.

Associated games:

- **Keep It Steady**: uses a sound at the end of the test to indicate the end of the test, especially useful when the user is not looking at the screen.
- **Memento Imago** and **Simon Says**: can include sounds to scan shifts or signal errors.
- **Count It Up**: sound can be used to mark the transition between the observation and response phases.
- **Tongue Twister**: uses the microphone to record the user's voice while repeating a tongue twister and analyses the accuracy of pronunciation and fluency of speech through a speech recognition system. Audible and visual feedback guides the user through the repetition and indicates any errors.

Audio interaction is also important to make the app accessible to users with different perceptual preferences or to integrate multiple sensory levels into a single task.

3.6.3 Integration of Technologies and Design Experience. The real strength of Sober Puzzle lies in the synergy between technology and experiential design. Each type of interaction is designed not only to support the performance of the game, but also to offer immediate, clear and consistent feedback that stimulates the user to reflect on his or her own psychophysical condition. The objective is not just the playful performance, but the generation of an insight, a moment of awareness in which the user asks himself: 'Am I really reacting as I expected?'

This integration also allows for technological modularity, where each mini-game can be improved or replaced independently, facilitating future updates and customisation based on the user's profile.

3.7 Development Process and Methodology

The development followed an Agile approach, with frequent iterations. Prototypes were created for each mini-game and validated with real users. Interactive wireframes guided the design of the user experience (UX), while specific tests served to improve the behaviour of the games and the fluidity of the interface.

3.8 Testing

The development process of Sober Puzzle was structured according to an iterative and incremental approach, inspired by the principles of the Agile method. This allowed the team to approach the project in a flexible manner, dividing the work into short, focused cycles, in which each phase was followed by moments of reflection, verification and improvement on the basis of the feedback collected. From the early stages, the goal was not only to build a technically functional app, but above all to design a coherent, intuitive user experience centred on the real needs that emerged during the analysis phase.

3.8.1 Definition of Key Features and Initial Prototyping. The design started by defining the key functionalities of the app and the cognitive and motor parameters to be tested. Based on the data collected during the interviews and the survey, the team outlined an initial set of mini-games to be developed, each of which would assess a specific aspect of psychophysical state: reactivity, memory, balance, coordination and concentration.

In parallel, interactive wireframes of the user interface were produced. These static prototypes, built with design tools such as Figma, made it possible to explore the architecture of the application, define the navigation flows between the various menus and mini-games, and assess the clarity and accessibility of the interaction. In this phase, some users were involved in short "pen and paper" test sessions to check the comprehension of the screens and the fluidity of the paths.

3.8.2 Development of Prototypes and Integration of Technologies. The next phase saw the implementation of the first working prototypes using React Native and the libraries offered by Expo, such as Haptics, Camera, Sensor and Audio. The minigames were initially developed in isolated environments, each as an independent module to facilitate testing and optimisation. Each mini-game was accompanied by minimal but significant functionality: gesture or touch recognition, motion detection, feedback generation, and result display.

The team then built an initial integrated version of the app, which allowed switching between minigames via a common interface, with introductory and summary screens. This made it possible to test not only the individual games, but also the consistency of the overall user experience.

3.8.3 User Testing and Feedback Collection. One of the most important aspects of the development was the continuous involvement of real users during the various phases. Several volunteers, selected from university students and young adults, participated in in-person or remote testing sessions. These tests were aimed at observing the user's behaviour in using the application in real time, collecting both qualitative (comments, observations, difficulties) and quantitative data (reaction times, errors, choices made).

The tests brought to light numerous initial criticalities, which were addressed and resolved in subsequent development cycles. For example:

- In the "Keep It Steady" minigame, the initial absence of an end signal made it difficult to tell when the trial had ended. A sound and visual signal was therefore introduced to clearly mark the beginning and end.
- In the game 'Golf It', the movements of the ball were too sensitive, generating frustration. After various tests, the gyro sensor was calibrated and haptic feedback was added to make the speed of the ball perceptible.
- Some users requested a clearer, more motivating and comparable scoring system. Consequently, a summary screen with scores for each mini-game and comparison with previous performances was introduced.

Furthermore, during the testing sessions, users were asked to reflect on how far the results of the mini-games reflected their perceived state. This made it possible to assess not only the technical correctness of the tests, but also the subjective perception of the app's usefulness and reliability.

3.8.4 Iterative Refinement and Final Adjustments. After each test cycle, finishing sprints were scheduled, during which bugs were fixed, interface responsiveness improved, and response times optimised. The team also worked on the responsiveness of the app on different devices, ensuring that functionality was accessible on both Android and iOS smartphones of various sizes and performance.

An interesting aspect is that, thanks to the modular system and the use of Expo Go, it was possible to quickly distribute updates to test users, gathering feedback almost in real time. This made the development process more participatory, transforming users from simple recipients into true co-designers.

4 Conclusion

Sober Puzzle is an effective example of how human-computer interaction can be exploited to offer useful and accessible tools to the general public. The gamified approach, supported by a solid technical basis and a careful needs analysis process, allowed the realisation of a product that combines entertainment and practical utility.

The value of the project lies in its ability to respond to a real need with a tool that is easy to use, scientifically motivated and supported by a good user experience. The fact that the app is designed for everyday contexts makes it even more relevant, especially in areas such as personal and road safety.

For the future, they imagine extending the app with new types of mini-games, perhaps calibrated to personalised profiles, or integrating data analysis algorithms to provide more detailed feedback. Looking ahead, Sober Puzzle could also be adopted in corporate, educational or clinical contexts as a preventive or preliminary screening tool.

References

Saskia Bakker, Elise van den Hoven, and Berry Eggen. 2015. Peripheral interaction: characteristics and considerations. *Personal and Ubiquitous Computing* 19, 1 (2015), 239–254.

David Benyon. 2019. *Designing User Experience: A Guide to HCI, UX and Interaction Design.* Pearson Education Limited.

Nelson Cowan. 2008. What are the differences between long-term, short-term, and working memory? *Progress in Brain Research* 169 (2008), 323–338.

Sebastian Deterding, Dan Dixon, Rilla Khaled, and Lennart Nacke. 2011. From game design elements to gamefulness: defining "gamification". In *Proceedings of the 15th International Academic MindTrek Conference.* ACM, ACM, Tampere, Finland, 9–15.

B.J. Fogg. 2003. *Persuasive Technology: Using Computers to Change What We Think and Do.* Morgan Kaufmann.

J. L. Hardy, R. A. Nelson, M. E. Thomason, D. A. Sternberg, K. Katovich, F. Farzin, and M. Scanlon. 2015. Enhancing cognitive abilities with comprehensive training: A large, online, randomized, active-controlled trial. *PLOS ONE* 10, 9 (2015), e0134461.