



An objective evaluation of the beholder's response to abstract and figurative art based on construal level theory

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Does abstract art evoke a different cognitive state than figurative art? To address this question empirically, we bridged art theory and cognitive research and designed an experiment leveraging construal level theory (CLT). CLT is based on experimental data showing that psychologically distant events (i.e., occurring farther away in space or time) are represented more abstractly than closer events. We measured construal level elicited by abstract vs. representational art and asked subjects to assign abstract/representational paintings by the same artist to a situation that was temporally/spatially near or distant. Across three experiments, we found that abstract paintings were assigned to the distant situation significantly more often than representational paintings, indicating that abstract art was evocative of greater psychological distance. Our data demonstrate that different levels of artistic abstraction evoke different levels of mental abstraction and suggest that CLT provides an empirical approach to the analysis of cognitive states evoked by different levels of artistic abstraction.

construal level | art | perception

Art is incomplete without the perceptual or emotional involvement of the viewer.

Alois Riegl

A viewer's subjective experience is essential to a work of art. How a viewer projects their own meaning onto a work of art has been of interest to both art historians and psychologists for more than a century. First formalized as the "beholder's involvement" by Alois Riegl (1), the viewer's active participation in a work of art became known as the "beholder's share" in the writings of Ernst Gombrich (2).

Subjectively experiencing a work of art may involve a myriad of cognitive processes, ranging from perceptual to mnemonic (3), and these vary based on level of abstraction of the art (4–6). The more abstract the work of art, the more ambiguous the image, and the "more the beholder must contribute to assign the work of art meaning, utility, and value" (5). It follows, then, that the subjective experiences of abstract and representational art are different, but empirically characterizing these differences is challenging. While much research has focused on differences in preferences, here we seek to determine whether abstract art and representational art evoke quantifiably different states of mind.

Differences in Processing Abstract and Representational Art.

Individual interpretations. Research in the field of neuroaesthetics has found that abstract art, defined here as art without objects or scenes, is approached and processed differently by the beholder than representational art, which details naturalistic objects or scenes. It has been suggested that the objects in a representational painting help instruct the beholder on how to view and

interpret the painting (7), whereas the lack of objects in abstract art forces the viewer to devise new ways to explore the painting outside of traditional patterns of object discovery—going beyond recognition and creating new personal associations in the process (5, 6). This additional contribution results in individual (subjective) interpretations of the same work, as reflected by greater variation in viewer response (8). While these variations in viewer response suggest the personal and constructive nature of the contributions that the beholder makes to the meaning of abstract works of art, an objective characterization of differences in the psychological experience of abstract art remains to be defined. **Eye tracking/brain imaging.** Research in neuroaesthetics has demonstrated that abstract art elicits different mental processes than representational art, in line with what we might expect given the lack of object representation (9). The differences begin with how abstract art directs our gaze. While representational art elicits more local and object-focused scan paths, abstract art elicits more globally distributed viewing patterns (7, 10, 11). This suggests that without the traditional cues of objects and scenes to guide our eye movements, we adopt more exploratory strategies for seeking visual information. This local vs. global gaze difference in response to representational and abstract art is mirrored in brain activity. Functional magnetic resonance imaging has shown that viewing representational art (portraits, landscapes, and still-lives) activates category-specific brain areas that are

Significance

Art affects our mindset; it can be therapeutic, emotionally evocative, and generative of aesthetic experience. But how art recruits cognitive processes, and how this process differs between abstract and representational art, remain unknown. To quantify differences in mindset evoked by abstract and representational art, we drew on construal level theory (CLT), a psychological theory that has systematically characterized differences in abstract and concrete mindsets. In three different decision making tasks, we found that abstract art evokes a more abstract mindset than representational art. Our data suggest that abstract and representational art have differential effects on cognition and that CLT provides a useful new empirical approach to the analysis of cognitive states evoked by different levels of artistic abstraction.

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thought to be tuned for faces, places, and objects, whereas viewing abstract art does not (12), instead activating areas thought to be tuned to features of intermediate complexity, such as shape and color (13, 14). In addition, transcranial magnetic stimulation has shown that the lateral occipital area, a key node in object recognition (15), plays a causal role in the aesthetic appreciation of representational art but not of abstract art (16), while V5, thought to process implied motion (17), plays a role in the aesthetic appreciation of abstract art but not of representational art (18).

Taken together, these findings suggest that the differences in perceptual features (lack of objects) inherent in abstract art are reflected in differences in processing. However, while this research points to the fact that abstract art is processed differently, it does not characterize quantifiable differences in the subjective psychological experience that abstract art generates. It is this difference that we examine in this paper.

Measuring Differences in Subjective Experience: Construal Level Theory. One way to quantify differences in the subjective experience of art is by measuring mindsets or cognitive states that different types of art evoke. A mindset or cognitive state can be defined as specific patterns of activity or behavior that make certain representations/habits readily available (19). We tested whether there are different cognitive states elicited by abstract vs. representational art using construal level theory (CLT), a cognitive theory of abstraction that systematically characterizes differences in abstract and concrete mindsets and can predict the availability of more abstract or concrete representations.

CLT is based on the premise that our mental representations of objects or events are flexible—we represent (or construe) different mental objects or events at different levels of abstraction, depending on the context of that object or event (20). Lower construal of an object involves representing that object by its concrete, item-specific, contextual features, while higher construal of an object involves representing that object by its abstract, essential, and decontextualized components. Critically, psychological distance (i.e., distance from the self) defines how abstractly we mentally represent objects and events, and the farther away in time or space an object or event occurs, the more likely that object or event will be mentally represented by its abstract components. This relationship between abstraction and distance serves as a tool to aid decision making. When making decisions about an event occurring far away in space or time, we are more likely to consider higher-level, more abstract components, as these components will be more likely to still be relevant in a distant setting. When making a choice about something close, we are more likely to consider concrete details, as they provide relevance in the here and now (20–23).

Results from CLT show a bidirectional relationship between psychological distance and abstraction. In other words, not only are psychologically distant objects and events represented more abstractly, but abstract construals of objects and events are felt to be more psychologically distant. High-level construals, by preserving abstract features, support “mental travel” (24), whereas low-level construals are bound to “me, here, and now” (21). This has been shown behaviorally. Considering “why” (vs. “how”) an event occurs, or priming subjects with a global (vs. local) processing task, increases temporal distance judgments of that event (25, 26). CLT’s well-reproduced association between psychological distance and level of abstraction of representations make psychological distance an attractive way to measure empirical differences in subjective interpretation of art, by quantifying differing levels of representation that abstract art evokes.

Psychological distance is already being applied in the context of aesthetics. One study found that temporal distance affects attitudes toward art (27). In that study, subjects were first primed by imagining their lives tomorrow (near future) or a year from

now (far future) and then asked to rate the conventionality of representational art and abstract art. The subjects given the far-future priming rated abstract art as more conventional than those given the near-future priming, while the subjects given the near-future priming rated representational art as more conventional than the subjects given the far-future priming. The authors suggested that far-future priming elevates construal level, resulting in the inclusion of abstract (unconventional) art within the category of art, whereas it may not previously have been perceived by others as a piece of art. Another study (28) showed abstract and representational art to subjects who were simultaneously listening to a recording in either their native language (psychologically near condition) or a foreign language (psychologically distant condition). They found that inducing greater psychological distance (listening to a foreign language) increased appreciation for abstract art.

While these studies illuminate environments in which abstract art is appreciated, we use psychological distance as a measure of the level of abstraction of the processes involved when viewing abstract art. As psychological distance has been used in previous studies to measure levels of mental representations of objects and events, we use it as an empirical measure of different cognitive states/processes elicited by abstract and representational art. In seeking to understand the relationship between different levels of abstraction of art and psychological distance, our study addresses the question of whether abstract art evokes a quantifiably different mindset than representational art.

To address this question, we performed three experiments: two between-subjects online experiments and one within-subjects experiment in a laboratory environment. Each experiment consisted of a forced-choice paradigm in which subjects were shown paintings of varying levels of abstraction by the same artist and asked to assign each painting to a hypothetical gallery located temporally or spatially distant or near to the subject (i.e., a gallery opening tomorrow vs. a gallery opening in a year and a gallery opening around the corner vs. a gallery opening in another state). Experiment 1 measured temporal distance judgments in a large sample of online participants; Experiment 2 replicated the study while measuring spatial distance judgments, also with online participants; and Experiment 3 replicated the temporal distance experiment in a smaller sample of participants tested in the laboratory and included additional measures of liking of individual paintings and subjects’ overall experience with art. We hypothesized that abstract art and representational art would elicit different psychological distances; specifically, we expected that when viewing abstract art, participants would be more likely to choose to place the art in a more distant time or place compared with representational art.

Experiment 1

Experiment 1 tested the hypothesis that abstract art evokes more temporal distance than representational art, using a large sample of online participants.

Methods.

Stimuli. We operationalized abstract art as the absence of realistically depicted objects or scenes. As stimuli, we used paintings by four abstract artists—Mark Rothko, Piet Mondrian, Chuck Close, and Clyfford Still—each of whom had developed a progressively more abstract style over their careers, transitioning from representation to elimination of objects completely (29, 30). Given that all works of art can be considered to fall somewhere on the continuum of abstraction, we divided abstraction level into three categories organized by how recognizable an object is in a painting: representational, indeterminate, and nonrepresentational. Representational paintings were defined as containing easily recognizable objects, indeterminate paintings were defined as containing recognizable but obviously distorted

objects, and nonrepresentational paintings were defined as not containing any recognizable objects. For example, in one set of stimuli by Clyfford Still, a representational painting depicts a realistic self-portrait; an indeterminate painting hints at a body, which can still be recognized through its distortion; and a nonrepresentational painting shows no recognizable objects but rather consists of jagged blocks of color and lines. We excluded nonrepresentational paintings that were solely geometric (geometric shapes are often interpreted as objects).

A total of seven sets of three paintings were collected, with each set consisting of a representational painting, an indeterminate painting, and a nonrepresentational painting by the same artist (to control for skill level and style). This categorization was confirmed by online objective ratings. To gauge the level of abstraction of the paintings, 40 independent subjects from Amazon's Mechanical Turk rated each painting from 1 to 7 according to how abstract they thought the painting was. Independent liking ratings were also obtained (*SI Appendix*).

Participants. On Mechanical Turk, 840 independent subjects saw one of 21 paintings; 40 subjects saw each painting. The subjects' demographic information, liking of, and experience with art were not explicitly determined (as they were in Experiment 3).

For all the experiments reported in this paper, the experimental procedures were approved by the Institutional Review Board at Columbia University. All participants provided informed consent before taking part in the experiments.

Procedure. To measure temporal distance, subjects were asked to imagine being an art consultant. Each subject was shown one painting and then asked whether or not the painting should hang in a gallery opening "tomorrow" or "in a year" (Fig. 1A). A total of 840 participants each viewed one of the 21 paintings (40 subjects per painting). Each subject was paid 10 cents per response.

Data and Materials Availability. All data and analytic code can be accessed at <https://github.com/cdurk/construal>.

Results and Conclusion.

Abstract art is associated with increased temporal distance. To examine the relationship between level of abstraction of art and temporal distance, we ran a χ^2 test for independence. The relationship between these variables was significant, such that abstract art was more likely than representational art to be placed in a gallery opening in a year: $\chi^2(2, n = 840) = 30.423; P < 0.001$ (Fig. 2).

Subjects were more likely to place abstract art in a temporally distant situation, indicating that abstract art elicits more abstract representations. However, abstract art may be associated with the future, given its later development in the history of art. Experiment 2 addressed the issue of a potential temporal confound by testing spatial distance.

Experiment 2

Because temporal distance may have been confounded with the historical development of artistic style (abstract art being developed later in time), this experiment sought to replicate the study with spatial distance.

Methods. As in Experiment 1, here 840 independent Mechanical Turk subjects saw one of 21 paintings, and 40 subjects saw each painting. These subjects were different from the subjects in Experiment 1. To measure spatial distance, each subject was shown one painting, asked to imagine being an art consultant, and asked to assign the painting to a gallery opening "around the corner" or "in another state". The subjects were paid 10 cents for each response.

Results and Conclusion.

Abstract art is associated with increased spatial distance. To examine the relationship between level of abstraction of art and spatial

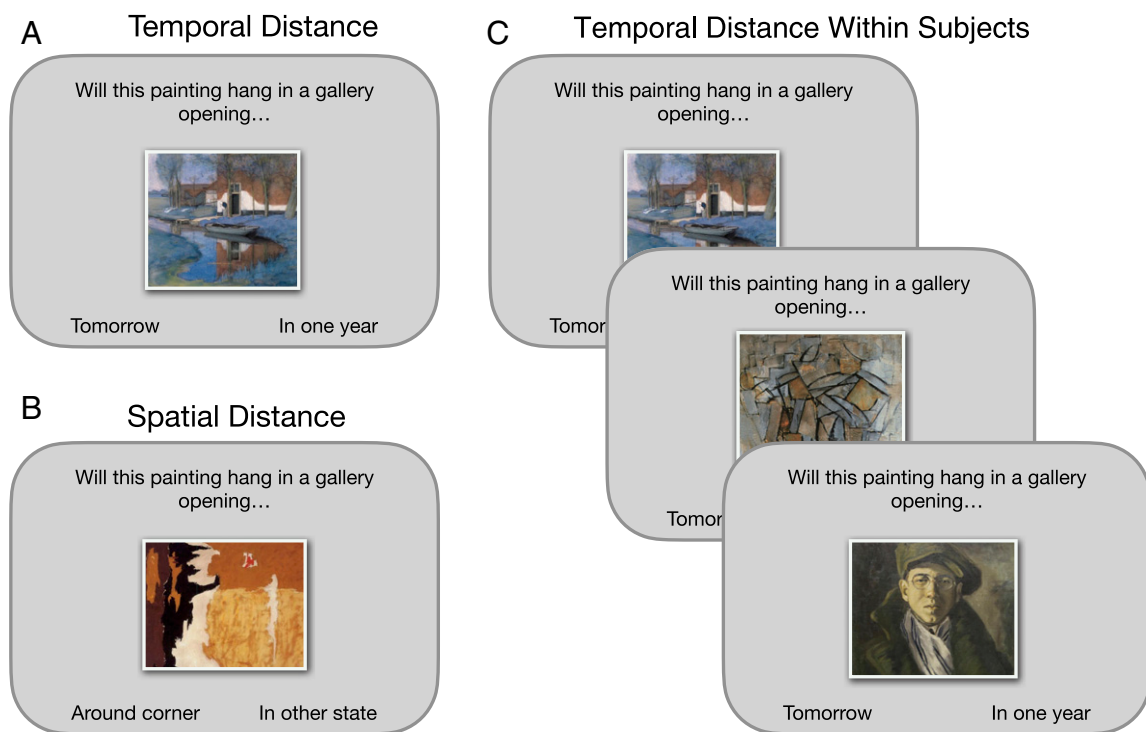


Fig. 1. Sample task events for Experiments 1 to 3. (A) Task measuring temporal distance evoked by art. In Experiment 1, subjects performed the temporal distance task; each subject saw one painting and made a distance judgment. (B) Task measuring spatial distance evoked by art. In Experiment 2, subjects performed the spatial distance task; each subject saw one painting and judged it. (C) In Experiment 3, subjects performed the temporal distance task; each subject responded to a total of 21 paintings (7 concrete, 7 indeterminate, and 7 abstract).

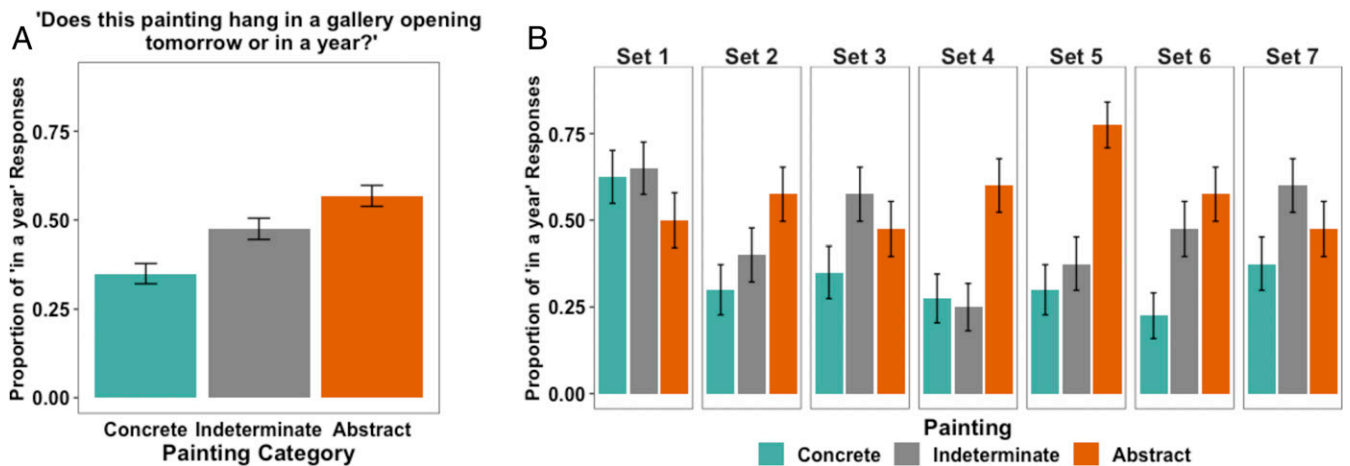


Fig. 2. Results of Experiment 1. Abstract art elicits greater temporal distance than indeterminate and representational art. (A) Effect of category of art on temporal distance judgments. (B) Effect of category of art on distance response, broken down by painting. Each set of art represents one representational painting, one indeterminate painting, and one abstract painting, all by the same artist (SI Appendix). Error bars represent SE.

distance, we ran a χ^2 test for independence. The relationship between these variables was significant; abstract art was more likely than representational art to be placed in a gallery in another state: $\chi^2(2, n = 840) = 38.25; P < 0.001$ (Fig. 3).

Subjects were more likely to place abstract art in a spatially distant situation. These results indicate that abstract art elicits more abstract mental representations compared with representational art, and the results were not solely due to a confounding futuristic quality of abstract art. We next examined whether liking of art and experience with art affected these distance judgments. To understand whether or not the previous results were due to liking/disliking the paintings or differing levels of experience with art, we performed a third experiment in which subjects each saw all 21 paintings, made a temporal distance judgment for each, rated their liking of the paintings, and answered questions about their experience with art.

Experiment 3

This experiment examined the role that liking and experience may play in temporal distance judgments. Unlike Experiments 1 and 2, Experiment 3 took place in a laboratory environment,

where each subject was exposed to all 21 stimuli and was later asked to rate the stimuli and answer questions about art.

Methods.

Participants. The participants in Experiment 3 included 51 subjects in and around the Columbia University community who were recruited through an advertisement for the study. Subjects were age 18 to 22 y, and most had little to no experience with art, as determined by answers to the questions “how would you characterize your experience with art?” and “how many hours a week do you look at art?” Subjects characterized themselves as novice ($n = 25$), enthusiast ($n = 23$), art historian ($n = 2$), or artist ($n = 1$). We excluded the two art historians and the one artist from our analysis, as well as one novice who did not complete the experiment, leaving a final sample of 47.

Procedure. Subjects were shown all 21 paintings, one at a time, in randomized order. Stimuli were presented on a 27" iMac monitor with a 2,560 × 1,440 pixel display, using PsychoPy, an open-source stimulus presentation software (31). All artworks were displayed as half the height and width of the screen and at a texture resolution of 512 pixels. Subjects viewed each painting and were asked whether the painting should hang in a gallery

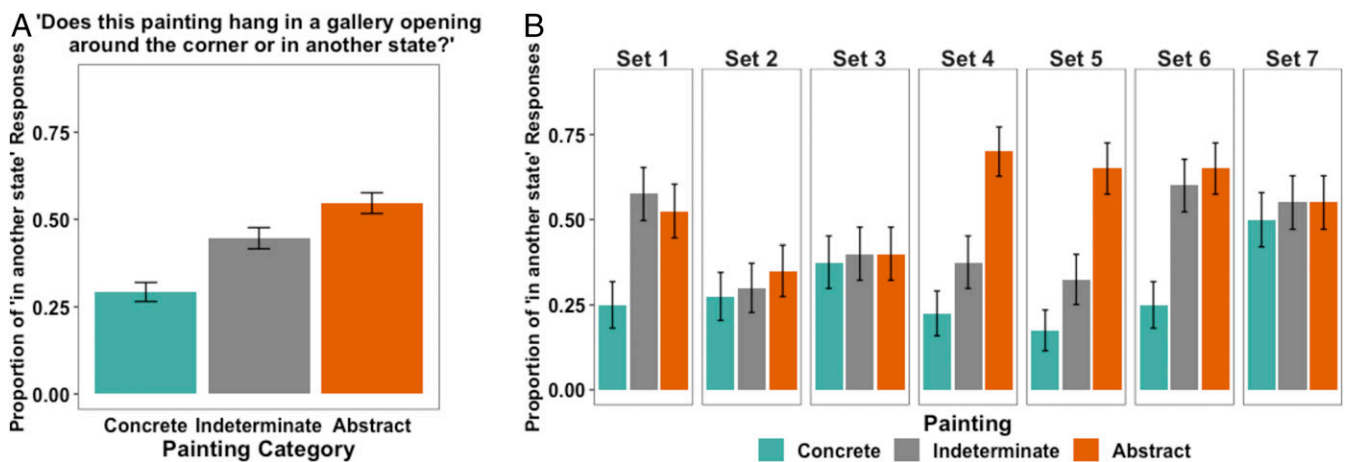


Fig. 3. Results of Experiment 2. Abstract art elicits greater spatial distance than indeterminate and representational art. (A) Effect of category of art on spatial distance response. (B) Effect of category of art on distance response, broken down by painting. Each set of art represents one representational painting, one indeterminate painting, and one abstract painting, all by the same artist (SI Appendix). Error bars represent SE.

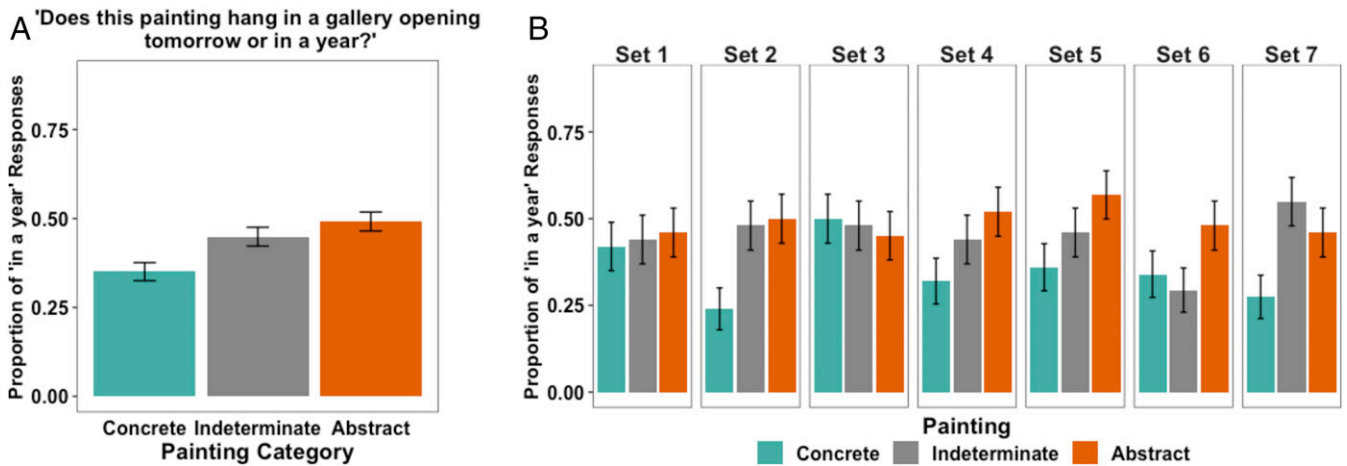


Fig. 4. Results of Experiment 3. Abstract art elicits greater spatial distance than indeterminate and representational art. (A) Effect of category of art on spatial distance response. (B) Effect of category of art on distance response, broken down by painting. Each set of art represents one representational painting, one indeterminate painting, and one abstract painting, all by the same artist (SI Appendix). Error bars represent SE.

opening “tomorrow” or “in a year”. After seeing all the paintings, subjects were then shown the paintings again and asked to rate how much they liked each painting on a 7-point Likert scale. They were then asked to rate how abstract the painting was (from 1, least abstract to 7, most abstract). Finally, subjects were asked to categorize their experience with art as either a novice, enthusiast, artist, or art historian and to report how many hours per week they spent looking at art.

Data analysis. For Experiment 3, in which all subjects viewed all the paintings sequentially, we used a linear modeling package created for the programming language R: lme4 (32). We ran two mixed-effects logistic regressions to model the relationship between painting category and psychological distance while controlling for liking of each painting and experience with art. Model 1 included painting category, liking rating, art expertise and hours spent with art per week as fixed effects and by-subject random intercepts. Model 2 was identical to model 1, except that painting category was replaced by abstraction rating. *P* values were obtained by likelihood ratio tests of the full model with the effect in question against the model without the effect in question.

Results.

Relationship between distance and painting category. Painting category was a significant predictor of distance. Similar to Experiments 1 and 2, we found that both indeterminate ($b = 0.37$; 95% CI, 0.05 to 0.70; $P = 0.026$) and abstract art ($b = 0.46$; 95% CI, 0.13 to 0.79; $P = 0.006$) were significantly more likely than representational art to be placed in a gallery opening “in a year” (Fig. 4).

Distance and abstraction rating. To ensure that the effect of distance was not due to subjectively defined categorizations of art, we also ran a model looking at the effect of independent abstraction ratings on distance choice. We found that subjects’ abstraction rating was a significant predictor of distance (Fig. 5), such that paintings with a higher average abstraction rating were more likely to be placed farther away ($b = 0.07$; 95% CI, 0.01 to 0.13; $P = 0.030$).

Liking. We found that liking rating also had a significant effect on distance, such that subjects were less likely to place a painting they liked in a gallery opening “in a year” ($b = -0.29$; 95% CI, -0.37 to -0.21 ; $P < 0.001$). To understand the two effects, we ran a model including them as an interaction and found no significant interaction between liking and abstraction ratings ($b = 0.01$; 95% CI, -0.02 to 0.05 ; $P = 0.474$). We conclude that the effects are additive, and when controlling for liking, the effect of abstraction value on distance persists.

Experience with art. Our finding that liking rating has a significant effect on distance raises the question about the effects of expertise and/or exposure on distance induced by abstract art. We obtained two measures of experience with art, one characterizing subjects’ relationship with art (novice, enthusiast, artist, or art historian) and the other concerning how many hours subjects viewed art per week (0, 1 to 4, 5 or more). We found that novices and enthusiasts did not differ in distance response ($b = -0.32$; 95% CI, -0.71 to 0.08 ; $P = 0.116$), and neither did subjects who spent 1 to 4 (vs. 0) hours per week with art ($b = -0.28$; 95% CI, -0.67 to 0.12 ; $P = 0.170$) (Table 1).

Conclusion and Discussion. Experiment 3 extended Experiments 1 and 2 with a within-subjects manipulation while controlling for liking of paintings and experience with art. As in the first two

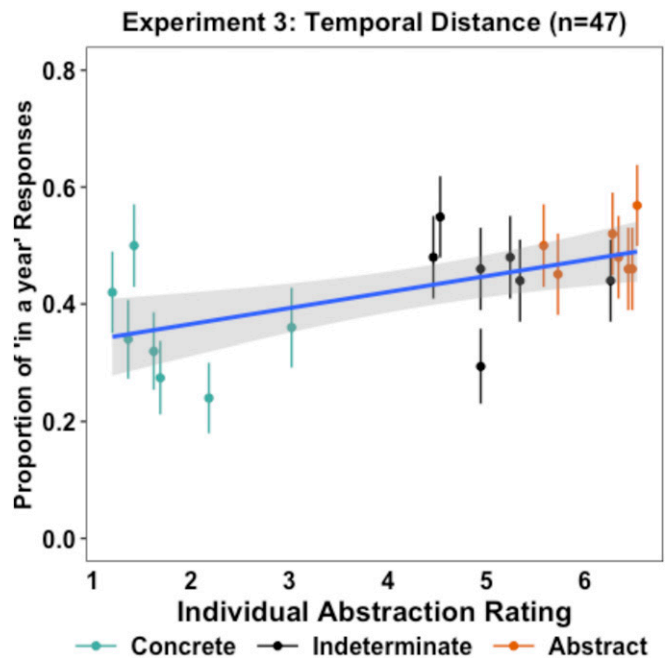


Fig. 5. Proportion of instances each painting was placed in a year according to the abstraction ratings for Experiment 3. In Experiment 3, the abstraction ratings were given by the subjects.

Table 1. Regression table for two models predicting temporal distance response in Experiment 3

Predictor	P (in a year)			P (in a year)		
	b	95% CI	P value	b	95% CI	P value
Intercept	0.58*	0.09–1.06	0.020	0.57*	0.04–1.10	0.034
Category (indeterminate)	0.37*	0.05–0.70	0.026			
Category (abstract)	0.46**	0.13–0.79	0.006			
Liking rating (1 to 7)	–0.29***	–0.37 to –0.21	<0.001	0.29***	–0.37 to –0.21	<0.001
Hours spent with art per week (1 to 4)	–0.28	–0.67–0.12	0.170	–0.25	–0.63–0.14	0.214
Art experience (enthusiast)	0.32	0.08–0.71	0.116	0.30	0.09–0.69	0.129
Abstraction rating				0.07*	0.01–0.13	0.030
Number of participants		47			47	
Observations		987			987	
Marginal R^2 /conditional R^2		0.090/0.144			0.085/0.137	

The first model (left) includes category of art as a predictor, whereas the second model (right) includes subject’s abstraction rating. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

experiments, abstract art was more likely than representational art to be placed in a psychologically distant condition. Although liking was a predictor of this distance choice, we found that when controlling for liking, the effect of abstraction on distance remained. This suggests that abstract art elicits more psychological distance, indicating a more abstract cognitive state. Neither subjects’ self-described experience with art (novice vs. enthusiast) nor hours spent viewing art per week was predictive of their distance choice (Table 1).

General Discussion

Art elicits a cognitive outcome and is designed to engineer a state of mind in the beholder (33), but how do these states of mind differ when elicited by abstract art vs. representational art? In this study, we used psychological distance as a theoretically and empirically based indicator of construal level (20–23). Specifically, we presented subjects with various abstract and representational paintings and asked them to judge each painting’s temporal and spatial placement in the world. Overall, we found that abstract art was more likely to be assigned to the more distant situation. This pattern of distance assignments across both spatial and temporal decisions suggests that abstract art is more highly construed.

This conclusion was supported by three experiments probing different dimensions of psychological distance. Experiment 1 measured temporal distance judgments in a large sample of online participants; Experiment 2 replicated Experiment 1 while measuring spatial distance judgments, also with online participants; and Experiment 3 replicated the temporal distance finding in a smaller sample of participants tested in the laboratory. Together, these studies show a reliable association between the perceived abstractness of paintings and assignment to distant settings, independent of both liking of the paintings and the temporal situatedness of abstract art.

Abstraction and Context Invariance: Where Abstract Artists and Construal Level Theorists Meet. CLT has shown that abstract construal of a psychologically distant mental object involves representing that object by its essential features, which are invariant to changes in context (21, 34–36). With distance comes the potential for contextual change—and so ancillary features of distant objects/events become irrelevant, as they may change with a changing environment. In this sense, abstract mental construal serves as an adaptive mental tool to predict and plan for distant mental events whose context is uncertain. In our study, the assignment of abstract art to a more distant context suggests that abstract art depicts context-invariant representations that survive the passage of time or space. Specifically,

abstract art transcends the idiosyncrasy of the here-and-now and remains relevant across greater context variability.

The idea of context-invariance was present in the minds of the artists from whom we sampled, whose theories of abstraction were deeply grounded in the notion of context (29, 37, 38). Abstract expressionists viewed abstraction as a process of revealing unchanging laws of reality, achievable only by divorcing the representation from all context. By removing any reference to the natural world (context), abstract art is able to reveal “laws hidden in the reality that surrounds us and do not change” (37). Mondrian, by reducing “natural forms to the constant elements of form and natural colours to the elementary colours” (37), was attempting to isolate essential, context-invariant truths about color and form. Other writings of such artists as Kandinsky (29) and Matisse (38) describe abstract art as isolating properties of reality that will remain the same over time, independent of changes in context. These artists spent years intentionally crafting these context-invariant representations. Our findings suggest that indeed these representations are realized in the beholder.

Implications for the Role of Memory in Processing Abstract Art.

While context-dependent representations include more external (sensory) information, context-invariant representations relate to information that we carry with us in memory (39–41). Although past research in neuroaesthetics has shown that passive viewing of abstract art activates brain regions tuned for processing simple sensory information (12, 13), our findings suggest that actively construing abstract art transcends direct sensory experience, evoking higher-level representations in the beholder and potentially activating a more mnemonic processing mode (42). If this is so, it should result in different patterns of neural activity in sensory regions related to perception of different forms of art and different experiences of construal. This prediction remains to be tested using, for example, fMRI to compare connectivity between visual areas and higher-level areas during near/far decisions made about abstract and representational art. If found, the activation of a more mnemonic processing mode while making decisions about art would support the conception of the beholder’s share as an active process in which we project our expectations and memories onto a work of art to endow it with meaning (3) (and must do this more so with abstract art).

Overall, our findings suggest that abstract art is represented as context-invariant, affording a traversal of mental time and space and resulting in a distal spatiotemporal placement in the world. In contrast, representational art is more limited and narrower in its spatiotemporal reach. This finding in the art domain may extend to other dimensions of psychological distance, such as

social distance (43–45) and hypotheticality (46–48). Abstract art may traverse social distance by connecting and affording aesthetic experiences to socially remote and diverse beholders. Abstract art may similarly remain invariant across hypothetical outcomes and connect to imagined and even unlikely beholders and settings. Finally, as context-independent representations are thought to recruit memory, the perception of abstract art as context-invariant suggests that beholding abstract art may involve a unique relationship between sensory and mnemonic

processing, and raises questions for future studies of the role of memory as a common mechanism by which we project ourselves both into a work of art and into a psychologically distant situation.

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