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When a Picasso is a "Picasso": The entry point in the identification of visual art

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ABSTRACT

We investigated whether art is distinguished from other real world objects in human cognition, in that art allows for a special memorial representation and identification based on artists' specific stylistic appearances. Testing art-experienced viewers, converging empirical evidence from three experiments, which have proved sensitive to addressing the question of initial object recognition, suggest that identification of visual art is at the subordinate level of the producing artist. Specifically, in a free naming task it was found that art-objects as opposed to non-art-objects were most frequently named with subordinate level categories, with the artist's name as the most frequent category (Experiment 1). In a category-verification task (Experiment 2), art-objects were recognized faster than non-art-objects on the subordinate level with the artist's name. In a conceptual priming task, subordinate primes of artists' names facilitated matching responses to art-objects but subordinate primes did not facilitate responses to non-art-objects (Experiment 3). Collectively, these results suggest that the artist's name has a special status in the memorial representation of visual art and serves as a predominant entry point in recognition in art perception.
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1. Introduction

People have an astonishing ability to identify objects in a fast, automatic, and very efficient way. This behavior is an evolution-based adaptation for accessing memory representations involving the identification of objects and the corresponding demands for specific actions (Rosch, 1975). In their seminal studies, Rosch, Mervis, Gray, Johnson, and Boyes-Braem (1976) determined the principles by which humans divide up the world the way they do. There is now a substantial body of research suggesting that most objects are initially classified at a particular level of abstraction, called the basic level (for a review, see Rosch et al., 1976). The basic level is defined as (a) the level at which most knowledge is organized and the highest level of abstraction at which a single mental image can be formed, (b) category members share a similar shape, and (c) similar motor actions are used to interact with category members (Tanaka, 2001). Rosch (1975) argued that the basic level of categorization provides the entry point in human classification and represents the level at which objects are first recognized and proposed: "in the perceived world, information rich bundles of perceptual or functional attributes occur that form natural discontinuities, and that [...] basic cuts in categorization are made at these discontinuities" (p. 31). The authors empirically demonstrated the special status of the basic level by interpreting participants' naming preferences and category membership verification times as indicating that people first identify objects at the basic level and then access the superordinate level or subordinate level categories. According to Rosch et al. (1976), basic level categories are noted by a balance between informativeness or "cue validity" (the number of attributes the concept conveys) and "cognitive economy" (a sort of summary of the important attributes that distinguish it from other categories). Informativeness is lacking at the highest level because few attributes are conveyed, and economy is missing at the lowest level because too many attributes are conveyed.

Later, Jolicoeur, Gluck, and Kosslyn (1984) proposed that the entry point in recognition corresponds to the level where "contact is made first with semantic memory" (p. 272) and where the perceptual stimulus first makes contact with its underlying memorial representation. Importantly, Jolicoeur et al. (1984) noted that the entry point often corresponds to the basic level, but in many instances of object identification it does not. Research on human object identification demonstrated that the entry point could be modulated by at least two factors: domain-specific expertise and typicality of an exemplar for its corresponding basic level. Concerning the former, expertise in a particular field is likely to shift

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entry level of many objects towards the subordinate level (Rosch et al., 1976). Tanaka and Taylor (1991), for example, found that a bird expert is able to recognize a picture of a sparrow as a "sparrow" as quickly as he recognizes it as a "bird". In the domain of face perception, Tanaka (2001) suggested a general basic level shift in human perception towards subordinate classification of familiar faces. Thus, a face will more likely be identified at the unique level of identity (e.g., as "Bill Clinton" rather than as a "face" at the basic level). Similar downward shifts in recognition were found by Gauthier and Tarr (1997) after participants were trained in the identification of artificial objects. On the basis of these findings, Jolicoeur et al. (1984) concluded "for many objects (and perhaps many situations) we use identification routines at levels other than the basic level" (p. 272).

1.1. Special features of art-objects

What might be the entry point in the identification of visual art? Up to this point research in the domain of object recognition has been concerned with object classes such as furniture (Rosch et al., 1976), faces (e.g., Tanaka, 2001), every-day objects (Op de Beeck & Wagemans, 2001) and even artificial objects (e.g., Gauthier & Tarr, 1997) but very little is known about the representation and initial identification of visual art. For instance, what might be the first access to semantic memory when a person identifies Pablo Picasso's "Dora Maar seated"? This painting might be initially recognized as a deformed depiction of a "woman's head" or simply as a "human". Alternatively, it might be identified as "Dora Maar seated", a "Picasso", a "Cubist painting", or even more general, as a "work of art". These numerous classification options reveal different taxonomies applicable to art-objects. We propose that visual art is distinguishable from many other object classes, since it matches at least two taxonomies that may affect its identification. The first is based on depictive content (what is represented) and the second on stylistic representation (how it is represented), such as the corresponding art school or artist's name (cf. Augustin, Leder, Hutzler, & Carbon, 2008). In this respect, artworks are multidimensional stimuli that can be placed in numerous classifying contexts and therefore provide a challenge for initial recognition.

The idea of multiple classification options for art-objects was proposed within a framework model of aesthetic experience, in which explicit identification is one of the cumulative stages of information processing that are involved in aesthetic experiences (Leder, Belke, Oeberst, & Augustin, 2004). The model states that, depending on the viewer's experience, explicit classification could be based on style or representational content. For instance, in the case of René Magritte's painting "Ceci n'est pas une pipe" it is possible to identify either a depiction of a "tobacco pipe" or a painting by "René Magritte", with both referring to a similar level of abstraction. Consequently, the investigation of a possible entry point in visual art must take into account at least two conceptual hierarchies, one content-related and the other art-specific, which allow for hierarchical relationships between categories (superordinate, basic, and subordinate level categorization). Moreover, in many cases of modern and contemporary art (e.g., Abstract Art, Minimalism) explicit semantic references are often completely absent. In these cases, the identification has to rely on syntactic qualities (Berlyne, 1971) such as stylistic or expressive information rather than its semantic content (e.g. subject matter, represented object).

Analyses of modern and contemporary art reveal that a persistent feature of art is stylistic variety, which refers to single artists as the main proponents (Leder et al., 2004). The stylistic diversity in art is propelled by artists' attempts to distinguish themselves from others in the art market. In order to be successful artists' styles have to be distinctive as well as novel or innovative. This strong individualization makes the art world special in that production structures still are very individual, but create forces that not only call for idiosyncratic objects, such as single artworks, but also encourage the establishment of individual styles – which are recognizable and attributable to single artists over different works of art (Grasskamp, 1994).

This style-based appearance may be reflected in human recognition and presumably allows for a style-based type of processing (Leder, 2003; Leder et al., 2004; Winston & Cupchik, 1992). As a result, the initial identification might yield cognitive processing that differs from other object domains (but might be comparable to the domain of architecture or design as well, see Carbon & Leder, 2005). Memory representations of artworks may be closely linked in semantic memory with the creating artist, as single works often contain elements which share ill-defined features of style that are similar throughout one artist's style (Hartley & Homa, 1981). These artist's specific stylistic features could serve as "basic-cuts" (Rosch et al., 1976) in categorization and provide an entry point (Tanaka, 2001) of recognition for artworks. We assumed that the importance of style-based processing and stylistic diversity in the visual arts makes it likely that artworks might most efficiently be recognized with respect to single artists, e.g. a particular painting being considered a "Picasso". This means that a Picasso painting might not initially be recognized as a "portrait" nor as a "Cubist painting", but rather as a painting "by Picasso" or a "Picasso-*esque*" painting. Alternatively, from the way that people gather knowledge and expertise in art (see Parsons, 1987), it might be possible that artworks are initially identified on a more general level of abstraction. Art historians propose the use of art-styles to categorize artworks of the same historical period (e.g., "Expressionism"), of groups of closely related artists (e.g., "Bauhaus"), or of a common visual approach to depiction (e.g., "Pointillism"). These concepts applied by art historians to categorize art might not be reflected in the initial human identification of artworks. We assume that they are of minor relevance compared with a more specific artist-related categorization (Hasenfus, Martindale, & Birnbaum, 1983).

1.2. The present study

We investigated whether there is a particular entry point in the identification of visual art that is different from other object classes, and if so, whether this entry point is at a medium (basic) level of abstraction as proposed for many object classes. In three experiments, initial identification of artworks was investigated by testing the relationship between art-related categories and art identification by relative art experts. Using tasks such as speeded naming, category verification, and visual matching, paradigms were applied that had been predominantly used in the domain of object and face identification (e.g., Rosch et al., 1976; Segui & Fraisse, 1968; Tanaka, 2001). Performances on works of art were tested against every-day objects, for which entry points are well investigated by a substantial body of research. According to our hypotheses about style-based representation in art, it was assumed that an entry point is based on recognition of style and shows up at a subordinate level of the creating artist with highest frequency proportion in naming (Experiment 1), with the fastest verification speed (Experiment 2), with the largest amount of priming in a visual matching task (Experiment 3). Alternatively, according to a structural definition of a basic level, artworks should be identified first at a more general level (such as artistic genre, e.g. "landscape") and are more frequently named as such, are verified faster and yield higher priming gains on such basic level categories than at subordinate level categories (of the artist's name). In contrast to these two hypotheses, art — due to its complexity, ambiguity and stylistic representation — may only allow for idiosyncratic recognition, so that a general entry point as revealed for many other object domains (e.g., Rosch et al., 1976; Segui & Fraisse, 1968) may simply not exist.

For methodological reasons, the three experiments required participants to have some professional art training, as art recognition relies on previous experience and knowledge. For example, a person who has never encountered a painting by Gerhard Richter and who is not familiar with his name would neither be able to classify it as such in a naming task nor to identify Richter's name in a matching task nor respond to it in a priming task. Therefore, it was necessary to test participants with some academic background in art history, as ensured by at least one year of study.

2. Experiment 1: Free Naming task

A free naming task (Rosch et al., 1976; Tanaka & Taylor, 1991) was carried out as the initial experiment. Participants were asked to name each object as fast as possible with the first noun that came instantaneously to mind. In order to analyze a broad spectrum of categories and concepts applied in the domain of art, paintings from a wide range of art-historic genres, artistic styles, and artists were used. Non-art-objects served as control stimuli. These consisted of artifacts and natural object classes, such as cars and dogs, for which effects of identification and explicit categorization are already well established and for which identification at a "basic level" was proposed and expected (e.g., Jolicoeur et al., 1984; Mervis & Rosch, 1981; Murphy & Brownell, 1985; Rosch et al., 1976; Tanaka, 2001; Tanaka & Taylor, 1991).

By analyzing naming frequencies, the aim of this experiment was to reveal at which level of abstraction artworks are initially identified compared with every-day objects. Previous research has shown that participants use basic level names (e.g., "bird", "dog", "chair", and "hammer") when asked to spontaneously identify pictures of common objects (e.g., Tanaka & Taylor, 1991). This finding has been used as evidence that the most accessible level of abstraction for categorizing objects is the "basic level". For free naming frequencies it was assumed that art-objects might be identified based on their corresponding artistic styles that are either at level of the individual artists or according to art-schools. Throughout the analyses we will refer to every-day objects as "non-art-objects" and to works of art as "art-objects".

Moreover, findings were taken into account that demonstrated effects of domain-specific expertise on object recognition. These studies showed that experts are more likely to classify objects in their domain of expertise at a more specific level of abstraction (e.g., Tanaka & Taylor, 1991). Therefore, each participant's level of art expertise, as reflected by academic training in the arts, was assessed to reveal potential influences on the level of identification and nature of concepts applied to categorize art-objects.

2.1. Method

2.1.1. Participants

Twenty students (17 female) studying for a MA degree in art history at the Freie Universität Berlin took part in the experiment. Mean age was 24.0 years (SD = 2.73) ranging from 21 to 33 years. Students had been enrolled between two semesters (1 year) and 12 semesters (6 years) (Mean = 6.45, SD = 3.36). Each participant was tested individually and received 5€ for participation. All participants had normal or corrected-to-normal vision.

2.1.2. Stimuli

The stimuli consisted of 42 pictures, half of which were from art and half from non-art categories. Seven pictures were selected from the non-art categories "dog" (Saint Bernard, Boxer, Collie, Dalmatian, Fox terrier, Poodle, and German Shepherd Dog), "car" (Audi A8, Mercedes-Benz E Class, BMW 5 series, Volkswagen Golf, Porsche 911, MCC Smart, and Volkswagen Polo), and "home furnishings" (office chair, bread bin, dining table, folding chair, desk, desk lamp, and table lamp). No furnishings by well-known designers were used (such as Eames chairs) to prevent familiarity effects with those objects. For the same reason, the trademarks and logos of cars were erased from the pictures. The criterion for the classes of non-art-objects was that they had been used in previous studies on human object identification studies (e.g., Rosch et al., 1976). Moreover, they belong to the most common (most frequently mentioned) categories of nouns in Germany. Exemplars of "dog" and "home furnishings" categories were among the ten most frequently mentioned category norms in Mannhaupt (1983) (the German equivalent of Battig & Montague, 1969) and selected car brands were among the ten most familiar brands in Germany as determined by a recent market study of AC-Nielsen (2004).

Art-objects were selected from various artists in the genres "landscape" (Paul Cézanne, André Derain, Caspar-David Friedrich, Wassily Kandinsky, Claude Monet, Vincent van Gogh, and John Constable), "portrait" (Max Beckmann, Paul Klee, Gustav Klimt, Roy Lichtenstein, Edvard Munch, Pablo Picasso, and Gerhard Richter), and "still life" (Salvador Dali, Albrecht Dürer, Gerhard Richter, Vincent van Gogh, Andy Warhol, and two paintings by René Magritte). See Appendix 1 for a list of titles and artists. Four additional pictures served as practice trials (i.e. wristwatch, racing bike and painting by Edgar Degas and Lyonel Feininger), which were selected from other object classes that were used in the experimental trials. Each picture was standardized to 380 square centimeters with the original width-to-height ratio maintained.

2.1.3. Procedure

The experiment consisted of four practice and 42 experimental trials. At the beginning of each trial, a short instruction appeared on the screen asking participants to name each of the stimuli as fast as possible with the first noun that comes to mind. After a 1000 ms interval, the written instruction was replaced with a 800 ms blank screen, which was then followed by a 2000 ms picture-stimulus (either a non-art-object or art-object), which in turn was followed by another blank screen. After 1500 ms, the participants were asked to start the next trial by pressing any key on the keyboard. The stimulus order was randomized.

The experimenter sat behind the participant and noted down the verbal responses for each experimental trial. Instructions and stimuli were presented on a Macintosh Powerbook with a 15" monitor (resolution 1024 × 768 pixels). The procedure was controlled by the software PsyScope 1.2.5 (Cohen, MacWhinney, Flatt, & Provost, 1993). Viewing distance to the screen was approximately 70 cm. Visual angles ranged from approximately 10.93° to 13.36°.

In order to exclude the possibility that basic level categories were used due to a lack of familiarity with subordinate level categories, a post-experimental questionnaire explicitly tested whether participants were able to identify each stimulus on a very specific (subordinate) level. In this paper and pencil questionnaire, participants were asked to name each object on a printed-paper version at a specific level of categorization. For example, they were asked to specify the particular kind of car (e.g. BMW or Audi). For art-objects, participants were asked to indicate the artist's name, painting's title, or specific artistic style. Stimuli that could not be identified correctly at a subordinate level were excluded from the main analysis for the corresponding participant.

2.2. Results and discussion

2.2.1. Data correction

Before the actual analyses, all incorrect responses were eliminated according to three criteria. First, verbal classifications were excluded from analyses if a person could not name an object cor-

rectly at a subordinate level in the post-experimental questionnaire. In the case of art-objects, this task required labeling of the specific painting with the artist's name, artistic style, or title of the painting. If participants could not provide any of these information the corresponding trial was omitted (e.g., if the painting "Hampstead Heath" by Constable could not be labeled as "a Constable", "Hampstead Heath", or "English Romantic"). Second, if an object was named wrongly in the experiment, the response was considered as incorrect (e.g. a painting by "Klee" labeled with "von Stuck"). Third, verbal classifications, which were not in accordance with the instructions as decided by two judges, such as adjectives (e.g., "yellow" and "linear") or free associations (e.g., "my favorite painting") were eliminated from the data set. Given these three exclusion criteria, participants responded to 93.0% of art-objects and 95.5% of non-art-objects. Thus, participants were very familiar with the subordinate level terms of the objects.

All correct responses were post hoc classified into three levels of abstraction (i.e., superordinate, basic, and subordinate levels). Responses to non-art-objects were classified similar to those classified by Tanaka and Taylor (1991). For example, the term "dog" was regarded as a basic level concept and "German Shepherd" as a subordinate level concept. While the level of abstraction for non-art-objects is quite clear by virtue of the level of inclusiveness and a host of empirical research (e.g., Jolicoeur et al., 1984; Mervis & Rosch, 1981; Murphy & Brownell, 1985; Rosch et al., 1976; Tanaka, 2001; Tanaka & Taylor, 1991), the level of abstraction for art-object categories is less evident. Therefore, a special rating procedure was necessary in which naming responses were classified according to their level of abstraction. Five independent expert raters received a non-redundant list of all categorizations in order to rate naming responses as referring to superordinate, basic, or subordinate levels. A concordance criterion (degree of inter-rater agreement) was set to .8 of response-categorization. In other words, four of five raters had to agree that the given verbal response belonged to a superordinate, basic, or subordinate level. In 74.59% of post hoc response labeling, there was an inter-rater-agreement of at least 80%. The remaining naming responses were classified through expert discussion.[1]

2.2.2. Analysis of variance

The dependent variable of interest was percentages of frequencies. Independent variables were object domain (i.e., art-object or non-art-object) and level of categorization (i.e., superordinate, basic, or subordinate). Fig. 1 shows that participants classified non-art-objects in 54% of the trials at the basic level and 44% at the subordinate level. Artworks were classified in 35% of the trials at the basic level and 65% at the subordinate level.

No verbal responses were given at the superordinate level for art-objects, and only 2% of verbal classifications at superordinate level for non-art-objects. Given the lack of superordinate level responses, verbal responses were analyzed by 2 × 2 analysis of variance with object domain (art-object vs. non-art-object) and level of categorization (basic vs. subordinate). As expected, the effect of level of categorization in this analysis was not significant, $F(1, 19) < 1$, $p = 0.414$, *n.s.* Critically, the object domain × level of categorization was significant, $F(1, 19) = 18.9$, $p < 0.001$, $\eta_p^2 = 0.498$. The interaction indicated that non-art-objects were more frequently named at the basic level than were art-objects, $F(1, 19) = 18.2$, $p < 0.001$, $\eta_p^2 = 0.489$, whereas art-objects were more frequently named at the subordinate level than non-art-objects, $F(1, 19) = 17.8$, $p < 0.001$, $\eta_p^2 = .4983$. The interaction between level of categorization and object domain confirms previous findings, namely that the basic level (Rosch et al., 1976) is important in the identification of every-day objects. In contrast, participants categorized art-objects more specifically with subordinate categories rather than applying basic level categories.

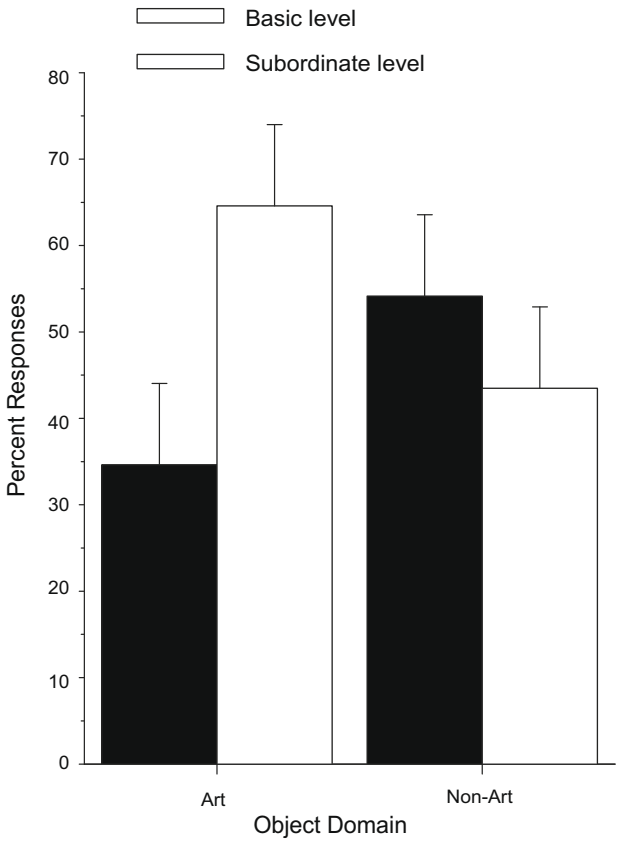

Fig. 1. The results from Experiment 1 showing the percentage of basic level and subordinate level labels used to name art-objects and non-art-objects. Error bars represent within-subjects confidence intervals (Loftus & Masson, 1994).

In a more detailed analysis, possible influences of relative art expertise were considered as indicated by the duration of academic training in the arts. Based on the number of semesters of enrollment in a MA degree in art history a post-hoc median split divided participants into groups of low and high art expertise. The median for semesters of enrolment for both groups was 5.5. The resulting medians were 3.5 and 9.5 for the low expertise and high expertise group, respectively. To reveal possible differences due to art expertise, we ran a 2 × 2 × 2 analysis of variance with object domain (art-objects and non-art-objects) and level of categorization (basic and subordinate) as within-subjects factors and expertise (high and low) as between-subjects factors. Again, the only significant effect was the object domain × level of categorization interaction, $F(1, 18) = 18.6$, $p < 0.001$, $\eta_p^2 = 0.507$. Neither a main effect of art expertise nor any interaction with any other factor was found (all Fs < 1.4). The lack of art expertise effects suggested that the preferred level of categorization of art-objects was not directly affected by differences in academic training.

2.2.3. Type of categories applied to categorize art-objects

To further explore the nature of concepts participants applied in naming of art-objects, in subsequent analyses art-related classifications were distinguished from content-related classifications.

[1] Notably, the inter-rater agreement about response classifications for style-related categories (such as "Impressionism") was below the consistency criteria of .8. After expert-discussion it has been decided that style-related classifications were to be regarded as subordinate level categories, since the criteria for basic level categories according to Rosch's definition (see this article page 3) did not apply to style categories, but seemed more specific. However, it seems worth mentioning that the pattern of results in Experiment 1 did not significantly differ when artistic style was treated as a basic level category.

These analyses of frequency were carried out independently of the level of abstraction. Art-related classifications comprised using the artist's name, artistic genre, artistic style, or title of the painting. Content-related classifications consisted of naming referring to the depicted object of the painting (e.g., "eye", "pipe"). In total, participants used 162 (61%) art-related and 117 (39%) content-related categories, χ^2 (1) = 7.3, $p < 0.007$. Furthermore, specific types of art-related naming were investigated. Among art-related categories, the artist's name was most frequently mentioned (135 instances, 83.3%), followed by the title of the work (20 instances, 12.4%), style (5 instances, 3.0%), and genre (2 instances, 1.2%). Thus, the artist's name was the predominant art-related category, which was mentioned significantly more frequently than the works' titles, $t(19) = 5.9$, $p \leqslant .001$. Titles were more frequently mentioned than artistic style, $t(19) = 3.0$, $p = 0.007$. The difference between style and genre was not significant, $t(19) = 1.4$, $p = 0.174$, *n.s.*

In more detailed analyses, we also investigated whether relative levels of art expertise influenced the level of specificity within art-related classifications. Specifically, we tested whether free naming would shift towards the more particular level of titles with increased academic training in the arts. For identifying art-objects, more art-trained students used the artist's name in 83 trials (86.5%) and applied titles in 13 trials (13.5%), while less art-trained students used the artist's name in 52 trials (88.1%) and titles in seven trials (11.9%). Percentages of frequencies of naming were subjected to a mixed design ANOVA with type of subordinate classification (artist's name vs. title) as within-subjects factor and art expertise (high vs. low expertise) as between-subjects factor. The analyses confirmed the above reported finding that artists' names were significantly more often used than titles, $F(1,18) = 34.1$, $p = 0.001$, $\eta_p^2 = 0.654$. The main effect of art expertise indicated that the differences of art expertise were marked by a higher frequency of art-related categories when compared to less trained participants, $F(1,18) = 6.2$, $p = 0.023$, $\eta_p^2 = 0.255$. Critically, the interaction was not significant, $F(1,18) < 1$, $p = 0.406$, $\eta_p^2 = 0.039$, *n.s.*, indicating that the artist's name was the predominant category in both expertise groups.

To summarize the findings of the free naming task, it was found that speeded naming of art-objects differed from non-art-objects. As expected, non-art-objects were classified at a more general (basic) level of abstraction, while art-objects were named at a more specific (subordinate) level, with the artist's name as the predominant category. In respect to the kind of categories, it was found that participants used art-related categories (artist's name, style or genre terms) more often than content-related categories. Moreover, advanced academically trained students used more art-related classifications compared to less academically trained students, while both groups showed equally high frequencies of identifying art-objects with their corresponding artists' names. Results are in accordance with the assumption that art-objects allow for a special kind of identification (and memory representation) based on individual artists' styles that may serve as an entry point in recognition. In order to show that the findings of the free naming task did not simply reflect naming preferences of participants or social convention rather than initial memory access, the accessibility of representations related to the artists' names was explicitly tested in a speeded verification task (Experiment 2) and in category verification and priming facilitation tasks (Experiment 3).

3. Experiment 2: Speeded category-verification task

Experiment 2 employed a speeded category-verification task similar to that used by Tanaka (2001, Experiment 2) in the domain of face recognition. Participants were presented with a superordinate, basic, or subordinate level category term and were subsequently shown a picture, and were asked to indicate whether the picture was an exemplar of that category. The results were compared between two different object domains: Portraits as a representative of art-objects and cars as a sample of non-art-objects. The choice of stimuli classes and selection of verbal categories was oriented on the findings of Experiment 1. Portraits were selected because they are considered one of the most important genres in fine art.[2]

Moreover, according to a post hoc questionnaire of Experiment 1, the set of portrait paintings received the highest familiarity with the corresponding subordinate level terms which ensured that participants were familiar with the corresponding artists' names or titles (participants correctly named portraits, still life and landscape paintings at subordinate level in 84%, 77%, and 58%, respectively). Cars were selected as the appropriate contrast category because they represent a widely known class of every-day objects, for which specific familiarity data of a current survey were at hand (see AC-Nielsen, 2004).

The task required participants to verify portraits and cars at the superordinate level ("artwork" or "vehicle"), basic level ("portrait" or "car"), and subordinate level ("artist's name" or "brand mark"). Reaction times were measured as the dependent variable. According to a "basic-first" hypothesis (Tanaka, 2001), it could be reasoned that portraits, like cars, should be identified at the basic level first and therefore categorized faster at a medium (basic) level of abstraction than on a subordinate level. This would mirror findings obtained for many everyday object classes (cf. Rosch et al., 1976), namely that the entry point of recognition occurs at a basic level of abstraction. Alternatively, according to Experiment 1 and our hypothesis on an artist-specific recognition of art, we expected participants to verify portraits faster on the subordinate level (with the artist's name) than on the basic level (as a "portrait").

3.1. Method

3.1.1. Participants

Sixteen (14 female) students of art history participated in this experiment. The mean age was 25.7 ($SD = 3.94$) ranging from 22 to 36 years. Participants were enrolled between three semesters (1.5 years) and 12 semesters (6 years) (mean = 6.63, $SD = 2.75$). Participants were tested individually and received payment for participation. None of them participated in Experiment 1. Each had normal or corrected-to-normal vision.

3.1.2. Stimuli

Pictures were taken from two categories, cars and portraits. The car category consisted of eight brands: Audi, Mercedes Benz, BMW, Volkswagen, Fiat, Ford, Peugeot, and Opel. According to AC-Nielsen (2004), these car brands are among the ten most familiar brands within the German population. Eight portraits by the artists Leonardo da Vinci, Paul Klee, Gustav Klimt, Roy Lichtenstein, Anselm Feuerbach, Pablo Picasso, Jean-Honoré Fragonard, and Vincent van Gogh represented the portraits category. It was expected that paintings by these artists would be familiar to students of art history.

In order to reduce expectancy effects, pictures from two contrasting categories, "bicycles" and "still life", were used as filler trials. The contrast categories shared the same superordinate level as the target categories (i.e., cars and bicycles are vehicles and portraits and still lifes are artworks). The bicycle pictures consisted of eight different types of bicycles: mountain, racing, trekking, BMX, collapsible, fitness, women's, and children's bicycles; as still life paintings depic-

[2] It seems noteworthy to mention that portrait paintings differ from portrait photography, as their visual representation is more strongly shaped by a style. Therefore, findings of face recognition might not apply to recognition of portrait paintings.

tions were used from Pierre Chardin, Albrecht Dürer, Jean Metzinger, René Magritte, Gerhard Richter, Vincent van Gogh, Andy Warhol and Georges Braque (for a complete list of artists and works see Appendix 2). Additionally, four pictures from categories other than those used for the experimental trials were selected as practice trials. All pictures were standardized to 380 square centimeters with the original width-to-height ratio of the paintings maintained.

3.1.3. Procedure

At the beginning of the experimental session, participants received a written list of subordinate level terms for all of the 16 target exemplars. Terms were presented in a random order one after the other on a monitor for 2500 ms each (after a fixation cross). Subsequently to an inter-stimulus interval of 800 ms, a fixation cross marked the beginning of each trial which remained for 1000 ms. Next, a blank screen appeared for 1000 ms, followed by a category word that remained for 2500 ms. After a 500 ms blank interval, the category name was replaced with a picture. Participants were instructed to verify whether the preceding word label matched the picture (e.g., "Does the following picture show a portrait?") and to give their response (true or false) by pressing the corresponding "true" or "false" buttons. The picture remained on screen until participants responded. Assignments of "false" or "true" to a left or right key on the keyboard were fully balanced across participants. Trial order was fully randomized. Each of the eight portraits and eight cars was shown with two response types (true and false) and three levels of categorizations (superordinate, basic, and subordinate) resulting in 96 experimental trials.

In the superordinate level and true condition, the category-word was either "artwork" or "vehicle". In the basic level and true response condition, "portrait" or "car" and in the subordinate level and true condition the corresponding artist's name (e.g., "Picasso" and "Van Gogh") or the brand of the car (e.g., "VW and "Porsche"). In the false conditions category words were taken from a different exemplar of the same higher-order level category. For instance, a "Porsche" letter string and an "Audi" picture stimulus were paired, with both referring to the more inclusive level category "car". In the basic level condition, a false word label that shared the same superordinate category was provided (e.g., the letter string "landscape painting" was presented with a "portrait" picture stimulus, with both referring to the superordinate category "artwork"). False trials were designed with the restrictions that each word-picture combination at the subordinate level would appear only once during the experiment and each word within a level of categorization would appear with the same frequency in order to prevent response bias.

In addition to the 96 experimental trials, the procedure contained 32 filler trials. The filler trials contained the foil categories bicycle and still life at the basic level of categorization and at two response types (true and false). True/false responses and reaction times were recorded.

3.2. Results

The analyses were based on reaction times of correct true and (separately) correct false responses. Responses to the cars category showed that participants correctly responded "true" to 97%, 98%, and 77% of the trials for superordinate, basic, and subordinate levels, respectively. For false trials, participants responded correctly to 99%, 98%, and 87% of the trials for superordinate, basic and subordinate levels, respectively. To portraits, participants responded correctly to 99%, 83%, and 95% of the trials for superordinate level, basic level and subordinate level, respectively. For false trials, participants falsified correctly to 98%, 97% and 98% for superordinate, basic, and subordinate level categorizations, respectively.

Reaction times were adjusted by setting boundaries to eliminate outliers. The lower boundary was set to 300 ms and the upper boundary was set to 3000 ms, which is equivalent to approximately 2.5 standard deviations from the mean (M_{RT} = 1098 ms, SD_{RT} = 807 ms). Thus, 3.32% of correct experimental trials (in the true and false conditions) were regarded as outliers.

3.2.1. Analysis of true responses

Mean adjusted RTs were analyzed as the dependent variable in a 2 x 3 repeated-measures analysis of variance with object domain (portrait and car) and level of categorization (superordinate, basic, and subordinate) as independent variables. The main effect for object domain was significant, $F(1, 15) = 7.6$, $p = 0.015$, $\eta_p^2 = 0.336$, indicating that portraits were verified faster than cars. The main effect for level of categorization was also significant, $F(2, 30) = 26.8$, $p < 0.001$, $\eta_p^2 = 0.641$, indicating slower responses for a more specific level of categorizations. Importantly, the critical domain × level interaction was also significant, $F(2, 30) = 21.6$, $p < 0.001$, $\eta_p^2 = 0.590$. As shown in Fig. 2, the interaction indicates that cars were categorized faster at the basic level than at the subordinate level, $F(1, 15) = 32.8$, $p < 0.001$, $\eta_p^2 = 0.686$. On the other hand, RTs for portraits at the subordinate level (i.e., the artist's name) and basic level did not differ significantly, $F(1, 15) = 1.4$, $p = 0.254$, $\eta_p^2 = 0.086$, *n.s.* The interaction indicates that participants were faster to verify cars on the basic level than on the subordinate level, which confirms the assumption of a general basic level advantage (Rosch et al., 1976) for non-art-objects. In contrast, a different pattern was found for works of art. At the subordinate level (the artist's name) works of art were categorized as fast as at the basic level (artistic genre).

In sum, this task demonstrated that art-objects were verified differently from non-art-objects. People are just as fast to categorize artworks (with the artists' names) at a level subordinate to the basic level, as they are to categorize artworks at the basic level. By contrast, verification times in the contrast category ("car") were faster at the basic level than at the subordinate level. This pattern of results is similar to findings in face perception, where verification times were as fast on the sub – as on the basic level for faces, while objects in the contrast category ("dog") were verified faster on the basic level (Tanaka, 2001). The results indicated that representations of artworks are highly accessible at a specific level of abstraction related to the artists' names. This provides further evidence for an artist-specific style-based recognition of art-stimuli.

3.2.2. Analysis of false responses

The results of responses in the false condition were in accordance with effects obtained in the true condition. Reaction times of correct falsification responses depending on object domain and level of categorization are displayed in the lower panel of Fig. 2. The resulting mean reaction times were analyzed in a repeated-measures analysis of variance with object domain (portrait and car) and level of categorization (superordinate, basic, and subordinate) as within-participant factors. The main effect of object domain was significant, $F(1, 15) = 7.1$, $p = 0.019$, $\eta_p^2 = 0.321$, indicating that portraits were verified faster than cars. The main effect of level of categorization was also significant, $F(2, 30) = 11.4$, $p < 0.001$, $\eta_p^2 = 0.431$, indicating slower responses for more specific level of categorizations. The critical object domain × level of categorization interaction was also significant, $F(2, 30) = 35.6$, $p < 0.001$, $\eta_p^2 = 0.704$. This interaction indicates that cars were categorized faster at the basic level than at the subordinate level, $F(1, 15) = 50.6$, $p < 0.001$, $\eta_p^2 = .772$, whereas portraits were categorized faster at the subordinate level than at the basic level, $F(1, 15) = 9.8$, $p = 0.007$, $\eta_p^2 = 0.393$.

4. Experiment 3: Conceptual priming task

The results from Experiments 1 and 2 suggested that participants have detailed perceptual representations related to single

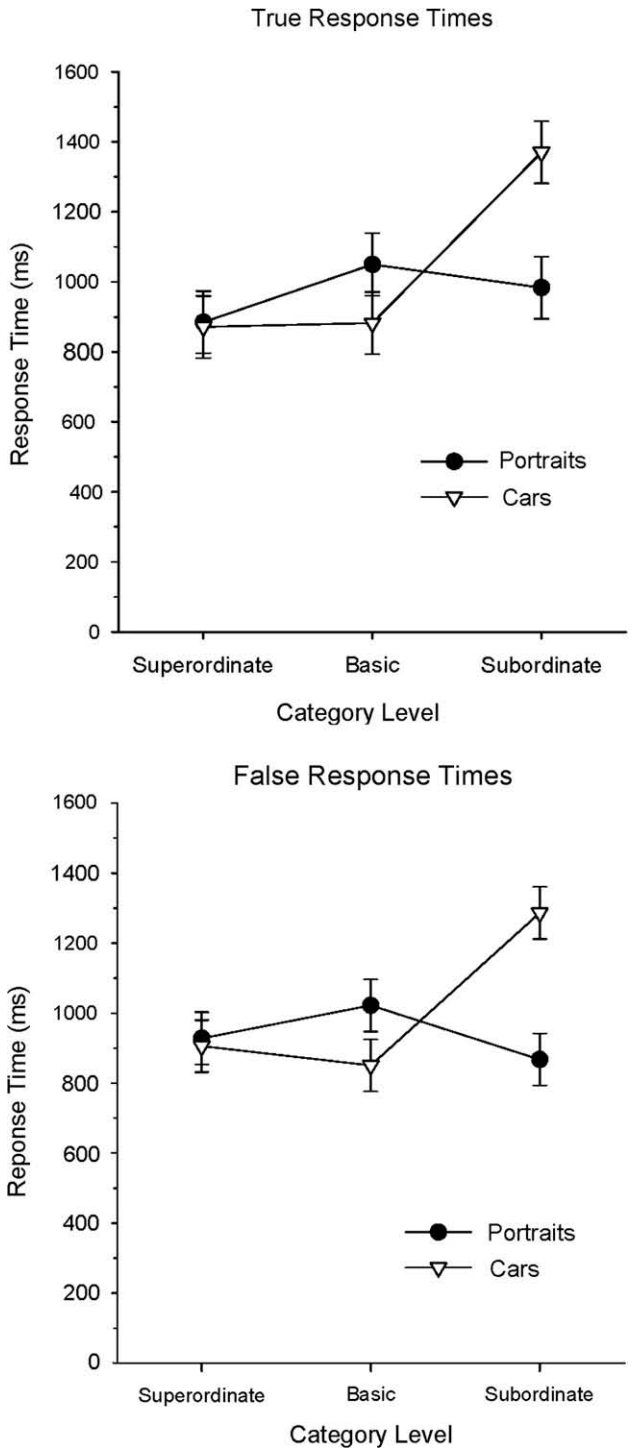

Fig. 2. The results from Experiment 2 showing the mean response times collapsed by participants for categorizing portraits and cars at the superordinate, basic, and subordinate level in the true and false conditions.

artists that can be quickly accessed during initial processing. In Experiment 3, such perceptual representations of art-objects were directly examined using a conceptual priming task. Participants were presented with a word prime, a basic level prime, a subordinate level prime, or a neutral category prime (consisting of the letter string "blank"). Two simultaneously presented pictures followed the word primes. Participants were asked to judge whether the two pictures were identical or different. As suggested by Tanaka (2001), cross-modal priming effects were measured by the difference in reaction time between primed trials and neutral trials in the same picture conditions. According to Posner (1969) and Posner and Mitchell (1967), such an identity-priming paradigm allows for the investigation of participants' visual representations that are activated by the word prime. The stronger the priming is, the shorter the reaction times will be. The degree of facilitation depends on the match between mental representations, as elicited by the word stimulus and its correspondence with the physical picture stimulus. Thus, "the closer the match between the mental representation and the visual percept, the faster the matching response" (Tanaka, 2001, p. 540). In comparison with Experiment 2, Experiment 3 considered a broader range of categories. Art stimuli were selected from four artistic genres (portraits, landscapes, nudes, and still life paintings) and compared with four classes of every-day objects (cars, insects, furniture and dogs).

Assuming that participants have developed elaborated representations related to artworks of single artists priming effects with artworks should be strongest at the subordinate level. For non-art-objects such effects were not expected.

4.1. Method

4.1.1. Participants

Fourteen (12 female) students in art history from the Freie Universität Berlin participated in the experiment. Mean age was 25.7 (SD = 2.02) ranging from 23 to 30 years. They were enrolled between eight semesters (4 years) and 11 semesters (5.5 years) (mean = 9.92, SD = 1,20) in a MA degree in art history. None of the students participated in Experiment 1 or 2. Participants were tested individually and received allowance for participation. Each participant had normal or corrected-to-normal vision.

4.1.2. Stimuli

Art stimuli were selected from four art categories, each containing four paintings: nudes (Francois Boucher, Lucas Cranach the Elder, Rembrandt, and Peter Paul Rubens), landscapes (Paul Cézanne, Caspar-David Friedrich, Claude Monet, and Vincent van Gogh), portraits (Leonardo da Vinci, Anselm Feuerbach, Jean-Honoré Fragonard, and Pablo Picasso) and still life paintings (Jean-Baptiste Chardin, Albrecht Dürer, René Magritte, and Andy Warhol); see Appendix 3 for a full list of artists and titles. Non-art stimuli were selected from four categories, cars (Audi, Mercedes, BMW, and Volkswagen), arthropods (ant, fly, butterfly, and spider[3]) furniture (bed, couch, cupboard, and table) and dogs (Collie, Dalmatian, Poodle, and German Shepherd). Exemplars of the categories furniture, dogs, and insects were among the ten most mentioned, as indicated in the linguistic production norms for the German population (Mannhaupt, 1983). Car stimuli were examples of the ten most mentioned brands in a recent market analysis (AC-Nielsen, 2004). Four exemplars were selected from each category resulting in 32 picture stimuli. Stimuli were standardized to 320 square centimeters with original width-to-height ratio maintained.

4.1.3. Procedure and apparatus

Participants were instructed to judge whether two simultaneously presented stimuli were identical or different. Afterwards, they performed eight practice trials followed by 192 experimental trials. Each trial began with the presentation of a fixation cross in the center of the screen for 1000 ms, which was then replaced with a word prime for 2500 ms. Subsequently, a 300 ms blank screen interval was shown and then followed by the simultaneous appearance of two pictures, which remained on screen until participants pressed one of two marked buttons (indicating that paintings were

[3] According to biological taxonomies spiders are of course not insects but arachnids. However, it is common usage to identify spiders as insects in Germany , as documented in production norms (Mannhaupt, 1983).

Table 1
Mean reaction times in milliseconds (and standard errors of the mean) depending on prime type and object category.

Object category	Neutral	Basic level	Subordinate level
Cars	857 (69)	837 (46)	934 (68)
Dogs	685 (42)	653 (46)	636 (35)
Furniture	687 (31)	635 (29)	621 (38)
Insects	738 (65)	655 (45)	681 (43)
Landscape paintings	708 (47)	745 (53)	708 (53)
Nude paintings	745 (31)	707 (46)	750 (47)
Portraits	744 (49)	702 (44)	690 (55)
Still lifes	824 (95)	791 (70)	660 (26)

either "the same" or "different"). Word primes appeared either at basic level, subordinate level, or in a neutral condition. Basic level primes for art-objects were "landscape", "nude painting", "portrait", and "still life". Basic level primes for non-art-object were "car", "furniture", "dogs", and "insects". In the neutral word prime condition, the word "blank" was presented on the screen.

The two pictures presented simultaneously in the "same" conditions were either two paintings or two non-art-objects. In the "different" conditions, the two pictures shared the same basic level (e.g., two different landscapes or two different cars) with the restrictions that each combination appeared only once and all stimuli appeared with equal frequency. Participants were asked to judge "as accurately and as fast as possible" whether the stimuli were the same or different by pressing one of two buttons with the right or left index finger. Assignment of "same" or "different" responses to the left or right key was balanced among participants. Key responses and reactions times were recorded by the experimental control software PsyScope 1.2.5 (Cohen et al., 1993), running on a Macintosh G4 with a 19" monitor (resolution 1024 × 768 pixels). Participants were tested individually. Thirty-two stimuli (art-objects and non-art-objects) combined with three levels of categorization primes (basic, subordinate, and neutral) in two response conditions (same or different) yielded a total of 192 experimental trials altogether. The visual angle was approximately 6.64° with a viewing distance of about 70 cm.

4.2. Results

The following analyses were based on priming scores for correct "same" responses. Reaction times were adjusted based on data correction as described in Experiment 2. Table 1 shows mean reaction times depending on prime level and object category. To measure the amount of priming effects, differences in reaction times were calculated between responses in the neutral conditions and correct the same responses in the priming conditions. To obtain individual priming scores for each object category and participant, differences in reaction times were calculated between the neutral condition and either the basic level condition or subordinate level condition. Mean priming scores for art- and non-art-objects were analyzed and compared.

As carried out by Tanaka (2001, Experiment 4, p. 541) differences were tested among the four art categories. Mean priming scores for category at the two levels of abstraction were subjected to a 4 (category: nude, landscape, portrait, or still life) × 2 (level of categorization: basic or subordinate) within-participants ANOVA. The main effect of level of abstraction was significant, $F(1, 13) = 5.1$, $p = 0.042$, $\eta_p^2 = 0.280$. Neither the main effect for category, $F(1, 13) < 1$, $p = 0.512$, $\eta_p^2 = 0.057$, *n.s.*, nor was the interaction significant, $F(3,39) = 2.1$, $p = 0.124$, $\eta_p^2 = 0.136$, *n.s.* Due to the lack of the main effect for category and interaction, the four art categories were collapsed to obtain one individual mean priming scores for the art-domain. To test differences among the four non-art-categories, mean priming scores at the two levels of abstraction were submitted to a 4 (cars, dogs, furniture, insects) × 2 (basic, subordinate) within-participants ANOVA. Neither any main effects nor the interaction was significant (all Fs < 1.37). Consequently, non-art-object categories were collapsed to obtain individual mean priming scores for the non-art domain.

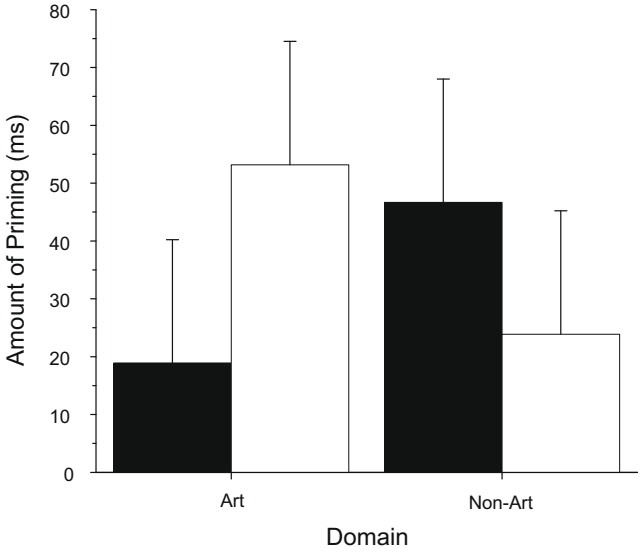

Fig. 3. The results of Experiment 3 showing the amount of facilitation for basic and subordinate level words for art-objects and non-art-objects. Error bars represent within-subjects confidence intervals (Loftus & Masson, 1994).

Priming scores (differences in RTs between neutral and treatment conditions) were collapsed and analyzed across participants. The amount of facilitation (based on reaction times) in the different conditions is shown in Fig. 3.

A 2 × 2 repeated-measures analysis of variance was performed with object domain (art-object, non-art-objects) and level of categorization (basic, subordinate). This revealed a significant domain × level of categorization interaction by participants $F(1, 13) = 8.3$, $p = 0.013$ $\eta_p^2 = .391$. No other effects were significant. The interaction indicates that additional priming effects were found at the subordinate level for art-objects but not for non-art-objects. Consistently, a post hoc comparison of priming effects at subordinate level and basic level primes showed a significant difference for art-objects, $t(13) = 2.3$, $p = 0.043$, $\eta_p^2 = 0.280$. For non-art-objects the difference was not significant, $t(13) = -1.1$, $p = 0.292$, $\eta_p^2 = 0.085$, *n.s.* Thus, people recognized artworks fastest with the artist's names and were able to access elaborated artist-related visual representations when primed with a matching artist's name.

To summarize the findings of Experiment 3, subordinate priming of the artist's name facilitated a visual comparison task for the corresponding paintings by the artists, but when participants were primed with subordinate terms of non-art-objects, no such additional facilitation on recognition was observed. According to the logic of the word-picture priming task (the stronger the match between word and picture the faster the visual comparison reaction time) this result indicates that participants activated artist-specific visual representations triggered by the artist's name. These primed representations could be either based on an artist's characteristic style or alternatively, given that the selected artworks were typical examples by each of the painters, consist of iconic representations of individual works. Taking into account that a painter such as Picasso has produced a substantial range of well-known works, and participants could not anticipate which painting by the artist is being shown, it is reasonable to conclude that participants activated style-related representations that facilitated visual comparison. This explanation is in line with the notion that artists try to establish highly recognizable individual styles that are

also represented in the cognitive structure of the beholder (for a theoretical explanation, see Leder et al., 2004). In sum, consistent with the results of Experiments 1 and 2, the results of Experiment 3 suggest that art-objects are identified at a specific level of identity and that detailed representations related to a single artist could be rapidly assessed.

In order to provide additional empirical evidence, absolute priming effects for each priming condition were analyzed with four one-sample *t*-tests (sampled over subjects). The pattern of results confirmed the results of analysis of variance described above. Priming facilitation for non-art-objects at the basic level was significant $t(13) = 2.4$, $p < 0.001$ $\eta_p^2 = 0.312$ one-tailed,[4] whereas priming facilitation for non-art-objects at subordinate level was not $t(13) < 1$, $p = .150$, $\eta_p^2 = 0.058$, *n.s.*, one-tailed. Thus, every-day objects were identified at a basic level of abstraction. Critically, priming facilitation for art-objects at subordinate level (artist's name) was significant $t(13) = 1.9$, $p = 0.009$, $\eta_p^2 = 0.199$, one-tailed, whereas priming facilitation at basic level (artistic genre) was not, $t(13) = 1.0$, $p = 0.124$, $\eta_p^2 = 0.067$, *n.s.*, one-tailed. This test provided further empirical evidence that priming of artist's name produces a significant amount of priming and suggested that participants possess fine-grained visual representations linked to individual artists' names.

5. General discussion

The purpose of the study was to present empirical evidence for a special art-related entry point in the identification of visual art. Converging empirical evidence from three experiments, which have proved sensitive to addressing the question of object identification suggested that initial recognition is at the level of the producing artist. In particular, the results of a speeded naming task (Experiment 1) showed that participants categorized a familiar painting with its matching artist's name (subordinate level) more often than with any other art-related concept. In a category-verification task (Experiment 2), it was shown that works of art were processed as fast with the artist's name (at the subordinate level) as with artistic genre (at the basic level). Verification times for artists' names were even faster compared to verification times of categories at the subordinate level for non-art-objects. In a conceptual priming experiment (Experiment 3), artists' names produced stronger RT facilitation compared to priming of artistic genre (basic level) terms. In this priming task, word-primes served as semantic cues in which visual representations specific to the subsequent stimulus had to be activated, in order to facilitate the visual matching response (cf. Posner, 1969; Posner & Mitchell, 1967; Tanaka, 2001). Therefore, the results suggested that participants possess of elaborate, fine-grained visual representations linked to individual artists' names. Given that each of the painters investigated in the present study has produced a substantial oeuvre of well-known single works of art, it seems implausible to assume that priming effects resulted from the priming of single iconic representations of single artworks. Rather, the pattern of cross-modal priming effects is best explained by the activation of artist-specific memorial representations, which presumably consist of a kind of style-related visual prototype linked to individual artists. This interpretation is in accordance with a central assumption of a model of aesthetic experience – that processing of visual art comprises processing of style, which separates art perception from many other domains of perception (Belke & Leder, 2006; Leder et al., 2004).

The idea that the identification of art is at the subordinate level of the corresponding artist is further sustained when considered in light of a "cognitive economy" argument often made for the human cognitive system (e.g., Rosch et al., 1976). Such a classification is in between an "entry-level" of unique identity (Tanaka, 2001) such as titles (which might be too demanding, see Leder, Carbon, & Ripsas, 2006), and more inclusive art categories, such as genres and broad art schools (which might be inefficient for identifying a particular piece of art). Therefore, identification at the level of the producing artist may allow for an optimum level. Moreover, the often-high degree of semantic ambiguity (or even absence of any representational information) often defies a clear semantic determinacy, which is why explicit classification based on artists' specific styles might provide the most efficient in the identification of art. Given the wide range of artistic 'strategies' for depiction such as alienation, distortion and abstraction and therefore often highly stylized representations (of objects, themes or subject matters), the recognition of visual art may most efficiently rely on reoccurring, salient stylistic features. These artist-specific prototypical style features might serve as "discontinuities" (Rosch et al., 1976) on which "basic-cuts" in perception are made, and which provide an entry point in recognition. Due to these arguments and findings of the study, we propose that art has a special status amongst external-world objects since it allows for a memorial representation based on stylistic features that are linked in semantic memory to the creating artist.[5]

Another contributing factor as to why the subordinate level produced superior performance in the paradigms applied may be that perceptual similarity for art-objects does not increase with the level of specificity in the same way as it does for every-day object classes. For every-day objects research has shown that subordinate-level classifications require additional perceptual processing to extract features that are needed to go beyond the basic-level of processing (Op de Beeck, Béatse, Wagemans, Sunaert, & Van Hecke, 2000; Gauthier, Anderson, Tarr, Skudlarski, & Gore, 1997). Compared to perceptual similarity within common object classes utilized in our study, paintings from a particular artistic genre might be generally more distinctive from each other. This increased distinctiveness might lower perceptual effort to discriminate amongst works of art and as a result favors a subordinate level of identification.

Our study revealed a processing advantage on the subordinate level of the creating artist for viewers with a considerable range of academic training in the visual arts, varying from one year to six years of full-time studies. This result provides some evidence that an artist-based recognition reflects a processing characteristic that is not restricted to advanced levels of art expertise, but may be a hallmark of art perception itself. However, due to methodological reasons, performances of the free naming, category verification and visual identity task were not compared with performances by art-lay people, since these tasks required participants to possess of some declarative knowledge about artists, genres and styles. Although one could argue that viewers with only a passing familiarity with artists, styles or genres would show a classic basic level advantage (and identify an artwork at a medium level of abstrac-

[4] One-sample *t*-tests were analyzed one-tailed because the priming hypothesis clearly predicts the direction of priming facilitation (decrease in RTs as compared to neutral conditions).

[5] The definition of an entry point as an object concept in this study is based on literature on conceptual hierarchies in the tradition of Rosch et al. 1976 (and many followers). In line with these approaches, the levels of abstraction and entry points in the categorization of objects were consistently defined and investigated as cognitive reference points. However, it seems likely, that such explicit classifications are preceded by perceptual analysis and implicit memory integration effects (see Leder et al., 2004 for a framework model of hierarchical processing stages) that may be linked to evaluations of the target stimulus (e.g., Scherer, 2003). Therefore, the early analysis of shape, form, content and style could be affectively experienced as e.g. "tender, disturbing, and fascinating". The informational value of such affective evaluations for the recognition of artistic objects could be that they may serve as prototypical or defining attributes (e.g., a painting by Mark Rothko may appear affectively "warm", "floating" and spatially "immersive", which might be crucial attributes for the artist's memorial representation as a "Rothko"). If such affective and evaluative information is accessible in early processing stages, it might be possible that these affective attributes play a significant role in the identification of artistic objects.

tion based on membership of a certain genre, broad art style or art school), we propose that the mental representation of visual art (due to the above-mentioned specificities) is generally organized around the subordinate level of the producing artist, even when art expertise is limited.[6]

This assumption is supported by Supplementary data which were obtained from people without formal art training and which we have not reported in this study. In a feature listing task people had to list as many attributes of given art-related categories as they could think of (see Rosch et al., 1976, for details of the method). The results indicated that art-lay people list significantly more items for the subordinate level terms of the artist's name and specific art-styles compared to basic level terms such as the artistic-genre. This result is in accordance with the assumption that art-specific declarative knowledge may be generally organized at the subordinate level of the producing artist. Clearly, future research is needed to investigate this hypothesis further.

Moreover, relative levels of art expertise did not show up as a contributing factor on the finding that the artist's name was the predominant category in naming art-objects in Experiment 1. Therefore, art expertise effects were not investigated further in Experiments 2 and 3, since they were not the primary focus of this study. However, it cannot be excluded that more advanced art expertise may modify the entry-level and provoke a downward shift in recognition (subsidiary to the artist's name) to the level of a painting's title, as the level of unique identity (Tanaka, 2001). The assumption of titles as an alternative (art-related) entry point was not investigated in Experiments 2 and 3, as frequencies of categorizing art-objects with their corresponding titles were rather marginal in Experiment 1, regardless of the level of participant's background in academic training in the arts. Future research may address the possible occurrence of such a downward shift more closely.

The results also indicated that expert viewers were able to access artist-specific representations as fast as basic-level representations of every-day objects, meaning that a painting by Picasso was identified as a "Picasso" within the same time frame as a depiction of a car was identified as a "car". Although converging evidence of the three experiments suggested the artist's name as a candidate for an entry point in art-recognition, we did not address the exact time-course involved, whether identification on the level of the artist precedes the identification of depictive content or vice versa. Therefore, we cannot rule out that the initial contact between stimulus and semantic memory might be on the level of depictive content (Augustin et al., 2008). However, this might be possible for representational art but is less likely with Abstract, Minimal or Conceptual art, which often lack unambiguous semantic references and often disrupt processing routines that are prevalent in every-day perception, such as object recognition (Leder et al., 2004). Furthermore, art-related genre labels provided in Experiments 2 and 3 contained explicit references to the paintings' depictive content (e.g., the category "landscape painting" contained the word landscape) but were of lesser importance for identification than artists' names. Future studies may address the exact time-course involved in content vs. style-based recognition and may reveal additional evidence (or boundary conditions) for the status of a subordinate artist-based recognition as the predominant entry point in the identification of visual art.

[6] It is important to note that exposure to art, unlike encounters with every-day objects, is a rather exclusive event and often restricted to a museum or gallery context; hence art can be regarded as an expertise domain per se. For many object categories a non-expert would still be able to name and identify an instance of such categories with an appropriate basic level and subordinate level concept. This is unlikely in the case of art, which represents a more specialised domain of knowledge. This study did not address the question how people without relevant art-specific categories and whose memorial representations have not been shaped by previous encounters with instances of a particular artist, genre or style, would identify an artwork. However, it seems likely that under these conditions, identification may more strongly rely on recognition of external-world object references (provided that representational information can be extracted from the work) and this may characterize a transfer of everyday processing strategies into the realm of art (Cupchik & Gebotys, 1988). Presumably, repeated exposure to works of art may foster the fast implicit learning of styles (Gordon & Holyoak, 1983) and the formation of style based memorial representations (Belke, Leder, & Augustin, 2006), which may evolve around single artists.

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Appendix 1

List of paintings used in Experiment 1.

Artist	Title	Style
Paul Cézanne	"Mont Saint-Victoire"	Postimpressionism
John Constable	"Hampstead Heath"	Realism
André Derain	"Landscape in southern France"	Fauvism
Caspar-David Friedrich	"Solitary tree"	Romanticism
Claude Monet	Detail of "Water lilies 1906"	Impressionism
Vincent van Gogh	"Starry Night"	Postimpressionism
Wassily Kandinsky	"Murnau"	The Blue Rider
Max Beckmann	"Self-portrait with a cigarette"	New Objectivity (Neue Sachlichkeit)
Paul Klee	"Senecio"	Expressionism
Gustav Klimt	Detail of "Judith"	Art Nouveau
Roy Lichtenstein	Detail of "That's The Way—It Should Have Begun! But It's Hopeless."	Pop-Art
Edvard Munch	"The Scream"	Symbolism
Pablo Picasso	"Portrait de Dora Maar"1937	Synthetic Cubism
Gerhard Richter	"Emma"	Photorealism
Salvador Dali	"Persistence de la Memoire"	Surrealism
Albrecht Dürer	"The Hare"	Renaissance
René Magritte	"Le Faux Miroir"	Surrealism
René Magritte	"Ceci n'est pas une pipe"	Surrealism
Gerhard Richter	"Skull 1983"	Photorealism
Vincent van Gogh	"Sunflowers"	Postimpressionism
Andy Warhol	"Campbell's Soup"	Pop-Art
Jean-Honoré Fragonard	"Diderot"	Rococo
Pablo Picasso	"Portrait de Dora Maar"	Synthetic Cubism
Roy Lichtenstein	Detail of "That's The Way – It Should Have Begun! But It's Hopeless"	Pop-Art

(*continued on next page*)

Appendix 1 (*continued*)

Artist	Title	Style
Leonardo da Vinci	"De Benci"	High-Renaissance
Gustav Klimt	"Judith" (part of it)	Art Nouveau
Anselm Feuerbach	"Nanna"	Classicism
Paul Klee	"Senecio"	Expressionism
Vincent van Gogh	"Armand Roulin"	Postimpressionism

Appendix 2

List of paintings used in Experiment 2.

Artist	Title	Style
Jean-Honoré Fragonard	"Diderot"	Rococo
Pablo Picasso	"Portrait de Dora Maar"	Synthetic Cubism
Roy Lichtenstein	Detail of "That's The Way – It Should Have Begun! But It's Hopeless."	Pop-Art
Leonardo da Vinci	"De Benci"	High-Renaissance
Gustav Klimt	Cut-out of "Judith"	Art Nouveau
Anselm Feuerbach	"Nanna"	Classicism
Paul Klee	"Senecio"	Expressionism
Vincent van Gogh	"Armand Roulin"	Postimpressionism

Appendix 3

List of paintings used in Experiment 3.

Artist	Title	Style
Francois Boucher	"Reclining Girl"	Rococo
Lucas Cranach the Elder	"Venus 1532"	Early Renaissance Painting
Rembrandt	"Bathsheba"	Baroque
Peter Paul Rubens	"Leda and the Swan"	Baroque
Paul Cézanne	"Mont Saint-Victoire"	Postimpressionism
Caspar-David Friedrich	"Solitary Tree"	Romanticism
Claude Monet	"Water lilies 1906"	Impressionism
Vincent van Gogh	"Starry Night"	Postimpressionism
Leonardo da Vinci	"De Benci"	High-Renaissance
Anselm Feuerbach	"Nanna"	Classicism
Fragonard	"Diderot"	Rococo
Pablo Picasso	"Portrait de Dora Maar"	Synthetic Cubism
J. B. S. Chardin	"Silver Tumbler"	Rococo
Albrecht Dürer	"The Hary"	Renaissance
René Magritte	"Ceci n'est pas une pipe"	Surrealism
Andy Warhol	"Campbell's Soup"	Pop-Art

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.actpsy.2009.11.007.

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