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Article

The interplay of biomechanical movement patterns and aesthetic context on explicit and implicit altruistic behavior in pupils

Tingting Wang[1,*], Ruihua Yang[2], Xiaojing Wang[3]

[1] Associate Research Fellow, China National Academy of Educational Sciences, Beijing 100088, China
[2] Vice Principal, Heping Experimental Primary School, Shenzhen 518110, China
[3] Institute of Psychology, Chinese Academy of Sciences, Beijing 100101, China
*** Corresponding author:** Tingting Wang, wangtt_nies@163.com

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Abstract: The current study delved into how aesthetic context intertwined with cell molecular biomechanics to influence pupils' explicit and implicit altruistic behaviour. In Experiment 1, when looking at the effects of different aesthetic contexts on pupils' explicit altruistic behaviour, it was found that explicit aesthetic context had a notable priming effect on implicit altruistic behaviour. From a cell molecular biomechanics perspective, perhaps in an explicit aesthetic context, specific cell surface receptors respond to external stimuli related to beauty, triggering intracellular molecular signaling pathways that eventually influence implicit altruistic responses more than in implicit or non-aesthetic contexts where such coordinated signaling is less pronounced. Experiment 2 on implicit altruistic behaviour again detected the implicit association test (IAT) effect. Implicit aesthetic contexts showed a significant priming effect. Here, at the cell molecular level, the microenvironment within cells might be altered by the implicit aesthetic perception, like changes in cytoplasmic viscosity or the movement of organelles affected by aesthetic feelings, which then play a key role in shaping implicit altruistic behaviour compared to explicit and non-aesthetic contexts. Overall, it's clear that explicit and implicit altruistic behaviours rely on distinct processing mechanisms involving both aesthetic context and cell molecular biomechanics. The two aesthetic contexts have selective impacts via different path mechanisms related to these cellular processes.

Keywords: aesthetic context; explicit altruistic behaviour; implicit altruistic behaviour; cell molecular biomechanics; pupils

1. Introduction

Aesthetic context refers to providing aesthetic objects for students, enabling students to produce positive emotional experiences, and cultivating students' healthy aesthetic interests and ideals [1–3]. Creating an aesthetic context in teaching is critical to effectively implementing aesthetic education. An explicit aesthetic situation means that teachers consciously provide aesthetic guidance to students. An implicit aesthetic situation means that students are in an aesthetic situation but do not receive any aesthetic guidance.

The term altruism was first coined by Comte, the founder of French sociology, to mean the willingness to benefit others through one's actions [4]. Dual processing theory [5–11] suggests that humans have an analytical and empirical information processing system. The former involves conscious, relatively time-consuming, rule-based reasoning mediated primarily by language. In contrast, the latter refers to non-verbal and rapid implicit mental activity that occurs at a preconscious level. Accordingly, altruism includes both explicit and implicit types. Explicit altruism refers

to the behaviour of an individual who consciously and voluntarily cares for and helps others without expectation of reward and is mainly measured by direct self-reporting. Implicit altruism, on the other hand, refers to an individual's ability to obtain internal, unaware self-rewards by helping others and is a kind of social feedback internalization behaviour, which is mainly quantified by the indirect association test (IAT) [12]. In recent years, the explicit and implicit separation effects of altruistic behaviour have also been certified by several studies [13,14].

The relationship between aesthetics and morality has received extensive attention from educationalists and psychologists [15–18]. Psychological research has shown that aesthetics has a profound and wide-ranging impact on human moral behaviour. For example, research on the effects of physical beauty on human beings has shown that the degree of physical beauty can influence people's judgments about moral behaviour, which is called as the "What is beautiful is good" stereotype [19]. Researchers have also found that participants perceive the protagonist of a story to be more generous after enjoying pleasing music. Similarly, fundraising activities at art museums tend to be far more rewarding than other venues [15,20]. The above research suggests that aesthetic situations can activate human beings' good side, i.e., the altruistic tendency.

Research has shown that the orbitofrontal cortex (OFC), which is associated with positive emotions, is activated when processing aesthetic stimuli, as well as when processing morally "good" stimuli [21–33]. In particular, Tsukiura and Cabeza [34] found that OFC activation increased with both moral and aesthetic rating scores by examining the brain activity of the same participants while making moral and aesthetic judgments. This suggests that processing morally good and aesthetically pleasing stimuli involves activity in the same brain region, the OFC.

In summary, aesthetics can influence human moral behaviour to a certain extent and initiate human altruistic tendencies, and this influence has a neural basis. However, previous studies have only focused on the influence of explicitly explicit aesthetic contexts on explicitly explicit altruistic behaviour but have yet to explore the influence mechanisms of explicit/implicit aesthetic contexts on explicit/implicit altruistic behaviour systematically. Therefore, how do different aesthetic contexts influence students' explicit and implicit altruistic behaviour, and what are the psychological mechanisms of such influences? This is the question needs to be explored. Previous studies showed that 9 years old is the critical period of aesthetic development as well as moral development. We supposed the effects could be more evident at the 9 years old participants. Therefore, we chose the pupils around 9 years old as participants.

The previous studies of altruistic behaviour have mainly adopted the methods of observation, situational testing, peer nomination, self-reporting, and interviews. However, the above methods could be influenced by the participants' social approbation. To avoid the potential problem, we adopted cartoon drawings to examine the participants' explicit altruistic behaviour and the Implicit Association Test (IAT) to explore their implicit altruistic behaviour, respectively [12,28]. The IAT is a classic method in implicit social cognition in recent years, which has a clear advantage in revealing the unconscious or implicit features of possible altruistic behaviour to avoid the participants' social approbation [12].

Our choice of 9-year-olds as the key age group is grounded in developmental psychology, which identifies this period as a critical juncture in aesthetic and moral development. Recent research underscores the significance of this age in the development of cognitive and emotional faculties that are closely tied to aesthetic sensibilities and altruistic tendencies [35,36]. The intersection of cognitive, emotional, and social development at this age makes it an optimal period to study the influence of aesthetic context on altruistic behavior.

The relationship between aesthetic context and altruistic behavior is further supported by the emerging field of neuroaesthetics, which explores the neural correlates of aesthetic experiences. Latest research evidence suggests that aesthetic stimuli activate brain regions associated with reward and emotional processing, which are also implicated in altruistic behavior [34,37]. This neuroscientific backing strengthens the theoretical link between aesthetic context and altruistic behavior, suggesting that aesthetic experiences may prime the neural circuits involved in prosocial actions.

2. Experiment 1: The effects of different aesthetic contexts on explicit altruistic behaviour

2.1. Participants

Ninety-six participants, 48 male, and 48 female third-grade pupils were selected as participants. All participants had normal vision or corrected to normal vision. Participants were paid a certain amount of money when they finished the test.

2.2. Materials

Figure1. Stage 1 pictures.

Stage 1 consisted of 10 landscape paintings or pictures with 20 Chinese characters written on (**Figure 1**). The landscape paintings included 5 Chinese landscape paintings and 5 Western oil paintings. Among them, five pictures contained "water" and five pictures did not contain water. In the Chinese character pictures, there are five pictures with the Chinese character "water" and five pictures without. All

images are 589 × 500 pixels in size. The selection of landscapes and cartoons was guided by criteria ensuring aesthetic diversity and ethical ambiguity, respectively. A panel of art and psychology experts evaluated the materials for neutrality and quality. A pre-experiment with a pilot group assessed comprehension, emotional response, and judgment variability, refining the materials for the main study.

The carton drawings were shown in Stage 2. The drawings were 18 black-and-white sketches describing a specific moral behaviour [28], in which the protagonist's behaviour was obscure, i.e., the behaviour could be judged as either altruistic or dis-altruistic (e.g., **Figure 2**). Each picture was presented with a descriptive statement of either altruistic (e.g., I voluntarily give up my seat to my elderly grandfather) or altruistic (I am reluctant to give up my seat to my elderly grandfather) nature. The image size was 589 × 500 pixels.

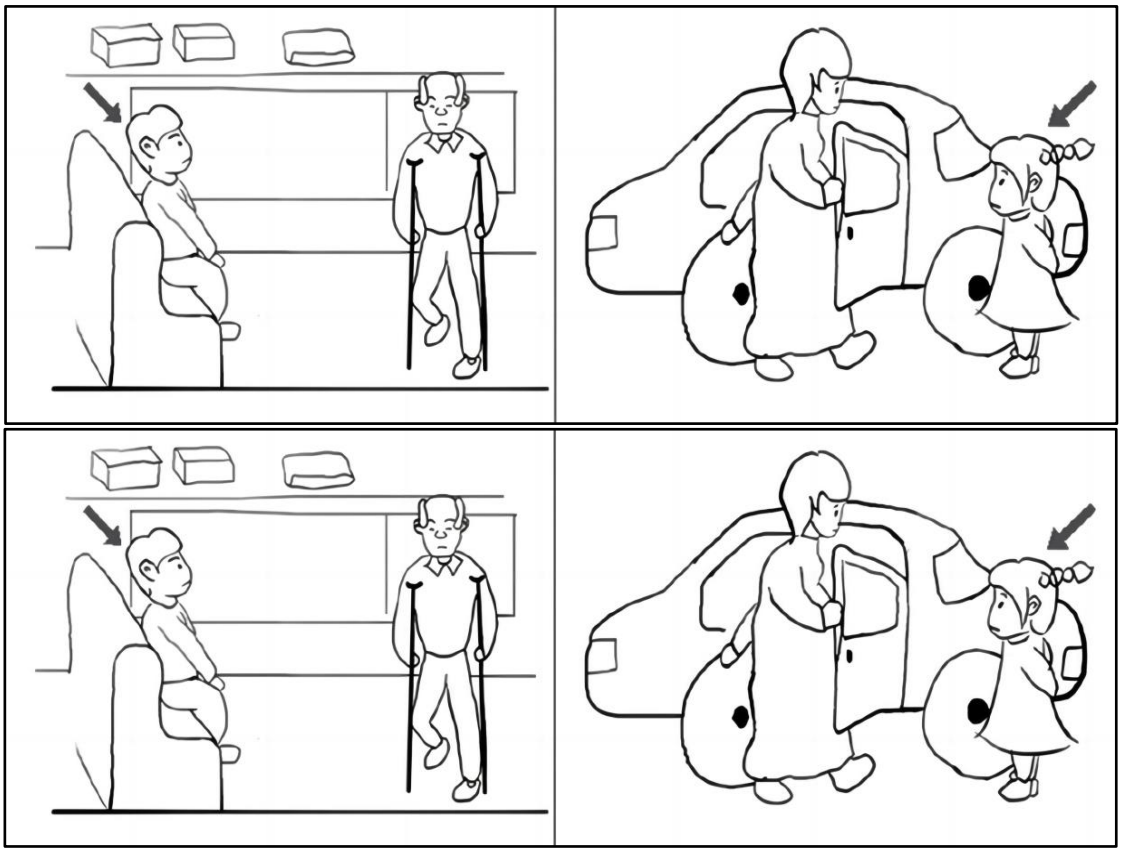

Figure 2. The carton drawings.

2.3. Design

A two-factor mixed design of 3 (aesthetic context: explicitly aesthetic, implicitly aesthetic, non-aesthetic) × 2 (altruistic behaviour type: altruistic, dis-altruistic) was used.

2.4. Procedures

The experiment has two phases (**Figure 3**).

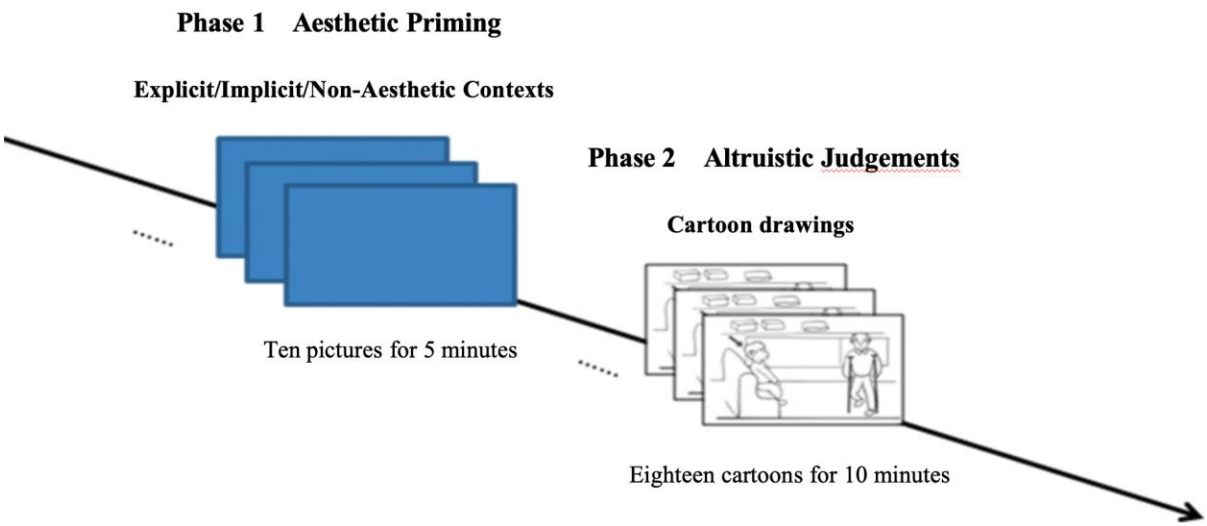

Figure 3. The procedure for experiment 1.

2.4.1. Phase I

In Stage 1, participants were randomly assigned to three initiation situations. To further explore the biomechanical aspects of aesthetic appreciation, we included measurements of movement patterns during the aesthetic judgment tasks. Specifically, we focused on capturing the nuances of participants' movements as they interacted with the aesthetic stimuli, which is in line with biomechanical metrics described in dance research literature [38]. This additional data allowed us to analyze the kinetic responses to aesthetic contexts, potentially revealing how the physicality of movement correlates with aesthetic judgments and subsequent altruistic behaviors.

In the explicit aesthetic context group, participants were presented with artworks on their computer desktops and instructed to appreciate the paintings and judge whether they were "beautiful" or not within 5 min.

In the implicit aesthetic context group, participants were presented with artworks on their computer desktops and asked to judge whether the artworks had water (including sea, rivers, stream and waterfall, etc.) within 5 min. The logic was to set up a fake task unrelated to aesthetic judgement but related to aesthetic feelings, i.e., participants could feel the beauty of the painting while performing the task.

In the non-aesthetic context group, participants were presented with a picture of 20 Chinese characters on their computer desktop and asked to judge whether the Chinese character "water" was in the picture (two-point rating) within 5 min. The logic was to set up a cognitive task as a baseline, which is unrelated to either aesthetics judgement or aesthetic feelings.

2.4.2. Phase II

In Stage 2, all three groups viewed a series of cartoons and decided, "What would you do if you were the main character in the picture? Please judge the likelihood of the behavioural description statement." Each picture was presented for 5 seconds. Participants were required to respond using the number keys on the top of the keyboard while presenting the pictures. Psycloud software was used to run the experimental procedure and collect experimental data.

2.5. Data processing

SPSS 26 was used to analyze the data. The data of five participants whose reaction times (RT) exceeded three standard deviations were deleted.

2.6. Results and analyses

Table 1. Altruistic behavioural judgement probabilities and response times.

Behaviour types / **Context types**	**Altruistic behavioural Responses**				**Dis-altruistic behavioural Responses**			
	RT		Probability ratings		RT		Probability ratings	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
explicit aesthetic context (n = 31)	10019.44	3382.27	6.34	0.42	10126.66	4110.47	2.08	0.76
implicit aesthetic context (n =29)	10487.73	3510.43	5.58	1.01	10708.13	3779.60	1.87	0.76
non-aesthetic context (n = 31)	11439.06	3950.02	5.18	0.72	12451.94	4270.69	1.79	0.73

The altruistic behavioural judgement probabilities and response times were shown in **Table 1**. Results showed that repeated measures ANOVAs for RT indicated an insignificant main effect of aesthetic context, F (2,88) = 2.243, p = 0.112; an insignificant main effect of altruistic behaviour type, F (1, 88) = 2.303, p = 0.133; and an insignificant interaction, F (2, 88) = 0.951, p = 0.390.

A repeated-measures ANOVA on rating probability indicated a significant main effect of aesthetic context, F (2, 88) = 23.351, p < 0.001, partial η^2 = 0.347; a significant main effect of altruistic behaviour type, F (1, 88) = 849.363, p < 0.001, partial η^2 = 0.906; and a significant interaction of aesthetic context and altruistic behaviour, F (2, 88) = 3.886, p = 0.024, partial η^2 = 0.081. Simple effects analyses indicated that in the altruistic condition, participants under explicit aesthetic condition had a significantly higher probability of perceiving altruistic behavioural discovery than under implicit aesthetic condition (p < 0.001, cohen's d = 0.520) and non-aesthetic condition (p < 0.001, cohen's d = 0.372), whereas no significant difference was found between implicit aesthetic and non-aesthetic conditions; in the dis-altruistic condition, there was no significant difference among the three aesthetic contexts. The results suggest that the explicit aesthetic context is more likely to initiate explicit altruistic behaviour than the implicit aesthetic and non-aesthetic contexts. In contrast, the type of aesthetic situation did not affect the dis-altruistic behaviour.

3. Experiment 2: The effects of different aesthetic contexts on pupils' implicit altruistic behaviour

3.1. Participants

One hundred fifty-six third-grade pupils (78 male and 78 female) were selected to participate in experiment 2. All participants had normal vision or corrected to normal vision, and each was paid a certain amount of money.

3.2. Design

The classic Implicit Association Test (IAT) was chosen to measure participants' implicit altruistic behaviour. A two-factor mixed design of 3 (aesthetic context: explicit aesthetic, implicit aesthetic, non-aesthetic) × 2 (task type: compatible task, incompatible task) was used.

In the IAT, participants were asked to give the same behavioural response to the "target word" as to the "attribute word". The underlying logic is that when the concepts of the two words are closely related or compatible, it takes a shorter reaction time to make the same response to both concepts. In contrast, if the concepts of the two words are not closely related or compatible, the response takes a longer reaction time. The difference in reaction times to complete the two types of tasks is known as the IAT effect.

3.3. Materials

The IAT is a 20-word test divided into target words and attribute words [39] . Target words include five Chinese wors describing altruistic behaviour (care, contribute, help, support, and protect) and five Chinese words describing dis-altruistic behaviour (reject, attack, defy, abuse, and cheat). The attribute words include five words Chinese words describing self-related concepts and other related concepts (**Table 2**).

Table 2. Steps and presentation materials of the IAT.

Order	Task	Label	Presentation
1	Initial target conceptual identification	Altruistic and dis-altruisitic	Dis-altruisitic or altruistic words
2	Associative targeting conceptual discernment	Self and other	Words for self or others
3	Compatibility tasks (exercises)	Self and altruistic, others and dis-altruisitic	All words
4	Compatibility missions (formal)	Self and altruistic, others and dis-altruisitic	All words
5	Conceptual identification of opposite objectives	Altruistic and dis-altruisitic	Altruistic or dis-altruisitic words
6	Incompatible tasks (exercises)	Others and altruistic, self and dis-altruisitic	All words
7	Incompatible mandates (formal)	Others and altruistic, self and dis-altruisitic	All words

3.4. Procedures

The experiment consisted of two phases (**Figure 4**). Phase 1 was the same as Experiment 1. In Phase 2, the Greenworld's [12] seven-step paradigm was used : 1) participants were asked to categorise the target concepts, identifying whether the words that appeared are the self or other concepts (e.g., left-click response for "self" and right-click response for "other"); 2) classify attribute concepts to identify whether they represent altruistic or dis-altruisitic behaviour (e.g., "altruistic" with a left-click response, "dis-altruisitic" with a right-click response); and 3) classify mixed target and attribute concepts and, for each pair of concepts, classify them as they were in the first two steps. For each pair of concepts reacting in the same key as their counterparts in the first two steps (e.g., "self + altruistic" with a left critical reaction, "other + dis-altruisitic" with a right key reaction); 4) repeating step 3 for the formal experiment; 5) reclassifying the attribute concepts, reacting in the opposite key to the original one

(e.g., "self + altruistic" with a right key reaction). (e.g., "other+disadvantageous" with a left-key response, "altruistic" with a right-key response); 6) Classification judgement of the remixed target concepts and attribute concepts, with target concepts and attribute concepts reacting in keys corresponding to steps 1 and 5 (e.g., "self+dis-altruisitic" with a right-key response); 7) Repeat step 3 for the formal experiment. "self+dis-altruisitic" with left key reaction, "others+altruistic" with right key reaction); 7) Repeat step 6 for the formal experiment. Only the data from the fourth and seventh steps were analysed, and the data from the third and sixth steps were treated as practice data but not included in the calculation.

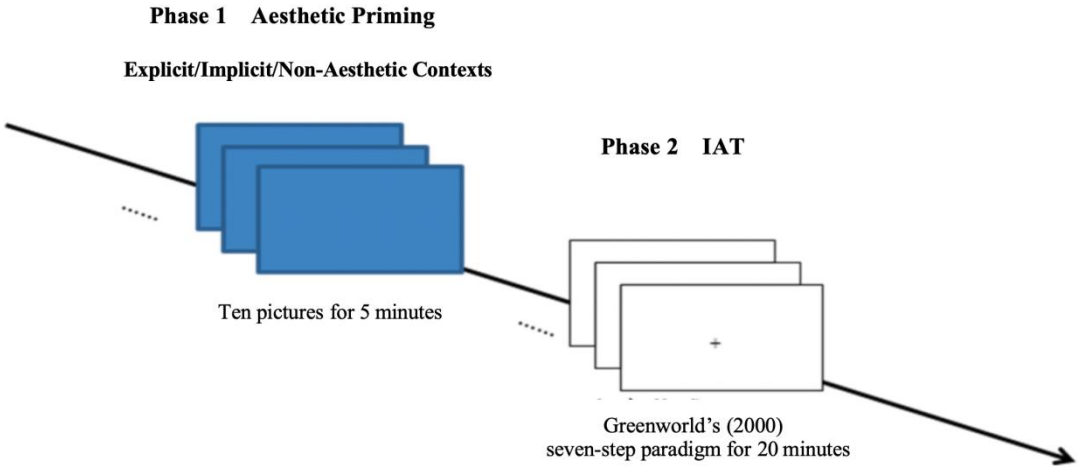

Figure 4. The procedure for experiment 2.

3.5. Data processing

SPSS 26.0 was used to analyse the data. The data of the participants who did not complete all experimental trials and whose average correctness was less than 80% were deleted.

3.6. Results and analyses

3.6.1. Analysis of IAT effect values in implicitly altruistic behaviour

The original IAT data were transformed into natural logarithms. The IAT effect value was obtained by subtracting the average response time of the compatible task from the average response time of the goal-attribute incompatible task. After the logarithmic transformation of each item's reaction time, the logarithmic mean of the reaction times of the compatible and incompatible responses was calculated, and the difference between them was the IAT log effect value (**Table 3**).

Paired *t*-tests revealed a significant difference between participants' RTs under the incompatibility task and the compatibility task (t (130) = 15.11, $p < 0.001$, cohen's $d = 0.698$), a significant difference in the logarithmic value of the IAT effect (t (130) = 15.18, $p < 0.001$, cohen's $d = 0.701$). All responses to the compatible task were significantly faster than those to the incompatible task, which showed an IAT effect.

Table 3. Mean IAT response times (ms) and effect sizes for compatible and incompatible tasks in different aesthetic contexts.

		Compatible task		Incompatible task		IAT effect value	
		M *SD*		*M* *SD*		*M* *SD*	
Explicitly aesthetic context (n = 47)	RT	30891.36	6023.34	41588.19	9042.85	10696.83	8101.02
	Logarithmic	4.48	0.08	4.61	0.10	3.80	0.65
Implicitly aesthetic context (n = 43)	RT	26273.40	5751.80	47726.63	11923.24	21453.23	11585.78
	Logarithmic	4.41	0.09	4.66	0.13	4.14	0.58
Non-aesthetic context (n =52)	RT	36131.27	9090.88	44661.11	9202.94	8529.84	4480.23
	Logarithmic	4.55	0.10	4.64	0.08	3.84	0.33

3.6.2. The effect of different aesthetic contexts on the IAT effect value of implicitly altruistic behaviour

A one-way ANOVA of IAT effect value revealed a significant main effect of aesthetic context, F (2, 128) = 27.928, $p < 0.001$, partial $\eta^2 = 0.625$. Further analysis revealed that the effect value of IAT was greatest in the implicit aesthetic context, which was significantly greater than that in the explicit aesthetic context ($p = 0.023 < 0.05$, cohen's $d = 0.312$) and non-aesthetic context ($p = 0.007 < 0.05$, cohen's $d = 0.562$). The effect value was not significant between the explicit aesthetic context and the non-aesthetic context ($p = 0.853$).

A one-way ANOVA of IAT log effect value showed a significant main effect of aesthetic context, F (2, 128) = 5.052, $p = 0.008 < 0.05$, and partial $\eta^2 = 0.391$. Further analysis revealed that the effect value of IAT was greatest in the implicit aesthetic context, significantly greater than that of the explicit aesthetic context ($p = 0.01 < 0.05$) and non-aesthetic context ($p = 0.032 < 0.05$). The effect value was insignificant between the explicitly aesthetic and non-aesthetic contexts ($p = 0.919$). This suggests that the implicit aesthetic context has the strongest initiating effect on an individual's implicit altruistic behavioural tendencies.

4. Discussion

A positive state of mind and environment can increase the likelihood of altruistic behaviour, and an aesthetic context will beautify the natural and social environment and cultivate a person's state of mind. In this study, we used experimental research to investigate the effects of different aesthetic education methods (creating an explicitly aesthetic context/implicitly aesthetic context/no aesthetic context) on explicit and implicit altruistic behaviour to explore further the psychological mechanism of the influence of aesthetic education on pupils' altruistic behaviour.

4.1. The effect of aesthetic context on explicit altruistic behaviour

Experiment 1 demonstrated the fact that in the altruistic condition, the probability of participants perceiving an altruistic behaviour finding was significantly higher in the explicit aesthetic condition than in the implicit and non-aesthetic conditions and that the difference between the implicit aesthetic condition and the non-aesthetic condition was not significant; and that the difference among the three types of aesthetic

conditions was not significant in the dis-altruisitic condition. This suggests that the explicit aesthetic context is more capable of initiating explicit altruistic behaviour than the implicit and non-aesthetic contexts. On the other hand, the type of aesthetic condition did not affect the dis-altruistic behaviour.

This result first validates previous findings that aesthetics can promote moral behaviour in humans and that there is neuroscience evidence for this link [21–33]. Second, the explicit aesthetic context involves "top-down" aesthetic judgement activities. Aesthetic judgement involves activities in brain regions associated with tvisual, cognitive and emotional processing. We suppose that the positive state of mind and the aesthetic atmosphere during the aesthetic judgement can improve the participant's state of mind, whereas the explicit cognitive judgement contained in the task of explicit altruism (where participants are asked to conceptualize whether to act altruistically or not to act altruistically) reduces cognitive exertion in the subsequent judgement of altruistic behaviour. Therefore, the explicit aesthetic context is more likely to facilitate explicit altruistic behaviour significantly than the implicit and dis-altruisitic context.

4.2. Effect of aesthetic context on implicit altruistic behaviour

The Implicit Association Test (IAT) found a significant IAT effect on altruistic behaviour, suggesting that third-grade students' altruistic behaviour have an implicit tendency. This result firstly validates the previous findings that the implicit initiation of altruistic behaviour is the unconscious activation of altruistic nature [13,39,40] . This activation occurs when an individual is cognitively close to relevant factors vital to one's altruistic nature. The process of participants completing the altruistic meaning grouping task is the process of cognitively approaching the altruistic culture that has an essential influence on one's altruistic nature. Therefore, participants' completion of the altruistic meaning word formation task leads to the concomitant activation of altruistic nature, i.e., implicit initiation occurs [40].

When one-way ANOVA was conducted with aesthetic context as the independent variable, and IAT effect value/IAT log effect value as the dependent variable, respectively, the results all found that the effect value of IAT under the implicit aesthetic context was the largest and significantly more significant than that of explicit and non-aesthetic context. The difference between the explicit and non-aesthetic contexts were not significant. This suggests that the implicit aesthetic context has the strongest initiating effect on an individual's implicit altruistic behavioural tendencies compared to the explicit and non-aesthetic contexts.

Unlike the aesthetic judgement in the explicit aesthetic context, the experimenter did not give any aesthetic instructions but only asked the participants to judge whether there was "water" in the artwork in the implicit aesthetic context. The logic is to set up a fake task that has nothing to do with aesthetics so that the participants can feel the beauty of the painting in the process of doing the fake task. In the implicit aesthetic condition, the bottom-up aesthetics of the paintings played a dominant role. This sense of beauty improved the participant's state of mind through emotions. When the aesthetic object evokes the participant's emotions, the non-social, non-rational impulses, desires, and emotions are subliminally regulated and gradually transformed

into aesthetic emotions permeated with rationality and sociality [41,42]. Once a person possesses this purely rational emotion and ability, he or she can overcome those irrational desires and emotions originating from physiological instincts and dedicate himself or herself to realizing the interests of others regardless of personal gain or loss.

4.3. Analysis of the mechanism of influence of different types of aesthetic contexts on pupils' explicit and implicit altruistic behaviour

Experiment 1 showed that an explicit aesthetic condition was more likely to initiate explicit altruistic behaviour than an implicit or non-aesthetic situation. Experiment 2 showed that implicit aesthetic situations were more likely to initiate implicit altruistic behaviour than explicit and non-aesthetic situations. This, on the one hand, indirectly verifies that implicit altruistic behaviour is independent of the structure of explicit altruistic behaviour. On the other hand, it also suggests that the aesthetic context has a different mechanism of influence on explicit and implicit altruistic behaviour.

Combining the analyses of aesthetic judgement activities and aesthetics in previous studies, we believe that the selective facilitation of explicit aesthetic contexts for explicit altruistic behaviour can be modelled as a "top-down" mechanism of aesthetic judgement activities. In contrast the facilitation of implicit aesthetic contexts for implicit altruistic behaviour can be modelled as a "bottom-up" mechanism of aesthetic perception.

This is because, first of all, the explicit aesthetic situation contains task-explicit aesthetic judgement, which prompts participants to consciously and actively make value judgements about the artwork, emphasising the cognitive judgement component of the aesthetic process, and participants will pay more attention to the task per se [37,43,44]. What is embodied is the role and influence of the participant (aesthetic subject) on the aesthetic judgement activity. On the one hand, the positive state of mind and the aesthetic atmosphere, when conducting aesthetic judgement, effectively enhance the participants' aesthetic interests, and they are closer to the pursuit of beauty and nobility in their state of mind. On the other hand, the task of explicit altruism also contains explicit cognitive judgements, which are similar to the pathway dependence of aesthetic judgement activities—both requiring cognitive, visual and emotional engagement—reducing cognitive exertion for subsequent judgements of altruistic behaviour. Thus, explicit aesthetic contexts that contain explicit tasks are more likely to significantly promote explicit oriented altruistic behaviour than implicitly aesthetic and non-aesthetic contexts.

Secondly, in the implicit aesthetic situation, since there is no explicit task instruction, the participants do not have to make any conscious and active aesthetic judgement; at this time, the unique feelings (i.e., the sense of beauty) triggered by the artwork (the aesthetic object of specific value) play an active role. In this case, the main characteristics of the sense of beauty are "rewarding" and "unconscious". In essence, the implicit initiation of altruistic behaviour is the unconscious activation of the altruistic nature. It will activate the implicit tendency of altruistic behaviour.

In summary, we hypothesized that the selective facilitation of explicit/implicit altruistic behaviour by explicit/implicit aesthetic contexts rely on two different pathways (**Figure 5**).

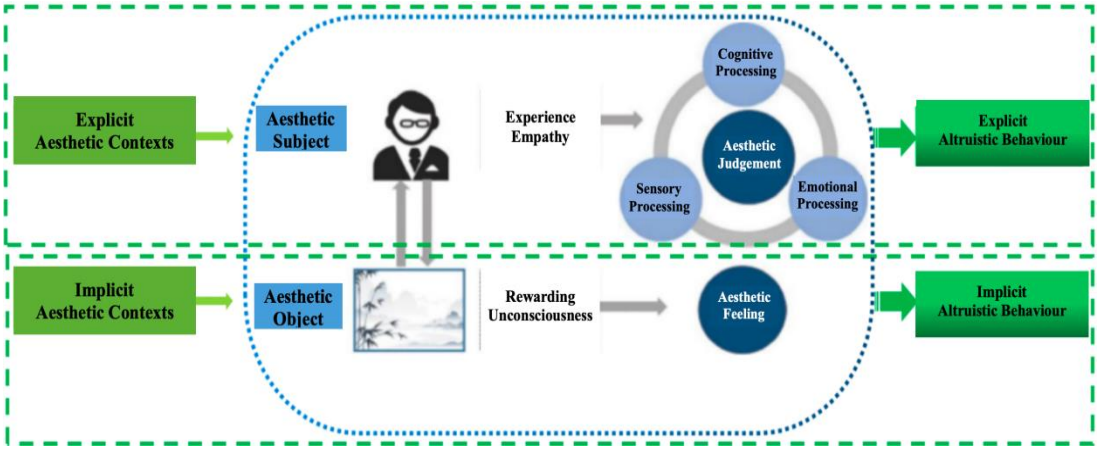

Figure 5. The pathways of the selective facilitation of explicit/implicit altruistic behaviour by explicit/implicit aesthetic contexts.

4.4. Biomechanical influences on aesthetic perception

Our analysis extends beyond psychological mechanisms to incorporate biomechanical factors that influence aesthetic perception. Particularly, the complexity of movement has been identified as a significant predictor of aesthetic judgment [38]. This suggests that the aesthetic experience is enriched by the intricate dynamics of physical movement, which in turn can influence altruistic behavior. The integration of physical and perceptual processes is a key aspect of aesthetic appreciation, as highlighted by [45], who discuss the neurological underpinnings of how we process and respond to aesthetic stimuli through movement.

Furthermore, the role of postural control in influencing perceptual processes cannot be overlooked [46]. Postural adjustments have a direct impact on cognitive processing, which can subsequently affect how individuals perceive and respond to aesthetic elements within their environment. This finding has profound implications for understanding aesthetic experiences, as it suggests that our physical stance and balance play a role in shaping our aesthetic and moral judgments.

4.5. Ecological validity limitations

The lab setting limits the generalizability of our findings to real-world classrooms. Future research should use more naturalistic designs to better understand aesthetic influences on altruism in educational contexts.

4.6. Practical implications

The findings of this study have direct implications for classroom teaching practices, particularly in the realm of aesthetic education. Based on our results, we propose the following specific and actionable teaching suggestions to foster altruistic behavior among students [47–51]:

Incorporating Aesthetic Elements: Teachers can enrich the learning environment by integrating aesthetic elements such as artwork, music, or nature-inspired designs. These elements can evoke positive emotions and create an atmosphere conducive to altruistic behaviors.

Aesthetic Appreciation Activities: Regular lessons on aesthetic appreciation can be incorporated into the curriculum. For example, students can be guided to reflect on the beauty of nature during outdoor lessons or discuss the aesthetics of different art forms, thereby enhancing their sensitivity to beauty and its moral implications.

Creative Expression Opportunities: Encourage students to express themselves creatively through art, drama, or writing. Such activities can help students develop empathy and understanding towards others' perspectives, which are foundational to altruistic behavior.

Role-Playing and Simulations: Utilize role-playing and simulations to place students in scenarios that require altruistic decision-making. This can help them practice and internalize the values of kindness and cooperation.

Aesthetic and Moral Discussions: Facilitate discussions that link aesthetic experiences with moral and ethical considerations. For instance, after watching a performance or visiting an art exhibition, have students discuss how the experience affected their feelings and behaviors towards others.

Incorporate Movement and Posture in Learning: Given the link between posture, movement, and aesthetic perception, incorporate physical activities that encourage good posture and mindful movement. This can enhance cognitive processing and potentially influence students' aesthetic and moral judgments.

By implementing these strategies, educators can create a more aesthetically rich and morally engaging learning environment that nurtures the development of altruistic behavior in students [47–51].

5. Conclusion

It was found that the explicit aesthetic context had a selective facilitating effect on pupils' explicit altruistic behaviour. In contrast, the implicit aesthetic context had a selective initiating effect on implicit altruistic behaviour. This result verifies that implicit altruistic behaviour is independent of the structure of explicit altruistic behaviour. Meanwhile, it also suggests that the two selective facilitating effects depend on two different pathways. This further suggests that creating different aesthetic education methods can effectively promote students' explicit or implicit altruistic behaviour in actual aesthetic education teaching.

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