Interactive Visual Experience in the Game *Spellscript* as a Supportive Approach for Green Health Systems and Sustainable Care Technologies

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Abstract. Interactive digital media increasingly shape how users process information, receive feedback, and experience emotional engagement. This exploratory qualitative study analyzes the visual-effect system of Spellscript, a hybrid-genre game that combines turn-based strategy with real-time typing, and considers how its design principles may inform user-centered digital care technologies. Data consisted of structured gameplay observation, analysis of design documents and development notes, frame-by-frame review of screen recordings, and think-aloud feedback from five playtesters. The analysis identified four principal categories of visual effects: spell particle effects, accuracy feedback, interface transitions, and dynamic lighting. Across the playtesting sessions, immediate and context-sensitive visual cues were generally perceived as helping participants detect typing errors, distinguish game states, and sustain engagement. The findings suggest, rather than demonstrate conclusively, that responsive and hierarchically organized visual feedback can externalize information, support attention, and contribute to emotional involvement. These principles may be relevant to digital rehabilitation and mental-health interfaces when they are combined with clinical validation, accessibility testing, and environmental assessment across energy use, infrastructure, and device life cycles. Because the sample was small and the study did not measure clinical or environmental outcomes, the results should be interpreted as exploratory design evidence.

Keywords: digital health, Green Health Systems, interactive media, player experience, Spellscript, Sustainable Care Technologies, visual effects

1. BACKGROUND

Interactive digital media have developed from primarily presentational channels into systems that respond continuously to user input. Digital games are a clear example: they combine rules, audiovisual representation, interface feedback, and player action to produce an experience that is simultaneously cognitive, emotional, and behavioral (Schell, 2019; Wiemeyer et al., 2016). Within this process, visual design is not merely

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decorative. It is part of the communication layer through which the system indicates available actions, changing conditions, success, failure, and urgency.

In this study, visual effects (VFX) refer to dynamic graphical responses such as particles, lighting changes, flashes, screen movement, interface transitions, and other time-based visual signals. When these effects are legible and proportionate, they can direct attention and clarify the consequences of player actions. When they are excessive, poorly timed, or visually ambiguous, they may compete with task-relevant information and disrupt comprehension.

Spellscript is a hybrid-genre game that combines turn-based strategic decision making with real-time typing. Players type words or spells accurately and rapidly to attack, defend, or activate abilities. Its visual-effect system responds to player input in real time, creating an appropriate case for examining how aesthetic feedback also performs informational and emotional functions.

The relevance of this analysis to Green Health Systems and Sustainable Care Technologies must be stated carefully. Digital technology is not inherently sustainable. Its environmental effects depend on infrastructure, energy demand, procurement, device production, maintenance, and end-of-life management (Lokmic-Tomkins et al., 2022; Alami et al., 2023). Nevertheless, user-centered interaction principles developed in games may inform digital care interfaces that aim to support comprehension, engagement, accessibility, and efficient interaction. Such transfer requires independent clinical, accessibility, and environmental evaluation rather than an assumption that a game design is automatically therapeutic or green.

Accordingly, this study aims to: (1) identify the principal visual-effect categories used in Spellscript; (2) examine how those effects function as an adaptive communication system during play; and (3) discuss, at a conceptual level, how the identified principles may inform the design of humane and sustainable digital care technologies.

2. THEORETICAL FRAMEWORK

2.1 Visual effects and affordance in interactive media

Visual effects in interactive media are dynamic graphical elements that respond to user actions or system states. In game design, feedback connects player input with perceivable consequences and therefore supports understanding of rules and mechanics (Schell, 2019). The concept of affordance is also relevant. Gibson (1979) described affordances as action possibilities available in an environment, while Norman (2013) emphasized the importance of perceptible signifiers in designed objects and interfaces. In a digital game, visual cues can therefore help users infer what has happened, what can be done next, and which information requires immediate attention.

2.2 Player experience, flow, and cognitive load

Player experience includes functional and psychosocial dimensions such as usability, challenge, competence, immersion, emotion, and flow (Wiemeyer et al., 2016). Flow describes a state of concentrated involvement that is more likely when perceived challenge and individual skill are balanced and when goals and feedback are clear (Csikszentmihalyi, 1990). Visual feedback can contribute to these conditions by making action outcomes immediately understandable, although visual intensity alone does not produce flow.

Cognitive Load Theory states that working memory has limited capacity and that unnecessary processing can interfere with task performance and learning (Sweller, 1988). In the context of Spellscript, poorly structured feedback may add extraneous demands during rapid typing, whereas concise and context-specific cues may externalize information that players would otherwise need to remember. This theoretical relationship is used here as an interpretive framework; the present study did not directly measure cognitive load.

2.3 Game-based interaction and sustainable digital care

Research on gamification and games for health reports potential benefits for engagement and selected health-related outcomes, but the effects vary by population, intervention design, and evaluation method (Hamari et al., 2014; Primack et al., 2012). More recent work on game-based digital mental-health interventions similarly emphasizes the need to integrate engagement, mechanisms of action, target-user needs, and effectiveness rather than treating game elements as an intervention by themselves (Lukka & Palva, 2023).

For the present article, Green Health Systems and Sustainable Care Technologies are treated as an analytical perspective that combines human-centered care, accessibility, operational efficiency, and environmental responsibility. Environmental sustainability requires assessment across the full digital technology life cycle, while care quality requires evidence of safety, usability, and clinical value (Lokmic-Tomkins et al., 2022; Alami et al., 2023). The transfer from game design to health technology is therefore framed as a set of design hypotheses for testing, not as evidence of clinical efficacy.

3. RESEARCH METHODOLOGY

3.1 Research design

The study used an exploratory descriptive qualitative design centered on digital-artifact analysis. This approach was selected to examine how the visual-effect system operates within Spellscript and how players interpret its feedback during play. The analysis focused on design functions and user perceptions rather than on clinical effectiveness, causal effects, or population-level generalization.

3.2 Research object and analytic focus

The research object was Spellscript, an interactive media research-and-development project using turn-based typing mechanics. The analytic focus covered: (1) visual-effect assets, including particle animation, lighting, interface transitions, and action feedback; (2) the interaction between those effects and the game mechanics; and (3) the player perceptions generated during gameplay.

3.3 Data collection

Data were collected through three techniques: structured observation of gameplay in controlled sessions; review of technical materials, including design documents, asset lists, and development notes; and frame-by-frame analysis of screen recordings representing different gameplay conditions. These materials were used to identify recurring visual patterns and the gameplay events to which they responded.

The study also included five playtesting sessions involving five participants with varied experience using digital games. Each participant played for approximately 30–45 minutes and described their perceptions through a think-aloud procedure. The verbal data were recorded, transcribed, and used to support an exploratory thematic interpretation of clarity, attention, error recognition, and emotional response.

3.4 Data analysis

The analysis proceeded in three stages. First, each visual-effect element was identified and categorized according to its dominant informational, aesthetic, or emotional function. Second, the researchers examined how each category corresponded with game events, player actions, and comments from the think-aloud sessions. Third, the resulting design principles were compared conceptually with literature on player experience, cognitive load, game-based digital health, and environmentally responsible digital technology. Given the small sample and descriptive design, participant counts are reported as observations rather than inferential evidence.

4. RESULTS AND DISCUSSION

4.1 Visual-effect categories in Spellscript

The analysis identified four principal categories of visual effects: (1) spell particle effects, (2) accuracy feedback, (3) interface-transition effects, and (4) dynamic lighting. Together, these effects created an integrated feedback layer linking player input, system response, and the changing emotional tone of gameplay.

Spell particle effects varied according to the type and perceived power of an action. Attack spells used high-energy particle movement and warmer tones, while defensive or protective actions used more restrained and concentric patterns. The contrast sup-

ported visual differentiation between action types, although the interpretation of specific colors should be tested for accessibility and should not be the sole carrier of critical information.

Table 1. Functional Categories of Spellscript Visual Effects

Visual-Effect Category	Communication Function	Observed or Intended User Impact
Spell particle effects	Differentiate spell type and intensity	Support comprehension of mechanics without relying exclusively on text
Accuracy feedback	Provide immediate response to typed input	Support faster error detection and correction
Interface transitions	Signal changes in game context or phase	Support spatial and temporal orientation
Dynamic lighting	Reinforce atmosphere and event intensity	Contribute to emotional engagement and perceived urgency

4.2 Visual effects as an adaptive communication system

The visual effects functioned as more than isolated embellishments. Their intensity, timing, and form changed with the gameplay context, producing a layered communication system. The most task-relevant cues appeared close to the point of action, while broader atmospheric effects reinforced context. This arrangement is consistent with the design principle that signifiers should make system states and action consequences perceptible (Norman, 2013).

Accuracy feedback was particularly important because the typing mechanic required rapid error recognition. Correct keystrokes generated a brief positive visual response and a cumulative trace across the word. Typing errors produced a short red flash and localized movement in the input area. Four of the five participants stated that this immediate visual feedback helped them locate mistakes more quickly than a textual error message alone. One participant explained, “I can immediately see where I made a typing error without first reading an error statement.” This observation is exploratory and should be validated with performance measures in a larger study.

4.3 Perceived cognitive load and emotional response

The think-aloud data suggested that participants valued feedback that was immediate, localized, and proportional to the event. These characteristics appeared to reduce the need to search across the screen for status information. From a Cognitive Load Theory perspective, such cues may reduce extraneous processing by externalizing information at the moment it is needed (Sweller, 1988). However, the study did not administer a cognitive-load scale or compare alternative feedback conditions; therefore, no causal reduction in cognitive load can be claimed.

Participants also described stronger involvement during high-intensity spell sequences and clearer reassurance during successful input. Dynamic lighting and particle effects contributed to atmosphere, but the playtest comments also indicated that excessive intensity could become distracting. The design implication is not to maximize visual stimulation, but to calibrate it to information priority, player skill, accessibility needs, and the pace of interaction. Clear goals and interpretable feedback may support conditions associated with flow, although flow itself was not measured in this study (Csikszentmihalyi, 1990).

4.4 Relevance to green health systems and sustainable care technologies

The identified principles may inform digital rehabilitation platforms, game-based mental-health tools, and interactive care-support interfaces. In rehabilitation contexts, immediate and comprehensible feedback may help users interpret task completion and progress. In mental-health applications, restrained and predictable visual responses may support psychological comfort. In interfaces for older adults or users with cognitive or sensory limitations, redundant cues, scalable intensity, and alternatives to color-only signaling may improve accessibility. These applications are consistent with the broader emphasis on user engagement and evidence-based development in game-based digital health (Primack et al., 2012; Lukka & Palva, 2023).

The sustainability contribution is more conditional. Efficient interaction may reduce unnecessary repetition, support lower-complexity interface states, and enable use across a wider range of devices. However, environmental benefit cannot be inferred from interface efficiency alone. Digital health technologies require assessment of energy demand, data processing, device manufacture, maintenance, procurement, and disposal across their life cycle (Lokmic-Tomkins et al., 2022; Alami et al., 2023). Accordingly, the Spellscript findings provide candidate interaction principles for sustainable care technology, not evidence that the game itself reduces environmental impact.

5. CONCLUSION AND RECOMMENDATIONS

This study identified four main categories of visual effects in Spellscript: spell particle effects, accuracy feedback, interface transitions, and dynamic lighting. These categories operated together as a communication layer that differentiated actions, indicated input accuracy, signaled context changes, and reinforced emotional tone. The playtesting observations suggest that immediate and context-sensitive feedback can help users interpret system states and detect errors, while excessive visual intensity may interfere with attention.

The study also clarifies the limits of transferring game-design findings to Green Health Systems and Sustainable Care Technologies. The identified principles—responsiveness, hierarchy, contextual differentiation, accessibility, and calibrated emotional reinforcement—may inform digital rehabilitation, mental-health, and care-support interfaces. They do not, by themselves, establish therapeutic effectiveness or environmental sustainability.

Future research should use larger and more diverse participant samples, standardized measures of cognitive load and player experience, controlled comparisons of visual-feedback conditions, and accessibility testing. Any health-related implementation should be co-designed with users and health professionals and evaluated for safety and clinical outcomes. Environmental evaluation should include energy use, infrastructure, hardware requirements, procurement, maintenance, and end-of-life impacts. These steps are necessary before the proposed design principles can be regarded as evidence-based components of sustainable care technology.

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