WINEBOX PROJECT

Whitepaper v1.2
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Cognitive Optimization Through Reduce Visual Fidelity

An Analysis of the WineBOX Model in Neurodivergence

Abstract

WineBOX is a digital **Cognitive Stimulation (CS)** proposal that deliberately utilizes low visual fidelity video games (MS-DOS/Shareware aesthetic) and minimalist interfaces. Its design reduces **Extraneous Cognitive Load (ECL)** to enhance **Germane Cognitive Load (GCL)**, optimizing mental effort towards reasoning and decision-making.

The objective is to stimulate **Executive Functions (EF)** —planning, cognitive flexibility, inhibitory control, and digital autonomy— in users with autism, ADHD, and attentional or emotional difficulties.

The model is based on **Cognitive Load Theory** (Sweller, 1988) and neuropsychological evidence linking **visual inference** and **perceptual closure** to prefrontal **cortex functioning** (Miller & Cohen, 2001; Mayer & Moreno, 2003).

1. Introduction

Sensory overload is one of the most frequent barriers to digital inclusion for neurodivergent children and adolescents. Many digital environments use intense stimuli (lights, fast animations, chromatic saturation) that can cause fatigue, anxiety, and disconnection.

WineBOX emerges as an **accessible, legal, and cognitively optimized** alternative, based on freely distributable software and retro video games as a tool to:

- Reduce sensory distress
- Stimulate imagination and reasoning
- Facilitate orientation in real digital environments
- Empower families and therapists with a free resource

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2. Project Objectives

General Objective

Optimize executive function training through a low visual complexity digital interface.

Specific Objectives

- Reduce distractions and visual noise
- Enhance decision-making in simple environments
- Foster autonomy and technological curiosity
- Guarantee legal and cross-platform accessibility
- Develop clinical and scientific evidence for the model

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3. Development Methodology

WineBOX integrates three cognitive-technological pillars:

Pillar	Purpose
Low visual fidelity	Promote inference and attentional focus
Simplified multitasking	Train spatial orientation and autonomy
Retro interface with touch support	Accessibility and direct manipulation

The games used are shareware or **legally freeware**, avoiding abandonware or piracy.

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4. Neurocognitive Foundations

4.1 Explanation for Families

When the environment **isn't distracting,** the brain **thinks more**.

Simple graphics force the user to:

- Interpret shapes
- Imagine what's missing
- Plan before acting

This trains the mind without causing sensory stress.

Furthermore, WineBOX resembles a real computer: **windows, folders, buttons**, helping children **orient themselves**, gain confidence, and better use technology outside of WineBOX.

Fewer stimuli → More independent thought.

4.2 Scientific Theoretical Framework

4.2.1 Low Visual Fidelity and Cognitive Load Theory

Reducing the load that does **not contribute** to learning (ECL) frees working memory for core reasoning (GCL). (Sweller, 1988; Mayer & Moreno, 2003; Paas et al., 2003)

Expected Results:

- Fewer distractions → greater planning
- More transferable learning to other contexts

4.2.2 Visual Inference and Prefrontal Cortex

Low resolution demands perceptual closure and schema retrieval, **increasing activation of** the dorsolateral PFC**, essential for planning and cognitive flexibility.**

(Miller & Cohen, 2001)

4.2.3 Inhibitory Control and Sensory Regulation

Reducing visual intensity can decrease impulsivity and the over-emotional reaction associated with hyperstimulation.

(Barkley; Baron-Cohen)

This frees resources for fine motor precision and visuomotor coordination.

(Logan & Robinson, 2020)

4.2.4 Retro Exploration and Cognitive Flexibility

Variations in interaction rules (historical GUIs) favor **task-switching**, a central mechanism of cognitive flexibility. (Monsell, 2003)

5. Expected Results and Validation

WineBOX proposes an **advantage through limitation**:

Competencia	Mecanismo	Resultado esperado
Cognitive Flexibility	GUI Switching	Reduced Rigidity
Planning	Decisions in Simple Environments	More Reflective Action
Inhibitory Control	Low Sensory Intensity	Less Impulsivity
Digital Autonomy	Guided Exploration	Greater Independence

Planned Validation:

- Controlled clinical trials
- Standardized neuropsychological tests
- fNIRS/EEG for executive markers
- Clinical observation in family/therapeutic context

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6. Legality, Security, and Accessibility

- All executed software is legal
- No data collection without consent
- Browser and sandbox isolation
- Compatible with Windows, macOS, Linux, iOS, Android, WebOS, and consoles

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7. Technical Implementation

7.1 Wine + WASM Architecture

- WINE: Native execution of Windows software
- WebAssembly: High performance in browser
- Linux sandbox: Security and portability

Result: Universal execution without installation.

7.2 DOS Engine: js-DOS

- HTML5 integration
- Native keyboard and gamepad support

7.3 Retro Multitasking Interface

- Persistent windows
- Simplified taskbar
- Spatial association → working memory

Remembering "where things are" = better digital autonomy.

7.4 Touch Support Box

- Touch-to-mouse/keyboard translation
- Precision + accessibility + sensory consistency

8. Limitations and Future Work

- Requires clinical validation for therapeutic use
- Does not replace professional intervention
- Continuously expanding game library

Next Steps:

- Longitudinal trials with families
- Clinical metrics for therapists
- Profiles with ethical consent
- Group use in schools and development centers

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9. Conclusion

WineBOX demonstrates **that less can be more**:

Visual reduction → increase in useful thought.

It is an accessible and global proposal to promote:

- Imagination
- Planning
- Digital autonomy
- Emotional and social well-being

With the collaboration of the scientific and family community, WineBOX can become a key **tool for cognitive stimulation in neurodivergence**.

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10. Acknowledgments

To the families, for the invisible effort that supports every step of progress. Without you, inclusion would not be possible.

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11. License and Contact

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