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Beyond learning: understanding playful experiences in museums

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Abstract

Play is increasingly recognised within museums, yet limited research has examined how adult visitors experience playfulness as a multidimensional and momentary state. This study applies the Playful Experience Scale (PES) to investigate playful experiences among 239 adult visitors interacting with five digital exhibits at two museums in the UK and China. The study examines variations in 23 playful experience items across exhibits, their relationships with playful personality traits measured by the Adult Playfulness Trait Scale (APTS), and cross-cultural differences. Results reveal that Creative & Intellectual Pursuits emerged as the most consistent strength, and Social Connections remained the weakest. Significant relationships indicate that visitors with stronger playful traits tend to report stronger playful experiences across twelve items. Cross-cultural comparisons revealed differences in Uninhibitedness and Spontaneity, as well as Fun, Creative & Intellectual Pursuits, and Mastery & Achievement, while Sensory & Physical Engagement and Social Connections showed no significant differences. The study further offers practical implications for designing playful experiences for museums and other cultural organisations.

1 Introduction

As museum education has developed into a major specialised function of museums, visitor experience research has paid substantial attention to learning. Influential approaches to museum experience identify cognitive and learning experiences as important dimensions of museum visiting (e.g., Falk and Dierking, 2000; Pekarik et al., 1999). The rise of the constructivist museum has further reinforced the understanding of museum learning as a process through which visitors actively construct meaning (Hein, 2006). However, this prominence of learning can sometimes obscure the multidimensional nature of museum experience. For instance, while museums have been struggling with the either-or dilemma between their missions to educate and entertain (Roppola, 2012), most museum visitors ‘see no apparent conflict between fun and learning’ (Falk et al., 1998). Rather than functioning as mutually exclusive outcomes, learning, fun, and other dimensions can coexist within the same museum experience. This suggests a need to look beyond learning as the primary analytical focus and to investigate other, potentially interconnected dimensions of visitor experience, such as play and playfulness.

Beyond the established use of play in children’s museums to facilitate interaction, collaboration and learning, Holdgaard and Olesen (2023) describe attention to play in museum settings as a relatively recent and growing tendency, finding that only 35% of the studies they reviewed investigated play as a centred or defined concept. They also found that museum play research has been concentrated mainly within HCI, with a predominant focus on digital technology-enhanced features and relatively less attention to adults (Holdgaard and Olesen, 2023). Consequently, there remains limited understanding of whether and how adult visitors experience digital and interactive museum exhibits as playful.

Unlike conceptualising play as a compound of activity types, functions and structures (Olesen and Holdgaard, 2026), this study focuses on playful experience, with playfulness at its core. While play activities describe what visitors do, playfulness concerns how visitors experience and respond to those activities. It represents a distinct physical, psychological, and emotional state towards play and playful activities (Lieberman, 1977). In HCI, playfulness is often understood as 'having a ludic attitude that sees the world's structures as opportunities for playful engagement'(Zimmerman, 2009). Importantly, visitors may approach exhibitions with a playful attitude even when the exhibits themselves are not explicitly designed for play. From this perspective, playful experience captures a momentary state of mind that emerges during visitors' engagement with exhibitions and reflects the extent to which they perceive those experiences as playful.

On the other hand, playful experience, like fun, is often treated as a desirable outcome rather than as an integral dimension of visitor experience requiring systematic investigation (Divjak and Ferwerda, 2024). However, playful experience cannot necessarily be reduced to whether visitors report having fun, enjoyment, or satisfaction. Playfulness may emerge through diverse experiences, such as creating and expressing ideas through participation, exploring and discovering unfamiliar spaces or content, experiencing challenge through interactive activities, or developing social connections through shared experiences. These possibilities suggest that playful experience is multidimensional rather than a single evaluative outcome.

A multidimensional approach is therefore needed to examine how museum interactions become playful and why different exhibits, visitors, and contexts may produce different forms of playful experience. Emerging work has begun to address this complexity by considering multiple dimensions of playful engagement. Rodley (2025), for example, proposes a model of playful engagement in museums incorporating sensory immersion, emotional evocation, narrative transportation, and gameful participation. Yet empirical research systematically examining the nature and composition of playful experience itself remains limited.

To address this gap, the present study applies the Playful Experience Scale (PES), a recently developed and validated instrument comprising 23 playful experience items. These are organised into four clusters —Creative and Intellectual Pursuits, Mastery and Achievement, Sensory and Physical Engagement, and Social Connections—with Fun serving as a general indicator of playful experience. The development and psychometric validation of PES are reported separately (Anonymous, 2026); the present study focuses instead on its application within museum contexts. Specifically, it investigates the first research question:

RQ1: What patterns of playful experience emerge across different interactive museum exhibits?

Moreover, individual dispositions and the broader cultural contexts in which museum interactions occur may shape how playful experiences are perceived and reported. Accordingly, two further research questions are proposed:

RQ2: To what extent are visitors' playful personality traits associated with their playful experiences?

RQ3: How do playful experiences differ between visitors in the UK and China?

By addressing these questions, this study conceptualises museum playfulness not simply as fun or pleasure, but as a multidimensional visitor experience that can be systematically investigated across exhibits, individuals, and cultural contexts. In doing so, it demonstrates how a multidimensional approach can extend existing understandings of museum experience and provide a basis for evaluating and designing playful experiences in museums or broader cultural settings.

2 Related work

2.1 Playful Experiences in Museum Contexts

Some museum research has approached playful experience primarily as a desirable outcome or consequence of visitor engagement. For example, Wöhrer and Harrasser (2011) explore children's gendered interactions with scientific objects, Pivec and Kronberger (2016) investigate the possibilities of virtual content to create playful visitor experiences, and Purwatiani et al. (2018) examine how museum space, sequential flow, and colours can encourage play and playfulness. Although these studies explicitly emphasise playful experience, it is generally treated as an accompanying quality of visitor learning or a visit, providing limited explanation of what constitutes a playful experience and how this experience might be identified.

Other studies address playfulness more explicitly but primarily through the design and facilitation of play activities. Remes and Trench (2014), for example, discuss how artworks in exhibitions can encourage viewers to experience play as a creative activity and identify play and playfulness as tools for enhancing participation and encounters. Vosinakis et al. (2020), in developing a playful mixed reality installation, similarly highlight playfulness as a means of increasing visitor curiosity and awareness of museum content. Other work has explored critical play through transgressive play, critical games, and boundary play (Løvlie et al., 2021), as well as how interactive and immersive museum practices bring play and playfulness to the foreground (Ntalla, 2021). While these studies demonstrate the value of incorporating playfulness into museum experiences, they largely approach it through play activities, without clearly distinguishing the activity of play from visitors' playful experience.

A smaller body of research examines playful experience more directly by investigating particular dimensions through which it emerges. Kidd (2015) considers empathy in relation to playful experiences with online museum games, while Ryding and Fritsch (2020) examine how play design can intensify affective encounters in art museums. Ryding (2022) develops practical guidance for fostering social and introspective playful experiences, and Kumar et.al (2022) propose an analytical framework for examining flexible social playfulness around interactive museum exhibits. What's more, Wu et al. (2022) identify perceived playfulness as a significant predictor of behavioural intention in digital museum adoption and conceptualise it through concentration, curiosity, and enjoyment. Similarly, Løppenthin et al. (2022)

demonstrate how playfulness can both encourage and emerge out of exploration, uncertainty, and curiosity in museum encounters. Collectively, these studies demonstrate that playful experience can encompass social, affective, empathetic, exploratory and enjoyable dimensions. However, these dimensions have largely been examined separately, leaving limited understanding of playful experience as an integrated visitor experience.

One of the more comprehensive attempts to conceptualise playful experience relevant to museum contexts is Costello and Edmonds' (2007) pleasure framework, developed through three playful interactive artworks. The framework identifies thirteen pleasures of play and was proposed as a tool for the conceptual design and evaluation of playful interactive art. Building on this work and integrating more frameworks and models from digital engagement (e.g., O'Brien and Toms, 2008), game and gamification(e.g., Hunicke et al., 2004; Tondello et al., 2016), and playful experience (e.g., Lucero et al., 2013) research, Anonymous (2026) developed and validated the Playful Experience Scale, comprising 23 dimensions of playful experiences. The items and corresponding statements are presented in the Appendix. This study applies the PES to examine how playful experiences vary across audiences and interactive exhibits in different museums and cultural contexts.

2.2 Individual Playfulness and Playful Experience

Alongside understanding playfulness as the state of mind underlying a playful experience, psychology has traditionally conceptualised playfulness as an individual predisposition. Shen et al. (2014a), for example, define adult playfulness as 'a personality trait that underlies the individual's tendency to be intrinsically motivated by fun, and to engage oneself spontaneously in an unconstrained manner'. Importantly, trait playfulness does not operate independently of experience. Shen (2020) added two components for the trait: situations for play and playful states, with the latter referring to behavioural and affective outcomes arising from person–situation interactions at a particular time and in a particular setting. This understanding closely relates to the momentary playful experiences examined in this study. A similar distinction has been recognised in HCI, where Webster and Martocchio (1992) conceptualise playfulness as both an individual motivational characteristic (trait) and a subjective characteristic of an experience (state).

This distinction raises an important question about the relationship between the two: are individuals with stronger playfulness traits more likely to experience museum interactions as playful? Despite extensive research on trait playfulness, this relationship has received little attention in museum contexts. Kanhadilok and Watts (2017), for example, examine playfulness among young people in a science museum using established measures of playfulness traits, but focus primarily on play behaviours rather than the relationship. This study addresses this gap by examining whether visitors' playfulness traits are associated with their playful experiences during museum interactions.

2.3 Playfulness Across Cultural Contexts

Relatively few studies of playfulness have adopted a cross-cultural perspective or compared playfulness across different cultures (Pang and Proyer, 2018). Barnett (2017) examines whether Western

conceptualisations of playfulness apply to Chinese culture, while Pang and Proyer (2018) compare adult playfulness between university students from China and German-speaking countries. Both, however, approach playfulness as a personality trait from a psychological perspective. More recently, Masek (2025) identifies four characteristics of playfulness across cultures through interviews with 50 adults from 38 countries, asking participants to describe a highly playful memory with a focus on their internal experiences. While this moves closer to understanding playfulness as an experience, it captures retrospective experience rather than momentary experiences during engagement. Building on this limited cross-cultural literature, the present study examines both playfulness as a personality trait and playful experience as a state of mind across museum visitors in the UK and China.

3 Methods

The research was conducted in two countries, the United Kingdom (UK) and China. As playful experiences in museums frequently emerge through visitor interaction with digital and interactive installations, two museums containing multiple interactive exhibits were selected as research sites: Thinktank Birmingham Science Museum in the UK and Linfen Museum, a National First-Class Museum in China. Five exhibits representing different forms of interaction were included. At Thinktank, Memory Test challenges visitors to remember a set of displayed objects and identify them through an interactive control panel in 20 seconds. Create an Alien invites visitors to construct an alien from different body parts according to the environmental conditions of a selected planet until it successfully passes survival tests. At Linfen Museum, Guess Objects asks visitors to match historical objects with their corresponding names through a drag-and-drop digital interface, while Quiz presents three rounds of multiple-choice questions about historical knowledge. Digital Screen, a large multi-user interactive display, enables visitors to explore the basic information of hundreds of historical objects. Figure 1 shows an overview of the five exhibits at two museums. Together, these exhibits provided varied forms of interaction, including memory and knowledge challenges, creative construction, object matching, exploration, feedback, and multi-user engagement, allowing playful experiences to be examined across different interactive contexts.

Two scales were used in the study. First, the validated Playful Experience Scale (PES) (Anonymous, 2026) -- a 23-item instrument comprising four clusters: Creative and Intellectual Pursuits, Mastery and Achievement, Sensory and Physical Engagement, and Social Connections, together with a general indicator of Fun–was employed to capture visitors' momentary playful experiences while interacting with the selected exhibits. Items were rated on a five-point Likert scale from 0 to 4 (0 = very untrue, 4 = very true). Second, the Adult Playfulness Trait Scale (APTS) (Shen et al., 2014a) was used to measure playfulness as an individual personality trait and examine its relationship with reported playful experiences. The APTS comprises 19 items across three attributes: Fun-Seeking Motivation, Uninhibitedness, and Spontaneity, rated on a six-point Likert scale from 1 to 6 (1 = strongly disagree, 6 = strongly agree).

Adult visitors on site were randomly approached and invited to interact with the selected exhibits. Immediately following the interaction, participants completed the study measures near the exhibit. Participation was voluntary, with no predetermined quotas for age or gender. A total of 239 valid responses were collected, including 122 from Thinktank and 117 from Linfen Museum. The gender distribution was broadly similar across the two samples: 54% of UK and 57% of Chinese participants identified as female, while 41% and 43%, respectively, identified as male; the remaining UK participants identified as non-binary (2%), transgender (1%), or preferred not to say (2%). The Chinese sample was generally younger: 40.2% were aged 18–29 and 43.6% aged 30–44, whereas 65.8% of UK participants who reported their age were aged 30–44.

Data analysis was structured around the three research questions. For RQ1, descriptive statistics from the PES were used to examine how playful experiences varied across items, clusters, and exhibits. For RQ2, APTS scores were analysed to examine correlations between trait playfulness and momentary playful experiences (PES). For RQ3, data from the UK and China samples were compared to examine whether and how trait playfulness and playful experience differed between the two museum contexts.

4 Results

4.1 Playful experiences across the five exhibits

This section compares playful experiences across the five exhibits using the validated Playful Experience Scale (PES). Mean scores are reported across the general indicator Fun and four clusters—Creative and Intellectual Pursuits, Mastery and Achievement, Sensory and Physical Engagement, and Social Connections (23 items in total)—and are presented in Figs. 2–6. The analysis includes 239 adult visitors: Memory Test (n = 70), Create an Alien (n = 52), Guess Objects (n = 47), Digital Screen (n = 54), and Quiz (n = 16).

At the exhibits level, Memory Test (Fig. 2) recorded the highest Fun score (M = 3.60). Its four-cluster means were 3.25, 2.84, 2.95, and 2.47, respectively, with Creative and Intellectual Pursuits demonstrating the strongest performance, including Discovery (M = 3.50) and Challenge B/C (M = 3.44/3.43). Create an Alien (Fig. 3) showed a similar pattern, with Creative and Intellectual Pursuits again the strongest cluster (M = 3.30), including high scores for Challenge B (M = 3.46) and Challenge C (M = 3.44). Its overall Fun score was also high (M = 3.37).

Among the Chinese exhibits, Guess Objects (Fig. 4) showed a relatively balanced profile, with moderate mean scores across most items, ranging from 2.0 (Nurture) to 3.32 (Discovery and Fun). Creative and Intellectual Pursuits again demonstrated the highest cluster mean (M = 3.13). Digital Screen (Fig. 5) generally produced lower scores, including the lowest Fun score among the five exhibits (M = 3.00). Its Mastery and Achievement cluster was particularly weak (M = 2.28), although Creative and Intellectual Pursuits remained its strongest cluster (M = 2.98). Quiz (Fig. 6) showed a more uneven profile, with relatively high scores for Fun, Exploration, Challenge B and Relaxation (M = 3.36), alongside particularly

low Subversion (M = 1.36) and Nurture (M = 1.93). Across four clusters, Social Connections emerged as the weakest, while Creative and Intellectual Pursuits demonstrated the strongest performance.

Cross-exhibit comparison reveals several consistent patterns. First, Fun remained relatively high across all five exhibits, ranging from 3.00 for Digital Screen to 3.60 for Memory Test. Second, Creative and Intellectual Pursuits was consistently the strongest PES cluster, with cluster means ranging from 2.98 to 3.30. Discovery, Exploration, Challenge B and Challenge C were particularly prominent across several exhibits, suggesting that intellectual curiosity and challenge were common components of visitors' playful experiences.

Greater variation emerged in Mastery and Achievement. Competition A/B, Completion and Control generally received higher scores than Cruelty and Subversion. Subversion was consistently among the lowest-rated items across the five exhibits. This suggests that this cluster is more strongly associated with pursuing goals and completing tasks than with disrupting established rules.

Sensory and Physical Engagement showed moderate and relatively stable scores, although its prominence differed between exhibits. Guess Objects showed relatively strong Sensation (M = 3.23) and Challenge A (M = 3.15), while Quiz scored particularly highly for Relaxation (M = 3.36). Digital Screen generally produced weaker values. Across all five exhibits, Simulation demonstrated the weakest item in this cluster.

Finally, Social Connections was consistently the weakest cluster, with cluster means ranging from 2.34 to 2.70. Fellowship A tended to perform more strongly with this cluster, whereas Nurture remained consistently low across the exhibits. This suggests that the interpersonal and empathetic aspects of playful experiences were less experienced by visitors compared to other clusters.

Overall, the five exhibits generated distinct playful experience profiles despite several common patterns. Creative and Intellectual Pursuits emerged as the most consistent strength, whereas Mastery and Achievement and Sensory and Physical Engagement varied more substantially by exhibit. Social Connections remained comparatively weak, indicating that different exhibits may facilitate particular dimensions of playful experiences rather than playfulness as a uniform experience.

4.2 Correlation between playful experiences and personality trait

This section examines whether visitors' playfulness traits are associated with their playful experiences. The three dimensions of the Adult Playfulness Trait Scale (APTS)—Fun-Seeking Motivation, Uninhibitedness, and Spontaneity (Shen et al., 2014a)—were examined in relation to the 23 PES items (Fun and four clusters). Using SPSS Statistics 29 software, Chi-square tests were first used to identify significant associations, followed by ordinal regression to examine the direction of these relationships.

As shown in Table 1, Fun-Seeking Motivation demonstrated the broadest pattern of associations with playful experience. It was significantly associated with overall Fun ($p = .006$) and multiple items across

Creative and Intellectual Pursuits, Mastery and Achievement, and Sensory and Physical Engagement. These included Creation, Expression, Exploration, Challenge B, Competition A, Completion, Cruelty, Sensation, and Challenge A. However, no significant association was identified with Social Connections items. Uninhibitedness showed a more selective pattern, with significant associations with Expression and Exploration, as well as Control, Challenge A, and Nurture. Spontaneity showed the fewest associations, being significantly related to overall Fun ($p = .004$), and Competition A and Control in the Mastery & Achievement cluster. Overall, the results indicate that different attributes of trait playfulness are associated with different dimensions of playful experience rather than with all PES items uniformly.

Table 1
Chi-square results for PES and APTS conducted by SPSS 29.

PES Clusters	APTS/PES items	Fun-seeking	Uninhibitedness	Spontaneity
	Chi-square	Motivation		
Fun	Fun	.006	.899	.004
Creative & Intellectual Pursuits	Creation	.014	.595	.051
	Expression	.048	.048	.232
	Exploration	.027	< .001	.312
	Discovery	.087	.590	.852
	Challenge B	.009	.661	.743
	Challenge C	.152	.316	.829
Mastery & Achievement	Competition A	.006	.387	.005
	Competition B	.562	.525	.098
	Completion	.008	.084	.710
	Control	.508	.049	.021
	Cruelty	.006	.621	.121
	Subversion	.882	.060	.432
Sensory & Physical Engagement	Captivation	.387	.951	.948
	Sensation	.025	.358	.846
	Relaxation	.500	.393	.331
	Immersion	.519	.429	.160
	Simulation	.250	.590	.238
	Challenge A	.011	.031	.891
Social Connections	Empathy	.661	.343	.722
	Nurture	.768	.030	.534
	Fellowship A	.218	.172	.213
	Fellowship B	.291	.225	.316

Ordinal regression was subsequently conducted for the significant associations identified by the chi-square tests. The results generally supported the same pattern and further indicated that higher levels of playfulness traits were associated with a lower likelihood of reporting low levels of playful experiences.

For example, visitors with higher Fun-Seeking Motivation were less likely to report lower levels of Fun, Creation, Expression, Exploration, Challenge B, Competition, Completion, Sensation, and Challenge A. Similar patterns were observed for the PES items associated with Uninhibitedness and Spontaneity.

Taken together, the findings suggest that trait playfulness is related to playful experiences, but the relationship is selective rather than uniform. Fun-Seeking Motivation shows the broadest relationship with playful experience, whereas Uninhibitedness and Spontaneity are associated with narrower sets of experiences. Social Connections shows particularly limited associations with trait playfulness. Across the significant relationships, higher trait playfulness is primarily associated with a reduced likelihood of low playful experience. These findings support a multidimensional understanding in which personality tendencies are associated with particular playful experiences rather than determining a single generalised playful state.

4.3 UK- China comparison

This section examines whether playfulness differs between the UK and Chinese samples, considering both playfulness as a personality trait (APTS) and playful experience as a state of mind (PES).

4.3.1 APTS Comparison

The UK (n = 122) and Chinese (n = 116) samples showed similar levels of Fun-Seeking Motivation (UK: M = 4.98, SD = 0.34; China: M = 5.00, SD = 0.30). Regarding the three sub-dimensions under Fun-Seeking Motivation (see Fig. 7), Fun Belief (prioritising fun, pleasure, and enjoyment in life, measured by items 1, 2) and Reactivity (being responsive to fun stimuli, measured by items 7–9) got nearly identical scores for two countries, while Initiative (actively creating fun activities, measured by items 3–6) of Chinese participants scored slightly higher (China: M = 4.59; UK: M = 4.39).

Greater differences emerged for the other two APTS dimensions (see Fig. 8). UK participants reported higher Uninhibitedness (UK: M = 3.96; China: M = 3.63) and Spontaneity (UK: M = 3.96; China: M = 3.22). Consequently, the overall APTS score was higher for the UK sample (M = 4.30) than for the Chinese sample (M = 3.95). Overall, the two samples were highly similar in their tendency to seek fun but differed more noticeably in uninhibited and spontaneous expressions of playfulness.

Mann–Whitney U tests were further conducted to examine whether trait playfulness differed significantly between the UK and Chinese samples. No significant difference was found for Fun-Seeking Motivation ($U = 6946.50$, $Z = -0.244$, $p = .807$, $r = .02$), indicating highly comparable levels between the two groups. In contrast, UK participants scored significantly higher in both Uninhibitedness ($U = 5696.50$, $Z = -2.604$, $p = .009$, $r = .17$) and Spontaneity ($U = 4541.00$, $Z = -4.783$, $p < .001$, $r = .31$). The effect was small for Uninhibitedness and moderate for Spontaneity, indicating that Spontaneity represented the most pronounced difference in trait playfulness between the two samples.

4.3.2 PES Comparison

Before comparing PES scores between the two samples, internal consistency was examined separately for each country. Creative and Intellectual Pursuits (UK: α = .853; China: α = .803), Mastery and Achievement (UK: α = .747; China: α = .793), and Sensory and Physical Engagement (UK: α = .769; China: α = .775) demonstrated acceptable internal consistency in both samples. Social Connections showed acceptable reliability in the UK sample (α = .747) but lower reliability in the Chinese sample (α = .632). Thus, while three PES clusters demonstrated acceptable internal consistency across the two samples, the items comprising Social Connections were less internally coherent among Chinese visitors.

Mann–Whitney U tests were subsequently conducted to examine differences in playful experiences between the UK and Chinese samples (see Table 2). Significant differences were found for Fun (U = 5692.00, Z = − 2.658, p = .008, r = .17), Creative and Intellectual Pursuits (U = 5283.50, Z = − 3.199, p = .001, r = .21), and Mastery and Achievement (U = 4855.00, Z = − 4.016, p < .001, r = .26). In all three measures, UK visitors had higher mean ranks than Chinese visitors, although the effect sizes were small to small-to-moderate. In contrast, no significant differences were found for Sensory and Physical Engagement (U = 6600.50, Z = − 0.676, p = .499, r = .04) or Social Connections (U = 6451.50, Z = − 0.964, p = .335, r = .06), with negligible effect sizes.

Table 2
Mann–Whitney U test results across UK and China datasets.

Measure	UK Mean Rank	China Mean Rank	U	Z	p	r
Fun	128.84	107.43	5692.00	−2.658	.008	.17
Creative & Intellectual Pursuits	132.19	103.85	5283.50	−3.199	.001	.21
Mastery & Achievement	135.70	100.09	4855.00	−4.016	< .001	.26
Sensory & Physical Engagement	121.40	115.40	6600.50	−0.676	.499	.04
Social Connections	122.62	114.09	6451.50	−0.964	.335	.06

The UK–China comparison therefore reveals selective rather than uniform differences in playfulness. At the trait level, the two samples showed comparable Fun-Seeking Motivation, while UK visitors reported significantly higher Uninhibitedness and Spontaneity. At the playful experience level, UK visitors reported significantly higher Fun, Creative and Intellectual Pursuits, and Mastery and Achievement, although effect sizes were generally small. No significant differences were found for Sensory and Physical Engagement or Social Connections.

5 Discussion

Applying PES demonstrates that playful museum experiences operate at both specific and broader levels, revealing patterns that previous studies could not easily identify. Previous studies provide

evidence for diverse forms of playful experience in museums, such as fun (Archer et al., 2016), exploration, creation, expression (Ryding, 2022), and sensation (Cole and Brooks, 2016), but such experiences are rarely investigated in depth or together. At the item level, this study provides a more granular understanding of how particular playful experiences vary across exhibits. For example, Wyman et al. (2016) report that some students at the Samuel Dorsky Museum of Art expressed 'empathy' with the environment and the artist's perspective. The present study goes further by examining Empathy as a specific measurable dimension, showing that it was more strongly experienced in Guess Objects than in Create an Alien. Similarly, although empirical research examining Subversion as a playful experience in museums remains rare, the findings demonstrate its presence and allow it to be considered alongside other related experiences.

At the cluster level, this study reveals broader patterns among related playful experiences. Doering (1999) identifies object, cognitive, social, and introspective experiences as dimensions of satisfying museum experience, but does not quantitatively measure the specific experiences within each category. Similarly, Shen (2020) proposes four characteristics of playful states—Immersion, Sense of Mastery, Activeness, and Positive Affect—which overlap with some PES dimensions but do not capture the wider range of experiences identified here, such as those within Creative and Intellectual Pursuits. Across the five exhibits examined in this study, Creative and Intellectual Pursuits emerged as the most consistent strength, whereas Social Connections remained comparatively weak. This cluster-level perspective therefore reveals broader patterns that may be less visible when individual experiences are considered in isolation, while raising further questions about whether similar patterns emerge across other exhibits and museum contexts.

An individual's overall behavioural tendency should correspond to their dispositional level of playfulness; however, Shen et al.'s (2014b) study found only a moderate correlation between the two measures ($r = 0.55$). The present study provides further empirical evidence of the relationship between playfulness as a personality trait and playfulness as a state of mind by investigating whether individuals with stronger playful traits report stronger playful experiences during museum interactions. Chi-square tests between APTS and PES identified significant correlations between 12 PES items and the three APTS attributes. Notably, more playful individuals reported stronger experiences in Creative & Intellectual Pursuits (Creation, Expression, Exploration, and Challenge B), a correlation not captured by Shen's (2020) characteristics of playful states. This finding is particularly relevant because trait playfulness has long been linked to creativity (Lieberman, 1977) and intellectual or cognitive engagement. Proyer (2011), for example, reports an association between playfulness and academic performance, while Proyer (2017) identifies Intellectual Playfulness as one of four components of adult playfulness. Fung and Chung (2024) similarly suggest that playfulness may support creative thinking among children. The present findings extend this relationship to momentary museum experiences, suggesting that visitors with stronger playful traits may tend to experience more creative and intellectual pursuits.

From a design perspective, these associations suggest that differences in visitor playfulness could inform the design of personalised experiences. Visitors with higher Fun-Seeking Motivation showed the

broadest range of associations, spanning Creative & Intellectual Pursuits, Mastery & Achievement, and Sensory & Physical Engagement. Accordingly, exhibit design for this type of visitors can prioritise these three clusters to stimulate corresponding experiences. Uninhibitedness was associated with Expression and Exploration, as well as Control, Challenge A, and Nurture. These experiences commonly involve opportunities for autonomous action and less constrained interaction, suggesting that exhibits offering greater freedom to explore, express themselves, and determine how they interact may be particularly relevant. Spontaneity, meanwhile, was associated with Competition A and Control within Mastery & Achievement, suggesting potential value in interactions that provide immediate choices, a sense of control, and competitive elements. Rather than treating visitors as a uniformly playful audience, these findings indicate that playful experience design could account for individual differences in how visitors are predisposed to engage with and experience playful opportunities.

Regarding UK- China comparisons, at the personality-trait level, Fun-Seeking Motivation showed no significant cross-cultural difference, whereas UK participants scored significantly higher in both Uninhibitedness and Spontaneity. This partly aligns with Shen et al. (2021), who found that Chinese individuals tended to hold more negative attitudes towards the expression of playfulness and were less likely to regard it as a desirable personality trait. The finding differs, however, from Barnett (2017), who found that Chinese students had developed an appreciation of playfulness comparable to American understandings and suggested that playfulness could also be expressed indirectly. Barnett's study focused specifically on female university students in a US–China comparison, making direct comparison with the present study difficult. Interestingly, Initiative, a dimension of Fun-Seeking Motivation referring to actively creating fun activities, was slightly higher among Chinese participants. This echoes Shen et al.'s (2021) Chinese adaptation of APTS, in which Initiative emerged as a strong indicator of playfulness. Considered alongside the lower Uninhibitedness and Spontaneity scores, this finding suggests a potentially more nuanced cultural pattern: Chinese visitors may be similarly motivated to seek or create fun, while differing more in how freely or spontaneously they express playfulness. Further research would be needed to determine whether this pattern reflects broader cultures.

Beyond personality traits, the findings demonstrate that cultural differences also extend to visitors' momentary playful experiences. UK visitors reported significantly higher Fun, Creative & Intellectual Pursuits, and Mastery & Achievement, whereas no significant differences were found for Sensory & Physical Engagement or Social Connections. This suggests that not all playful experience items travel equally well across cultural settings, even within a theoretically unified model. For example, Masek's (2025) cross-cultural study of engaging playful experiences across 38 countries identifies Social Sharing as a characteristic of playfulness. Its cross-cultural presence is broadly consistent with the lack of a significant UK–China difference in Social Connections found here, suggesting that social dimensions of playful experience may be less culturally differentiated. Masek's Active Behaviour, encompassing cognitive involvement and physical participation, also partly overlaps with aspects of Creative & Intellectual Pursuits and Sensory & Physical Engagement. However, the contrasting cross-cultural patterns found for these two PES clusters further suggest that different forms of engagement should not be assumed to operate similarly across cultural contexts.

Finally, the application of PES across 239 visitors and five exhibits demonstrates its practical potential not only for evaluating existing exhibits but also for informing playful experience design in museums and other cultural organisations. At the exhibit level, comparatively weak experiences can indicate opportunities for redesign. For example, the relatively low Mastery & Achievement reported for Guess Objects suggests that elements such as progressive difficulty, timed challenges, or optional competition could be explored to strengthen this dimension of the experience.

More broadly, the four PES clusters provide a structure through which curators and designers can consider the types of playful experience they intend to support. Rather than attempting to maximise every item, designers can first identify the clusters most relevant to an experience or activity's purpose and audience, and then select particular PES items as prompts for design. Creative & Intellectual Pursuits, for example, can be supported through opportunities to explore objects, discover information, create interpretations, express personal perspectives, and solve intellectual challenges. A gallery trail might invite visitors to follow object clues, decode symbols, or construct their own interpretation of a partially revealed historical story.

Mastery & Achievement can be encouraged through clear goals, progression, challenge, competition, and visitor control. Multi-stage puzzles or adjustable difficulty levels can create stronger senses of Completion, Competition, and Control. Subversion can provide another route by allowing visitors to experiment with unexpected or rule-bending interactions within safe boundaries, such as discovering alternative sequences or hidden responses.

Sensory & Physical Engagement can be supported through tactile, auditory, visual, and embodied interaction. For example, a physical task embedded within a simulated historical environment could combine bodily movement, sensory feedback, and narrative context to support Sensation, Simulation, and Immersion. Such sensory elements can also complement other playful experiences; for instance, a weaving competition may be staged in a simulated workshop environment that encourages tactile interaction. Audiences could touch and try on woven products created by participants and vote for their preferred pieces. In this example, a playful competition is enriched through sensory engagement opportunities for audiences.

Social Connections deserves particular attention because it emerged as a comparatively weak cluster across the five exhibits. Designers could strengthen Fellowship, Empathy, and Nurture through cooperative tasks, shared decision-making, role-based participation, or care-oriented interactions. Importantly, social playfulness need not depend solely on social characteristics. Creative exploration can become collaborative, mastery challenges can involve shared goals or team competition, and sensory or physical interactions can be designed for joint participation. The four clusters can therefore be combined rather than treated as isolated design categories.

6 Conclusion

This study applied the Playful Experience Scale (PES) to examine momentary playful experiences among 239 visitors interacting with five digital exhibits across two museums in the UK and China. The findings demonstrate that playful experience is multidimensional and varies across exhibits, individuals, and cultural contexts.

At the exhibit level, applying PES revealed both specific item differences and broader patterns across its four clusters. Creative & Intellectual Pursuits emerged as the most consistently strong cluster, whereas Social Connections remained comparatively weak. This suggests that museum interactions can support more creation, expression, exploration, discovery, and challenges, extending understandings of museum play beyond entertainment-oriented experiences. The associations between APTS and PES further demonstrate that visitors' playful personality traits are related to specific momentary playful experiences. In particular, the findings highlight connections between trait playfulness and Creative & Intellectual Pursuits experiences.

The UK–China comparison further demonstrates that cultural differences in playfulness are multidimensional rather than uniform. While differences emerged in both playful personality traits and several experience clusters, Sensory & Physical Engagement and Social Connections showed no significant differences between the two samples. These findings suggest that some dimensions of playful experience may be more culturally differentiated than others and reinforce the importance of examining playfulness at both item and cluster levels, as well as the need for more culture-related research.

Despite its contributions, this study has several limitations. First, although the PES was validated before being used in this study, items such as Subversion, Simulation, and Nurture consistently received relatively low scores across the five exhibits, raising questions about whether these dimensions are underrepresented in the current museum contexts or may perform differently in other settings. Continued application of the PES across diverse exhibits and museum contexts could help further evaluate and refine the scale. Second, the UK–China comparison was based on relatively modest samples of approximately 120 visitors per country. The observed differences therefore warrant further investigation using larger samples and, subsequently, additional cultural contexts. Such research could provide a more robust understanding of how cultural factors shape playful experiences in museums.

Overall, this study demonstrates the value of playful experience as a momentary, multidimensional experience shaped by the interactions between audiences, exhibits, and cultural contexts. For practice, the findings provide a structured basis for evaluating existing exhibits and designing for different playful experiences through the four clusters. Further applications across different museum types, interaction formats, and cultural settings would help establish how consistently these patterns occur and deepen understanding of how playful experiences emerge within cultural institutions.

Declarations

Competing interests
The author(s) declare no competing interests.

Data availability

The raw and processed datasets, including relevant variable names and coding information, together with the survey questionnaire and visitor consent form, are provided as supplementary files for peer review purposes. The datasets are not publicly available because participants were informed through the consent process that their anonymised research information would be securely stored on University of Leicester protected servers. In accordance with the approved data protection arrangements, access to the research data is restricted to the researcher and their supervisors, and therefore the datasets cannot be made publicly accessible.

Ethical statements

Both the UK and China fieldwork were conducted as part of University of Leicester research. Ethical approval for this study was therefore obtained from the University of Leicester Research Ethics Committee, School of Heritage and Culture, covering both phases of fieldwork. The UK study was approved under Application 41874-yx194-ss/ms&galleries, and the China study under Application 42794-yx194-ss/ms&galleries. Both were classified as low-risk research involving non-vulnerable adult participants (aged 18+).

The study was conducted in accordance with the ethical guidelines and regulations of the University of Leicester and under research protocols approved by the University of Leicester Research Ethics Committee. For the China fieldwork, institutional permission to conduct the research was obtained from Linfen Museum, China, by email. No separate local ethics approval was obtained from Linfen Museum or another Chinese local ethics committee, as the research was conducted under the University of Leicester's approved ethics framework and ethical oversight was provided by the University of Leicester Research Ethics Committee.

All participants received study information and provided informed consent before participation. Data were collected, anonymised, stored, and managed in accordance with the approved University procedures.

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Figures

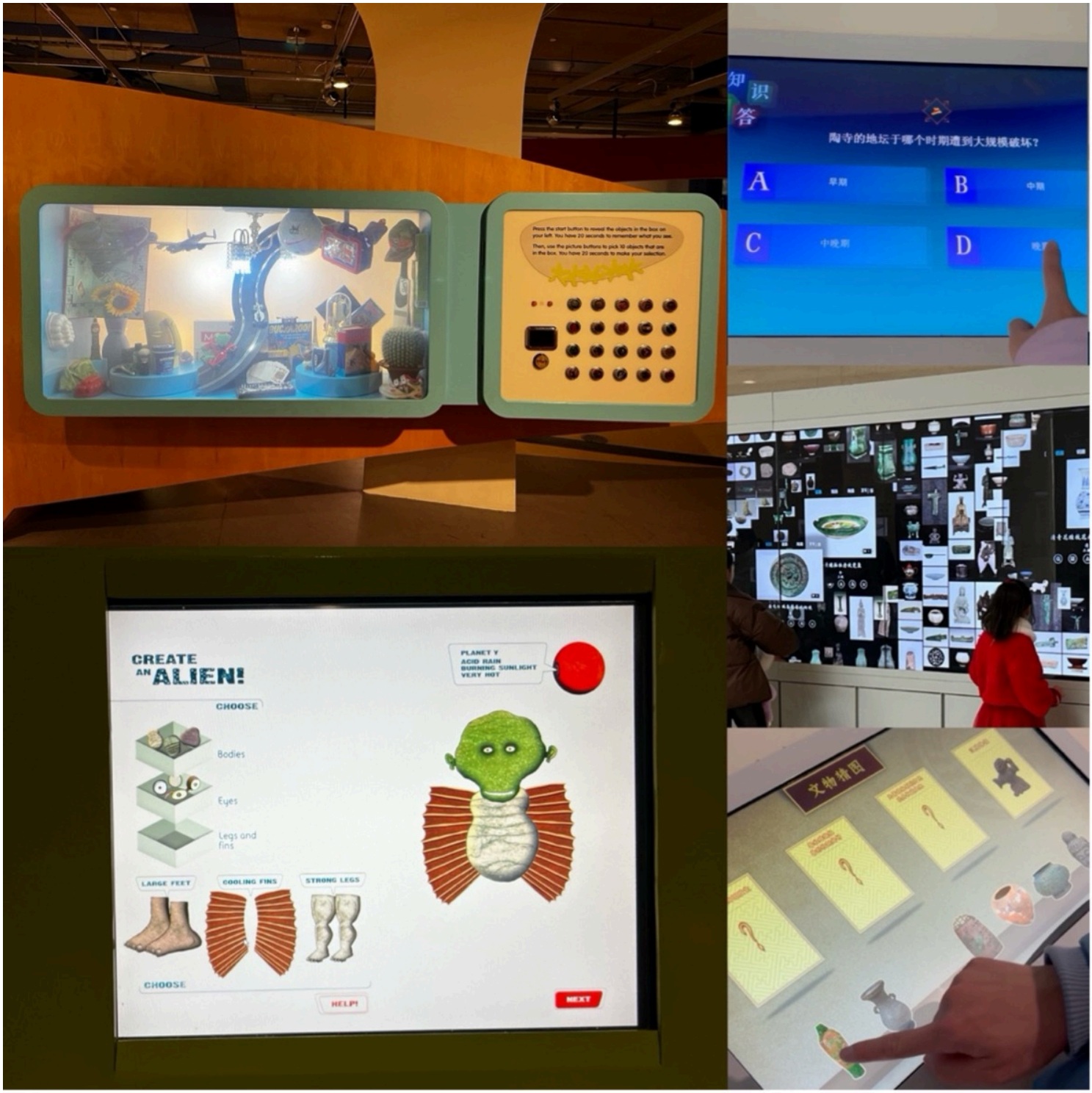


Figure 1

Five interactive exhibits at two museums in the UK and China.

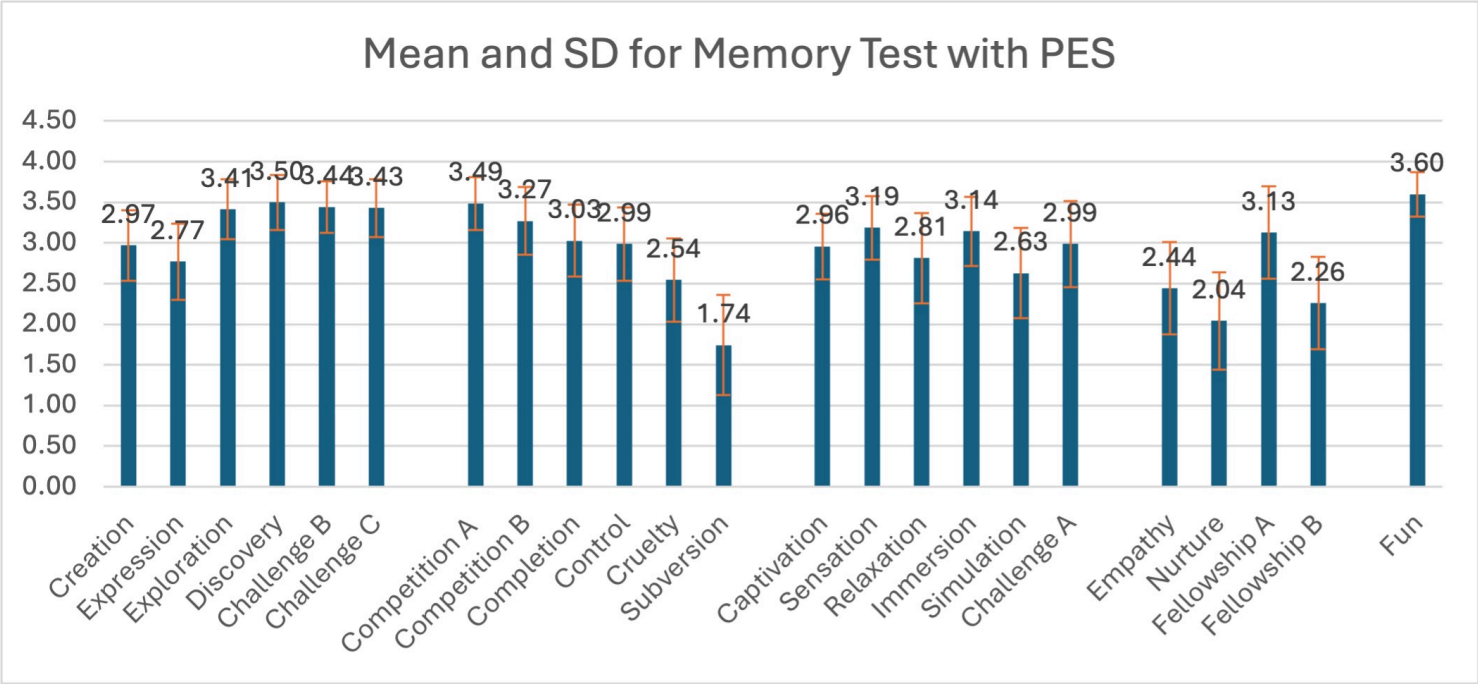


Figure 2

Mean and SD for Memory Test with PES

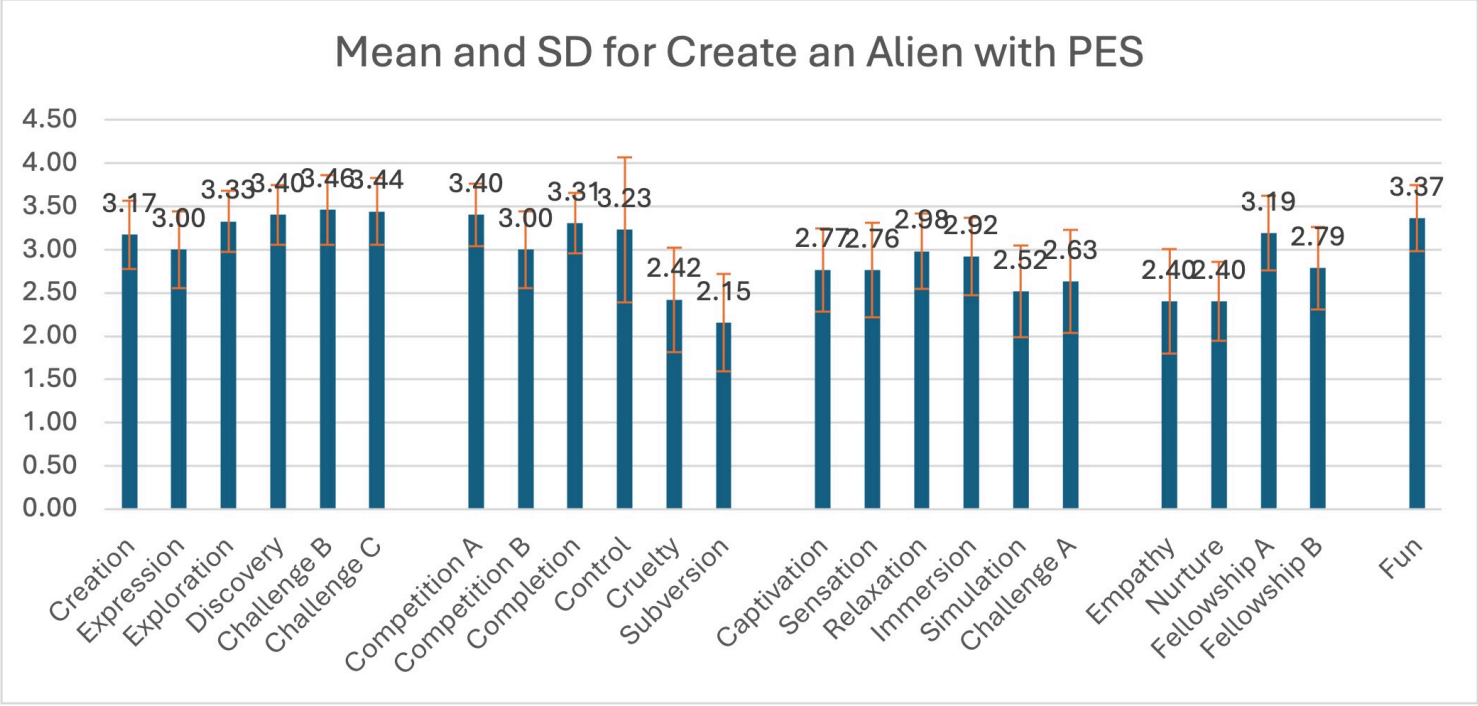


Figure 3

Mean and SD for Create an Alien with PES

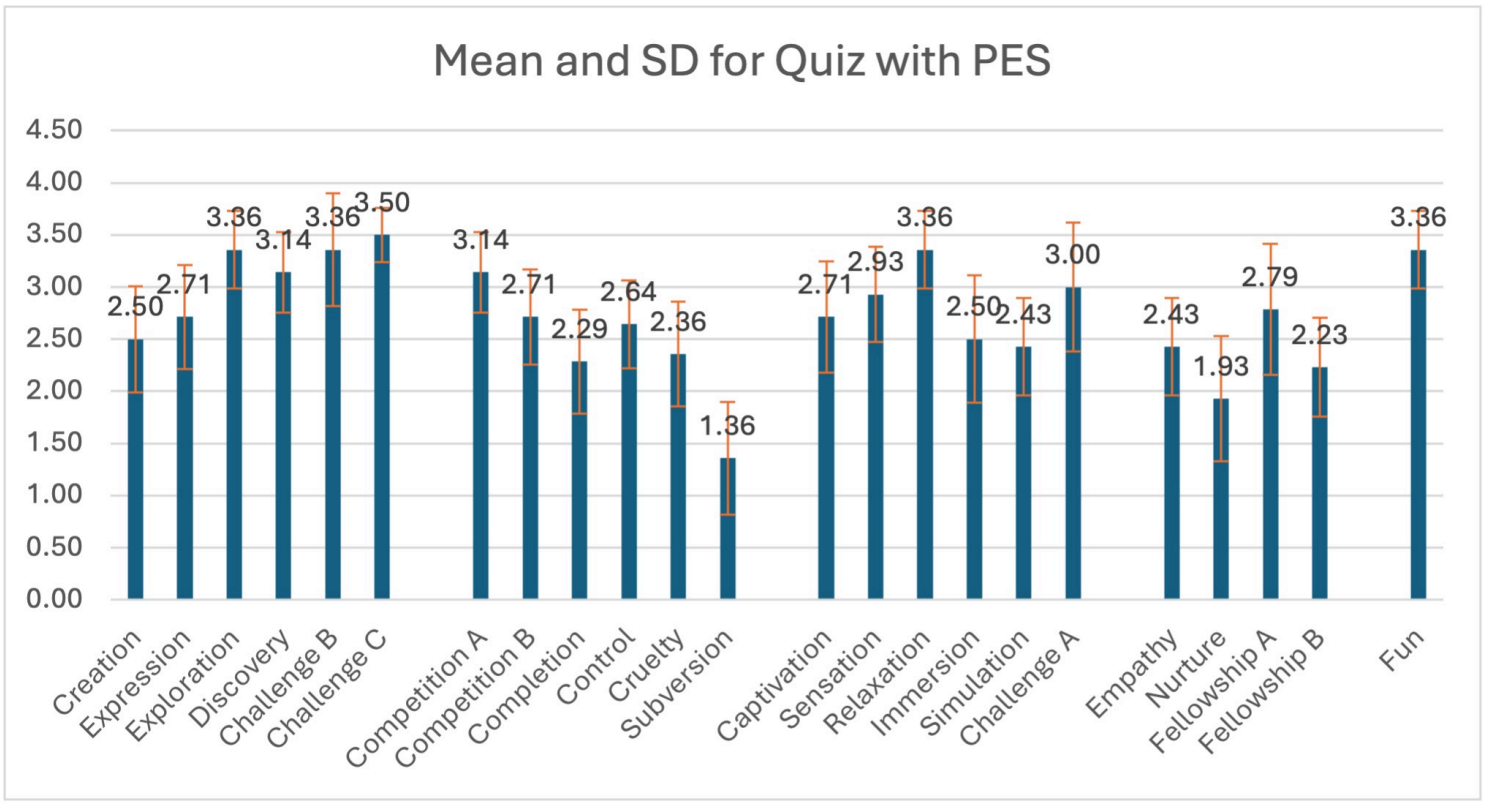


Figure 6

Mean and SD for Quiz with PES

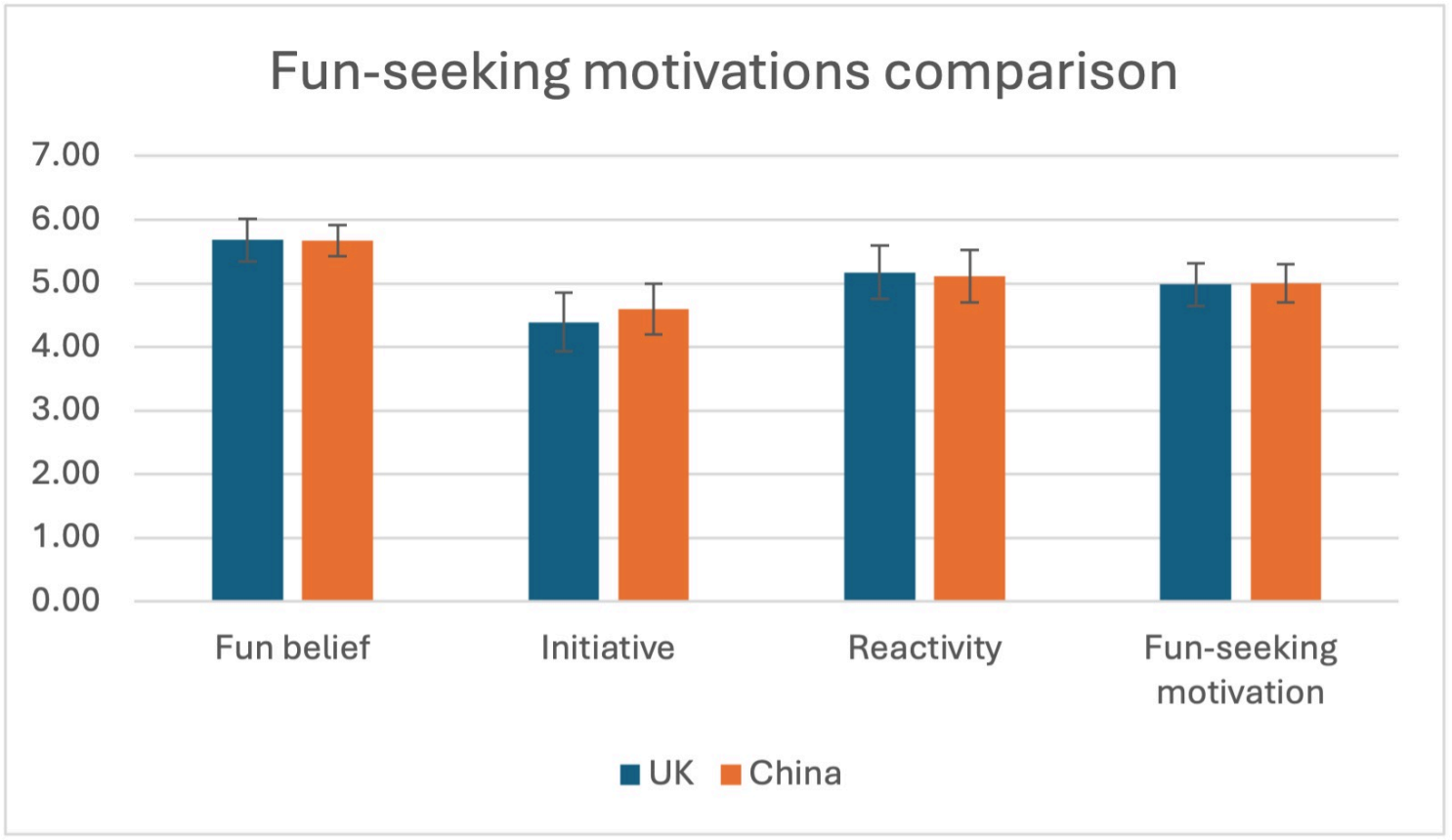


Figure 7

Mean and SD of Fun-Seeking Motivation and its three sub-dimensions

Supplementary Files

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- supplementaryinformation.docx
- RawdataandProcesseddata.xlsx
- Questionnaire.docx