Do Hedonic Aspects of Context Bias UX Evaluation? Evidence from Controlled Virtual Environments

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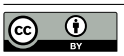
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Abstract

In this article, we propose a novel conceptual dichotomy to characterize the effects of context on User eXperience (UX), distinguishing between pragmatic and hedonic qualities of context. Pragmatic qualities refer to aspects of the interaction environment that affect UX through the alteration of users' ability to act, whereas hedonic qualities shape the experience by coloring it without directly impacting interaction capabilities. Focusing on the latter, which remain comparatively underexplored, we investigate the influence of the hedonic qualities of the physical context on UX evaluation. To this end, we developed a dedicated questionnaire, the Hedonic Qualities of Context Scale (HQCS), and designed immersive virtual environments varying along these qualities. We conducted two controlled user studies in which participants interacted with a TV service within these environments. While the environments elicited significantly different evaluations in terms of hedonic qualities, no differences were observed in UX evaluation as measured by AttrakDiff. Similarly, no variation in emotional state was found across conditions using the Self-Assessment Manikin. Taken together, these results suggest that hedonic qualities of context do not directly influence UX evaluation in the absence of changes in users' internal state. More broadly, they support the interpretation that context impacts product perception only insofar as it alters the user's internal state, and highlight the role of potential moderating factors—such as attentional engagement—in the manifestation of contextual effects.

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1 Introduction

The role of context in shaping user experience is widely acknowledged, both in major UX models [20, 32, 38] and in surveys of practitioners and researchers [25, 28]. While the term encompasses multiple aspects of the interaction situation, most definitions at least include environmental factors independent of both system and user characteristics [30]. Most studies assess the effect of context by following a similar overall protocol: first manipulating the context, then observing how it impacts UX measures. The contextual variations may apply on specific elements, such as noise or luminosity [1, 37], or may be more global — *e.g.*, a laboratory versus a living room [46].

Besides, only a few studies attempt to capture the subjective experience of the context itself in a quantitative manner. This is the case for instance of Lallemand and Koenig [26], who developed the User eXperience Context Scale (UXCS). The UXCS proposes a standardized measure across 30 items and seven dimensions (physical, social, internal, perceived resources, task, temporal, and technical context), drawing on Jumisko-Pyykkö and Vainio [22]'s taxonomy. It distinguishes objective items (*e.g.*, public vs. private setting, mobility) from subjective ones (*e.g.*, pleasantness, thermal comfort), enabling both the characterization of contexts that cannot be directly observed or controlled — as in remote or field studies — and the quantitative investigation of context–UX relationships. However, alongside the "manipulate context-measure UX" experiments, UXCS highlights a crucial point: context tends to be considered mainly through its effect on the pragmatic qualities of UX. Yet, we believe that reducing contextual influence to such a degree would be insufficient. Context could also shape experience in a more diffuse manner, without necessarily hindering action.

In line with Hassenzahl [16]'s UX model, which differentiates between a system's pragmatic qualities — related to usefulness, efficiency, and ease of use — and hedonic qualities — related to pleasure, stimulation, and aesthetics —, we propose to apply to context a similar conceptual distinction. *Pragmatic qualities of context* refer to situational attributes that facilitate or hinder the user's ability to achieve their goals. This is the area of research of the Situationally-Induced Impairments and Disabilities (SIID) [41], which describe contexts that temporarily degrade user abilities — such as cold-numbed fingers, reduced precision while walking, or one-handed

interaction — effectively simulating impairment [50]. *Hedonic qualities of context* refer to situational attributes that *color* the subjective experience (*e.g.*, pleasure, well-being, stimulation) without directly affecting instrumental performance. For instance, using a meditation app in a sunny park versus a dim waiting room does not change interaction capabilities, but could affect the lived experience. Aesthetics, atmosphere, or social meaning of a place fall under this pathway of influence.

In this paper, we investigate the effect of the hedonic qualities of context on UX. Our contribution is twofold: 1) we introduce an evaluation scale specifically focused on hedonic qualities of context, namely the Hedonic Qualities of Context Scale (HQCS); and 2) we used this scale in two experiments, to evaluate the effect of context in a TV interaction scenario, across three contrasting VR environments. The first experiment focuses on evaluating the direct effect of context on UX, while the second investigates how participants' attentional resources modulate the influence of context on their UX.

1.1 Mechanisms of the influence of the hedonic qualities of context on UX

To anticipate the possible effects of the hedonic qualities of context on UX, we consider two theoretical pathways of influence.

First, through the emotional state. Building on Hassenzahl's work on interaction situations and user goals [15, 17–19, 21], Lallemand and Koenig [26] propose that context influences product perception only insofar as it affects the user's internal state: "It seems to play no role whether some contextual factors are positive or negative unless this somehow impacts the user's internal state, which in turn impacts product perception and evaluation." This perspective does not reduce context to a source of degradation: hedonic qualities (aesthetic, symbolic) may support a positive emotional state independently of interaction capabilities. Since this pathway does not depend on instrumental task constraints, it may not be restricted to specific use cases — yet, to our knowledge, it remains largely underexplored.

Second, through a halo effect. Originating from social psychology [8], it is the tendency to generalize quality attributions from one entity to another, producing an excess of correlation between attributes beyond their actual relationship [4]. Two forms can be distinguished: one based on an overall impression coloring specific judgments [47], the other based on a single salient attribute driving broader evaluations [23]. In UX research, this mechanism is most studied through the aesthetics–usability effect: visually appealing interfaces are rated as easier to use [24], and conversely, usability influences perceived aesthetics [44]. These phenomena are referred to respectively as hedonic and pragmatic halo effects [34]. Similar patterns have been documented across multiple studies [7, 15, 36, 45, 48], raising methodological concerns about the validity of UX evaluations [42]. Extending this logic to context, the appraisal of the interaction environment may bias judgments about the system independently of its intrinsic properties.

1.2 Objectives

The preceding sections establish two things. First, that the hedonic qualities of context, *i.e.*, aspects of the environment coloring the subjective experience without altering interaction capabilities, remain comparatively underexplored relative to their pragmatic counterparts. Second, that two distinct mechanisms could, in principle, mediate their influence on UX: an indirect pathway through users' emotional state, and a more direct one through a contextual halo effect. The present work investigates both mechanisms in the specific case of the physical component of context — the dimension most directly amenable to experimental manipulation through immersive virtual environments. Concretely, we ask: *do the hedonic qualities of the physical context influence UX evaluation, and if so, through which mechanism — emotional mediation or a halo effect?* To address this question, we manipulate the hedonic qualities of the physical environment so as to induce distinct emotional valences, and measure their impact on both users' affective state and their evaluation of an interactive TV service. We also develop a dedicated instrument — the *Hedonic Qualities of Context Scale* (HQCS) — to capture users' appraisal of the hedonic qualities of their context, a dimension that existing tools such as the UXCS do not adequately cover.

2 Study 1

2.1 Method

2.1.1 Experimental conditions. The virtual environments were designed, tested, and modified iteratively prior to the studies. During this preliminary phase, participants were exposed to the environments and evaluated each of them in terms of emotional valence, overall appraisal, and sense of presence. This iterative process resulted in three final environments showing satisfactory differentiation in terms of emotional valence and appraisal, while maintaining comparable levels of presence (Figure 1), thereby ensuring their suitability for the experimental studies.

The *positive* environment consisted of a living room with Scandinavian-style furniture. Warm lighting, natural materials, and the presence of plants contributed to a cozy atmosphere. A sliding window opened onto a seaside landscape inspired by the northern Brittany coastline. The soundscape included seagulls and distant waves. The *neutral* environment retained the same geometry as the positive one but was stripped of decorative elements. Only essential furniture was preserved, and all tones were neutral. Two windows provided a uniform white light. The soundscape was limited to a low ventilation noise. The *negative* environment was smaller. The walls were damaged, and the furniture was replaced with a metal bed. Puddles of humidity, a bucket, and cobwebs were present. The soundscape consisted of dripping water and distant metallic noises, creating an unsettling atmosphere.

2.1.2 Procedure. The experiment followed a between-subjects design, with each participant exposed to only one of the three virtual environments, and lasted approximately one hour. After instructions and a demographic questionnaire, participants sat on a swivel chair and put on the VR headset. Following 70 seconds of immersion in the assigned environment[1], they interacted with a virtual book to complete the SAM and the first HQCS version to confirm the design-phase results. The experimenter then introduced the

[1]This duration was determined based on similar protocols exposing participants to low-dynamic scenes [9, 33]



(a) Positive environment.



(b) Neutral environment.



(c) Negative environment.

Figure 1: Virtual environments.

virtual remote control, and interaction with the TV application proceeded through three phases: *familiarization* (semi-guided menu navigation), *free navigation* (two minutes of unconstrained use), and *task-based interaction* (specific tasks involving live TV, replay, and recordings). Participants then reopened the virtual book to complete the SAM, AttrakDiff, and second HQCS version, removed the headset, and completed the presence questionnaire. A semi-structured interview concluded the session, covering perceptions of the interface, remote control, environment, and subjective experience. Interviews were recorded and reviewed; recurring themes were noted and relevant frequencies are reported in the discussion where they support or qualify quantitative findings.

2.1.3 Material. The TV service was chosen as the interactive system for its ecological congruence with the living-room-based environments, its familiarity which minimizes confounds due to differences in technical proficiency even in VR, and its sufficient interaction variety to sustain engagement across the session.

Access to the immersive virtual environments was provided via a Meta Quest 3 headset. The simulation, developed in Unity 3D, was run on a PC equipped with an Intel i5-6600 processor (3.30 GHz), 16 GB of RAM (2133 MHz), and an NVIDIA GeForce 4070 Ti SUPER graphics card, and streamed to the headset via Quest Link (wired connection). Audio from both the TV and the environment was delivered simultaneously through Beyerdynamic DT 990 PRO 250 ohm headphones. Questionnaires were presented via a Google Forms interface integrated into the virtual environment.

2.1.4 Measures.

2.1.4.1 Emotional state. To assess the effect of the immersive virtual environment on emotional state, we used the *Self-Assessment Manikin* (SAM) questionnaire developed by Bradley and Lang [5]. This non-verbal instrument measures affective responses along three dimensions: valence (pleasant–unpleasant), arousal (level of activation), and dominance. The dominance dimension was not included in the present study. Research suggest that core affect is fully captured by valence and arousal alone [2, 39]. Dominance has also shown limited and inconsistent effects across empirical studies [29] and is routinely omitted in UX and affective computing research [3]. The two remaining dimensions allowed us to validate the effectiveness of our environments in inducing the targeted emotional states and to establish an emotional baseline prior to interaction. Each dimension is assessed through a single pictorial item rated on a nine-point scale.

2.1.4.2 Context appraisal. To examine the influence of the hedonic qualities of context on user experience, we developed a dedicated scale, the *Hedonic Qualities of Context Scale* (HQCS). The decision to develop a specific scale rather than relying on the UXCS [26] was based on two considerations. First, the UXCS — even in its revised version [31] — is not specifically designed to assess hedonic qualities of context, but rather provides a more general evaluation. Second, a validated questionnaire already exists for assessing the hedonic qualities of an artifact: AttrakDiff. Our approach therefore consisted in adapting the short version of AttrakDiff. Specifically, items related to pragmatic quality were removed (PQ2 "*Complicated — Simple*", PQ3 "*Impractical — Practical*", PQ5 "*Unpredictable — Predictable*", PQ6 "*Confusing — Clear*"), as they are not applicable to the evaluation of an environment. The questionnaire stem was modified to orient responses toward the environment rather than the interface: "*I am in an environment that is …*". Two additional items were introduced: "*I did not like — I liked*" and "*Unpleasant — Pleasant*". The first, developed by us, served as a synthetic indicator of overall appraisal and allowed us to assess internal consistency (henceforth "APP"). The second, taken from the full version of AttrakDiff (ATT3), also corresponds to an item in the UXCS (PHYS2). An alternative version of the HQCS was also developed to explicitly incorporate the relationship between context and activity, using the stem "*While using the system, I was in a context that was …*". This version included two additional items: "*Motivating — Discouraging*" (ATT7 from AttrakDiff) and "*Supportive — Hindering*" (developed by us). This second version aimed to more directly capture the perceived link between the environment and the interaction with the system. The first version of the questionnaire was administered before interaction, and the second after. Each dimension score was computed as the mean of its constituent items, following the scoring logic of AttrakDiff. A total HQCS score was additionally computed as the mean across all dimension scores, serving as a global indicator of hedonic context appraisal.

2.1.4.3 User experience. Interface qualities were assessed using the French version of AttrakDiff [27]. This questionnaire measures four dimensions of user experience: Pragmatic Quality (PQ), Hedonic Quality–Identification (HQI), Hedonic Quality–Stimulation (HQS), and overall Attractiveness (ATT). Each dimension consists of seven pairs of opposite adjectives rated on a seven-point scale. For more clarity, Table 1 sums up the main measures described here.

2.1.5 Participants. Forty-five participants (26 women, 19 men) took part in the study (15 per condition), with a mean age of 37.8 years (SD = 11.0). All participants were recruited from the Orange Innovation Lannion tester panel and received a €30 gift voucher as compensation. Participants were randomly assigned to the three experimental conditions. Regarding prior experience with virtual reality, four participants reported regular use, eighteen reported multiple experiences, fifteen a single experience, and eight no prior experience.

2.1.6 Hypotheses. The present study investigated whether the hedonic qualities of the interaction context influenced both users' affective state and their evaluation of the system. Based on prior validation of the virtual environments, we expected (**H1**) emotional valence (SAM) to vary across conditions, with higher valence in the positive environment than the neutral, and higher in the neutral than the negative. Similarly, (**H2**) context appraisal (HQCS) was expected to follow the same pattern. In line with a potential contextual halo effect, we expected (**H3**) the hedonic qualities of the interface (AttrakDiff) to be rated more positively when interaction occurred in a positive environment compared to a neutral or negative one. Pre- and post-interaction measures of emotional state and context appraisal served respectively as manipulation checks and as a means to explore how interaction reshaped contextual perception. Correlations between context appraisal and UX were examined without directional hypotheses.

2.1.7 Data analysis. For all analyses, we first verified the assumptions for parametric tests. Normality was assessed using the Shapiro–Wilk test and homogeneity of variances using Levene's test. When at least one of these assumptions was violated ($p < .05$), non-parametric tests (Kruskal–Wallis) were used to examine group differences, followed by post-hoc comparisons when necessary. When assumptions were met, a one-way analysis of variance (ANOVA) was conducted, with post-hoc t-tests where appropriate.

2.2 Results

2.2.1 Presence questionnaire (IPQ). No significant differences were found across conditions, either for the global score or individual

Table 1: Overview of questionnaires, measures, and dimensions used in the studies.

Questionnaire	Measurement	Dimensions	Acronym
Self-Assessment Manikin (SAM)	Emotional state of the participant	Valence	—
		Arousal	—
Hedonic Qualities of Context Scale (HQCS)	Appraisal of the hedonic qualities of the interaction environment	Overall appraisal	APP
		Hedonic Qualities — Identification	HQI
		Hedonic Qualities — Stimulation	HQS
		Attractiveness	ATT
		Appraisal in activity	ACT
AttrakDiff	Perceived qualities of the interactive system (UX)	Pragmatic Qualities	PQ
		Hedonic Qualities — Identification	HQI
		Hedonic Qualities — Stimulation	HQS
		Attractiveness	ATT

dimensions. Presence levels were therefore considered equivalent across environments.

2.2.2 Emotional state (SAM). No significant effect of experimental condition was found on emotional valence or arousal, either before (valence: H(2) = 1.614, p = .446; arousal: H(2) = 1.084, p = .581) or after interaction (valence: H(2) = 0.110, p = .946; arousal: H(2) = 2.823, p = .244). However, arousal decreased significantly between pre- and post-interaction measures ($F(1,42)$ = 7.633, p = .008, η_p^2 = .154), while valence did not ($F(1,42)$ = 2.746, p = .105). Post-hoc tests showed that this arousal change was not significant within the negative environment alone (p = .171), with the positive and neutral environments approaching significance (p = .056 and p = .088, respectively).

2.2.3 Context appraisal (HQCS — pre-interaction). A significant effect of condition was found on the total HQCS score (H(2) = 28.544, p < .001) and all dimensions: APP (H(2) = 17.740, p < .001), HQI (H(2) = 29.610, p < .001), HQS (H(2) = 13.530, p = .001), and ATT (H(2) = 30.217, p < .001). Post-hoc comparisons showed that the negative environment was rated significantly less favorably than both the positive and neutral environments on the total score (p = .001 for both), APP (p = .004 and p = .029), ATT (p = .001 for both), and HQI (p = .001 and p = .005). For HQS, only the positive–negative difference was significant (p = .007), not the neutral–negative one (p = .358). No difference emerged between the positive and neutral environments on any dimension (all $p \geq .228$).

2.2.4 Context appraisal (HQCS — post-interaction). The same pattern was observed: significant effects of condition on the total score (H(2) = 21.582, p < .001) and all dimensions: APP (H(2) = 17.048, p < .001), ATT (H(2) = 23.534, p < .001), HQI (H(2) = 22.568, p < .001), HQS (H(2) = 6.836, p = .030), and ACT (H(2) = 19.085, p < .001). Post-hoc tests confirmed that the negative environment was rated significantly less favorably than the positive and neutral environments on the total score (p = .001 and p = .007), APP (p = .029 and p = .004), ATT (p = .001 and p = .007), HQI (p = .001 and p = .005), and ACT (p = .004 and p = .002). HQS differences did not reach significance (p = .110 and p = .409). No difference emerged between the positive and neutral environments (all $p \geq .517$).

Comparing pre- and post-interaction HQCS scores revealed significant changes for the total score ($F(1,42)$ = 11.915, p = .001, η_p^2 = .221), HQS ($F(1,42)$ = 9.528, p = .004, η_p^2 = .185), and ATT ($F(1,42)$ = 10.889, p = .002, η_p^2 = .206), but not for APP (p = .714) or HQI (p = .071). By environment, post-hoc tests revealed a significant change only for the total score in the positive condition (p = .039); significant changes across most dimensions in the neutral condition (total: p = .003; ATT: p = .036; HQI: p = .003; HQS: p = .001); and for the negative condition, a significant total score (p = .007) and ATT (p = .009), with HQI and HQS approaching significance (p = .083 and p = .051).

2.2.5 User experience (AttrakDiff). No significant differences were found across conditions, neither for the total score ($F(2,42)$ = 1.255, p = .296, η^2 = .056) nor for any dimension: PQ (p = .491), ATT (p = .801), HQI (p = .167), or HQS (p = .234).

2.2.6 Correlations between context appraisal and user experience. With all participants included, the correlation between HQCS and AttrakDiff was non-significant ($\rho(45)$ = .190, p = .211, 95% CI [-0.11, 0.46]). Visual inspection suggested that data from the negative environment were more dispersed, with a linear trend emerging only for the positive and neutral conditions (see Figure 2). Excluding the negative environment revealed a substantially stronger and significant correlation ($\rho(30)$ = .445, p = .014, 95% CI [0.1, 0.69]).

2.3 Discussion

This study examined the influence of hedonic aspects of the physical context on the evaluation of an interactive TV service by specifically manipulating hedonic qualities while holding pragmatic ones constant.

2.3.1 Influence of hedonic qualities of context on UX. **H2** was partially supported: the negative environment was rated significantly less favorably than the neutral and positive ones, though the positive–neutral difference did not reach significance. Despite this differentiation, the environment did not influence TV service evaluation (contrary to **H3**), consistent with the absence of emotional valence differences across groups (contrary to **H1**). Users appear able to clearly distinguish the object of evaluation from its context, with lower appraisal of the negative environment failing to propagate to interface judgments. These results do not support a contextual halo effect and may indicate a certain robustness of AttrakDiff to hedonic contextual variation.

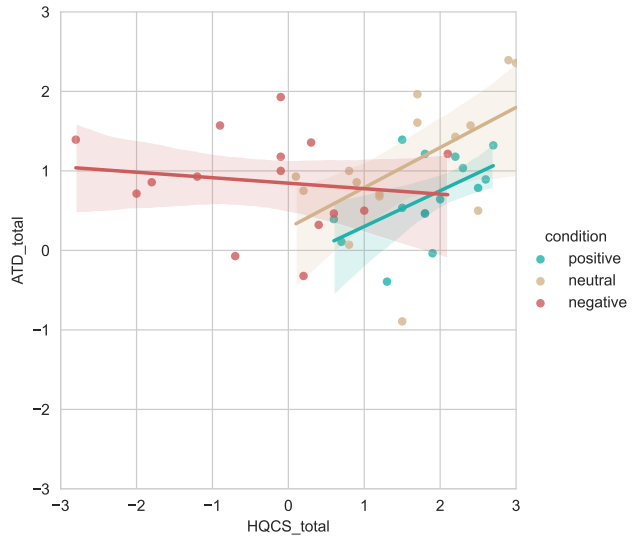


Figure 2: Scatter plot and linear regressions illustrating the relationship between HQCS total score and AttrakDiff total score by condition. Shaded bands represent 95% confidence intervals.

An unexpected finding concerns pre- to post-interaction convergence in environment evaluations: appraisal of the positive environment slightly decreased while that of neutral and negative environments increased, suggesting that task engagement attenuates contextual judgments.

2.3.2 Environment, experience, and comparison. The absence of emotional differentiation contrasts with results from the design phase, where valence varied across environments. This discrepancy likely reflects a methodological difference: successive exposure during design created contrast effects, whereas the main study exposed each participant to a single environment. Participants in the design phase may thus have evaluated environments comparatively rather than reporting their actual emotional state.

The positive–neutral HQCS equivalence may stem from the same cause. Without a comparison point, the neutral environment's technical quality (rendering, textures, parallax) was sufficient to avoid negative evaluations, while the negative environment remained more salient due to its stronger hedonic cues. Notably, HQS scores were similar across all three environments, suggesting a comparable level of perceived novelty — a factor known to strongly influence engagement and emotional response [35, 49]. The "wow" effect of VR immersion may have attenuated the emotional differences we aimed to induce.

2.3.3 Correlation between context and UX. Our results extend — and nuance — Lallemand and Koenig [26]'s suggestion that unfavorable contexts degrade UX while favorable ones do not necessarily enhance it. Focusing specifically on hedonic qualities, we found that negative contextual perception weakens the context–UX relationship entirely, whereas moderate to strong correlations emerge in neutral and positive environments.

This pattern is consistent with attentional avoidance of negatively valenced stimuli [11]. Post-experiment interviews supported this interpretation: when asked about their thoughts and feelings about the environment, thirteen participants in the negative condition spontaneously reported ignoring it during interaction, compared to six in the positive and four in the neutral condition. Although attentional allocation also depends on motivational intensity [12–14], negative valence appears to act as an additional repulsive factor: in a task requiring sustained attention, participants disengaged from the environment more strongly, further prioritizing the TV interface.

More generally, attentional disengagement from the environment may also reflect the protocol itself. Continuous task instructions directed participants' attention toward the interface regardless of condition. A less directive protocol, allowing greater visual exploration, might facilitate stronger transfer of environmental qualities to interface evaluation.

2.3.4 Conclusion. Despite clear hedonic differentiation between environments (**H2**), neither emotional state (**H1**) nor UX evaluation (**H3**) varied across conditions, indicating that hedonic context differentiation alone is insufficient to produce measurable UX effects. However, significant correlations in neutral and positive environments suggest that contextual influence does not disappear entirely — rather, it is moderated by attentional engagement. Two methodological factors likely contributed to the null effects: a directive interaction protocol focusing attention on the interface, and the absence of a direct comparison between environments.

3 Study 2

The previous study revealed no influence of the virtual environment on emotional state or UX evaluation, despite clear differentiation between environments in terms of perceived hedonic qualities. Two explanations are proposed. First, attentional resource allocation. Participants — particularly in the negative condition — reported paying little attention to the environment during interaction. The directive protocol likely limited resources available for environmental exploration, an effect compounded by the limited visual richness of the negative environment, which offered few novel elements to sustain attention beyond the initial immersion phase. Second, the absence of a comparison point. Exposed to a single environment, participants may have based their evaluations on overall graphical quality rather than on specific hedonic qualities, as several explicitly reported. Subjective accounts were generally positive and homogeneous across conditions, suggesting that exposure to contrasted environments could strengthen both hedonic differentiation and its impact on emotional state and UX. These observations motivate two protocol modifications: introducing a freer interaction scenario to increase attentional availability, and exposing each participant to a contrasting environment prior to the main interaction.

3.1 Method

3.1.1 Setting and design. This study followed a 2 × 2 between-subjects design, with virtual environment (positive vs. negative) and interaction scenario (free vs. guided) as independent variables. A between-subjects approach was chosen to prevent participants from identifying the manipulated variable, which could otherwise

bias their responses. Compared to Study 1, two modifications were introduced: prior exposure to a contrasting environment, and the addition of a free interaction scenario. The neutral environment was not retained, as it was not necessary to address the present research questions. The virtual environments were otherwise identical to those used previously.

The two scenarios were based on Hassenzahl's *usage modes* [16, 17], distinguishing a *goal mode* (task completion) from an *action mode* (spontaneous, self-motivated use), operationalized here as the "guided" and "free" scenarios respectively. The guided scenario replicated Study 1's protocol, consisting of a sequence of specific interaction tasks to execute. The free scenario unfolded in three phases encouraging autonomous exploration: free browsing of live TV channels, open exploration of menus and features, and free navigation of replay content.

3.1.2 Procedure. The procedure followed the same structure and hardware setup as Study 1. After completing a demographic questionnaire, participants were immersed in a contrasting environment for 70 seconds before the main interaction environment. Following a familiarization phase, participants completed one of the two interaction scenarios. Afterwards, they accessed a Google Forms questionnaire embedded in the virtual environment, collecting emotional state (SAM), user experience (AttrakDiff), and context appraisal (HQCS variant adapted to the interaction context). The session concluded with a semi-structured interview covering participants' perceptions of the TV interface, the virtual remote control, the environment, and their subjective experience within it. The session concluded with a semi-structured interview covering perceptions of the TV interface, the virtual remote control, the environment, and their subjective experience within it. Interviews were recorded and reviewed by the experimenter; recurring themes were noted and relevant frequencies are reported in the discussion where they support or qualify quantitative findings.

3.1.3 Participants. The sample consisted of 48 participants (25 women, 23 men), aged 17 to 60 years (M = 34.0, SD = 13.4), recruited through the Orange Innovation Lannion testing panel. Participants received a €30 gift voucher and were randomly assigned to the four conditions. Regarding VR experience, three reported regular use, fifteen multiple prior experiences, eighteen a single experience, and twelve none.

3.1.4 Hypotheses. This study examined how attentional engagement modulates contextual effects by introducing a scenario manipulation. We expected (**H1**) emotional valence to be higher in the positive environment than the negative one, reflecting a contrast effect from prior exposure to opposing environments. Crucially, (**H2**) this difference was expected to be amplified in the free scenario, where reduced task constraints would allow more attention to be allocated to the environment, yielding an environment × scenario interaction. Regarding UX, (**H3**) more positive interface evaluations were expected in the positive environment, and (**H4**) this difference was likewise expected to be amplified in the free scenario.

3.1.5 Data analysis. Effects were analyzed using two-way factorial ANOVAs, complemented where necessary by Student's *t*-tests with Holm–Bonferroni correction to preserve statistical power. Normality of residuals was systematically verified.

3.2 Results

3.2.1 Context appraisal (HQCS). Two-way ANOVAs revealed a strong main effect of environment across all HQCS dimensions: total ($F(1,44) = 181.65$, $p < .001$, $\eta_p^2 = .805$), APP ($F(1,44) = 59.705$, $p < .001$, $\eta_p^2 = .576$), ATT ($F(1,44) = 187.057$, $p < .001$, $\eta_p^2 = .810$), HQI ($F(1,44) = 220.368$, $p < .001$, $\eta_p^2 = .834$), HQS ($F(1,44) = 73.291$, $p < .001$, $\eta_p^2 = .625$), and ACT ($F(1,44) = 106.223$, $p < .001$, $\eta_p^2 = .707$). A main effect of scenario was found for the total score ($F(1,44) = 4.686$, $p = .036$, $\eta_p^2 = .096$), HQI ($F(1,44) = 5.080$, $p = .029$, $\eta_p^2 = .104$), and ACT ($F(1,44) = 6.118$, $p = .017$, $\eta_p^2 = .122$), but not for the remaining dimensions (APP: $F(1,44) = 1.218$, $p = .276$; ATT: $F(1,44) = 2.843$, $p = .099$; HQS: $F(1,44) = 2.282$, $p = .138$). No environment × scenario interaction reached significance for any dimension (all $F \leq 3.195$, all $p \geq .081$). Pairwise analyses revealed that the negative environment was rated less favorably under the directed than the free scenario, this effect was absent in the positive environment.

Beyond the main effect of virtual environment ($F(1,50) = 133.326$, $p < .001$, $\eta_p^2 = .727$), the analysis revealed a main effect of study ($F(1,50) = 7.610$, $p = .008$, $\eta_p^2 = .132$) and an interaction effect between these two variables ($F(1,50) = 12.775$, $p = .001$, $\eta_p^2 = .204$). Pairwise comparisons identified a significant difference between the negative environments across studies ($t(4.276) = 22.779$, $p = .001$, $d = 1.560$), but not between the positive environments ($t(17.261) = -.625$, $p = .540$, $d = -.255$).

3.2.2 Emotional state (SAM). Despite slightly lower valence in the directed negative condition, no significant main effect of environment ($F(1,44) = 2.320$, $p = .135$, $\eta_p^2 = .050$), scenario ($F(1,44) = 2.320$, $p = .135$, $\eta_p^2 = .050$), or their interaction ($F(1,44) = 0.906$, $p = .346$, $\eta_p^2 = .020$) was found for valence. Similarly, despite a visible gap between environments in the free scenario, no significant effect of environment ($F(1,44) = 0.619$, $p = .436$, $\eta_p^2 = .014$), scenario ($F(1,44) = 0.046$, $p = .831$, $\eta_p^2 = .001$), or their interaction ($F(1,44) = 0.619$, $p = .436$, $\eta_p^2 = .014$) was found for arousal.

3.2.3 User experience (AttrakDiff). Two-way ANOVAs revealed a main effect of scenario on the total AttrakDiff score ($F(1,44) = 6.394$, $p = .015$, $\eta_p^2 = .127$) and pragmatic quality ($F(1,44) = 9.508$, $p = .004$, $\eta_p^2 = .178$), and a trend for attractiveness ($F(1,44) = 3.434$, $p = .071$, $\eta_p^2 = .072$). No main effect of environment was found for any dimension (total: $F(1,44) = 0.300$, $p = .586$; PQ: $F(1,44) = 2.935$, $p = .094$; HQI: $F(1,44) = 1.782$, $p = .189$; HQS: $F(1,44) = 1.336$, $p = .254$; ATT: $F(1,44) = 0.110$, $p = .741$). No environment × scenario interaction reached significance for any dimension (all $F \leq 2.026$, all $p \geq .162$).

3.2.4 Correlations between context appraisal and user experience. A Pearson correlation analysis revealed a weak-to-moderate positive association between HQCS and AttrakDiff overall ($r(48) = .306$, $p = .034$, 95% CI [.02, .54]). By environment, the correlation was stronger and more significant in the positive environment ($r(24) = .607$, $p = .002$, 95% CI [.04, .71]) than in the negative one ($r(24) = .437$, $p = .033$, 95% CI [.27, .81]).

4 Discussion

This study introduced two protocol modifications to strengthen contextual influence: prior immersion in a contrasting environment, and a free interaction scenario to increase attentional availability.

4.1 Environment, scenario, and experience

The negative environment was rated significantly less favorably than in Study 1, likely driven by the contrast with prior positive immersion, confirming the effectiveness of this mechanism. Its weaker effect in the positive condition may reflect a ceiling effect [40]. Despite this increased differentiation, no emotional differences emerged across conditions or scenarios, contrary to **H1**.

This raises the question of why emotional differences were observed during the design phase but not here, despite participants being exposed to two contrasting environments. The comparative evaluation explanation invoked in Study 1 cannot account for this pattern, since participants here were also exposed to two contrasting environments. A more plausible account is that contextual emotional influence is short-lived, fading beyond the initial immersion phase. Sustaining it would require stimuli capable of dynamically redirecting attention during interaction — which our static visual and auditory elements were not designed to provide.

Contrary to **H2**, the free scenario did not amplify emotional state differences. Qualitative accounts from post-experiment interviews provide support for this interpretation: a comparable number of participants spontaneously reported ignoring the environment across both scenarios (n = 14 in each), suggesting that the scenario manipulation may not have substantially altered attentional disengagement.

4.2 Environment and user experience

As context appraisal differences did not translate into emotional differences, no UX differences were observed, contrary to **H3**. **H4** was likewise not supported: hedonic qualities of context did not influence UX evaluation regardless of scenario, consistent with Study 1 and with the absence of a contextual halo effect. Notably, the negative environment was appraised more favorably under the free scenario than the directed one, consistent with higher AttrakDiff scores in this condition, likely reflecting a more pleasant interaction experience without strict instructions. This effect did not extend to valence scores.

As in Study 1, HQCS–AttrakDiff correlations were stronger in the positive environment. This pattern supports the idea that hedonic qualities may positively influence UX when sufficiently salient, while their absence produces only limited degradation — a contrast with pragmatic qualities, which appear to affect UX primarily when they hinder interaction [26]. Post-experiment interviews revealed a marked attentional asymmetry: 22 participants reported ignoring the negative environment versus 6 in the positive condition. This disengagement — likely driven by limited visual richness, low aesthetic appeal, and incongruence between the prison-like setting and the modern TV interface — may explain the weaker correlation in the negative condition. Beyond their difference in strength, these correlations admit two interpretations: either variations within favorable environments genuinely transferred to interface evaluation, or they reflected individual response tendencies, with some participants consistently rating all measures more positively.

5 General Discussion

This paper examined a widely assumed yet rarely isolated hypothesis: that the hedonic qualities of the physical context influence UX evaluation. Across two controlled VR studies, we manipulated contextual hedonic qualities while holding pragmatic aspects constant, and tested two mechanisms — emotional mediation and a contextual halo effect. Our results converge toward a consistent and counterintuitive conclusion: the hedonic qualities of context, even when clearly perceived and experimentally manipulated, did not directly influence UX evaluation under the conditions studied. No evidence was found for emotional mediation: despite systematic differences in environment appraisal, these did not translate into variations in emotional state, suggesting that static, task-peripheral hedonic qualities are insufficient to induce sustained emotional changes. No support was found for a contextual halo effect either: participants appeared able to distinguish the system from its surrounding context even in immersive conditions, challenging the assumption that environments systematically spill over into product evaluation.

These null effects do not imply that context is irrelevant. A key moderating factor emerges from our data: attentional engagement with the environment. Contextual influence appears conditional on the extent to which the environment is attended to during interaction. When attention is directed toward the task — or when the environment is actively avoided, as in negatively valenced conditions — its influence on UX diminishes or disappears. Rather than exerting a systematic effect, context may matter only when its cues are both salient and cognitively integrated into the interaction experience. From a methodological standpoint, our results suggest a certain robustness of instruments such as AttrakDiff to hedonic contextual variation in task-focused scenarios, while highlighting the importance of attentional distribution in contextual effect studies. Protocols relying on directive tasks or static environments may systematically underestimate the role of context.

5.1 Limitations and future work

The between-subjects designs, while necessary to prevent participants from identifying the manipulated variable, introduce a further limitation: with relatively small samples (respectively N = 45 n = 15 and N = 48, n = 12 per condition in Study 1 and 2), uncontrolled inter-individual differences may have obscured contextual effects and limit statistical power, particularly for within-environment correlation analyses [6, 10]. Larger samples would allow more robust conclusions and better control of individual variability. The static nature of the environments likely explains the absence of sustained emotional effects; more dynamic stimuli — incorporating variations in light or sound — may be necessary to redirect attention toward the environment during interaction. Direct measures of attentional allocation, such as eye-tracking, would provide objective evidence for the mechanisms identified here. Generalizability is further limited by the use of a familiar TV service, whose UX may be resistant to contextual variation, and by reliance on AttrakDiff as the sole

UX measure. Beyond the physical environment, future work could extend this framework to other dimensions of context whose hedonic qualities remain uncharacterized. Social context, through the presence of others, carries strong hedonic valence: using an application in the company of friends [51] or under the gaze of strangers [43] shapes the subjective quality of the experience in ways that are largely independent of interaction capabilities.

6 Conclusion

This paper introduced a conceptual distinction between pragmatic and hedonic qualities of context, and examined whether the latter influence UX evaluation. To this end, we introduced the *Hedonic Quality Context Scale* (HQCS), a preliminary instrument for assessing users' appraisal of the hedonic qualities of their interaction environment, adapted from AttrakDiff. As a purpose-built operational tool rather than a fully validated scale, it served to operationalize the hedonic manipulation across both studies. Its psychometric properties warrant further investigation. Across these studies, we found that hedonic contextual qualities — even when clearly perceived and systematically varied — did not directly affect users' emotional state or their evaluation of an interactive system. These results support the interpretation that context influences product perception only insofar as it alters the user's internal state, and suggest that static, task-peripheral hedonic qualities may be insufficient to trigger this mechanism. More broadly, the pragmatic–hedonic distinction and the HQCS introduced here open directions for future work. The conditions under which hedonic qualities of context do influence UX remain to be identified — whether through more dynamic environments, less directive protocols, or measures more sensitive to subtle affective shifts.

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