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## Can music be figurative? Exploring the possibility of crossmodal similarities between music and visual arts

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According to both experimental research and common sense, classical music is a better fit for figurative art than jazz. We hypothesize that similar fits may reflect underlying crossmodal structural similarities between music and painting genres. We present two preliminary studies aimed at addressing our hypothesis. Experiment 1 tested the goodness of the fit between two music genres (classical and jazz) and two painting genres (figurative and abstract). Participants were presented with twenty sets of six paintings (three figurative, three abstract) viewed in combination with three sound conditions: 1) silence, 2) classical music, or 3) jazz. While figurative paintings scored higher aesthetic appreciation than abstract ones, a gender effect was also found: the aesthetic appreciation of paintings in male participants was modulated by music genre, whilst music genre did not affect the aesthetic appreciation in female participants. Our results support only in part the notion that classical music enhances the aesthetic appreciation of figurative art. Experiment 2 aimed at testing whether the conceptual categories ‘figurative’ and ‘abstract’ can be extended also to music. In session 1, participants were first asked to classify 30 paintings (10 abstract, 10 figurative, 10 ambiguous that could fit either category) as abstract or figurative and then to rate them for pleasantness; in session 2 participants were asked to classify 40 excerpts of music (20 classical, 20 jazz) as abstract or figurative and to rate them for pleasantness. Paintings which were clearly abstract or figurative were all classified accordingly, while the majority of ambiguous paintings were classified as abstract. Results also show a gender effect for painting’s pleasantness: female participants rated higher ambiguous and abstract paintings. More interestingly, results show an effect of music genre on classification, showing that it is possible to classify music as figurative or abstract, thus supporting the hypothesis of cross-modal similarities between the two sensory-different artistic expressions.

*Keywords:* visual arts; music; synaesthesia; abstract and figurative categorization.

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The relationship between art and emotion, although investigated in several different studies (e.g. Actis-Grosso & Zavagno 2015; Etlin, 1998; Goodman, 1976; Granger, 1979; Pickford, 1976; Ramachandran & Hirstein, 1999; Valentine, 1962), has never been clearly defined. This lack in definition is mainly due to the difficulty in defining invariant universal perceptual rules for different emotional responses. Furthermore it should be considered that there is no consensus in the scientific community on how to define what is art (Actis-Grosso & Zavagno, 2008; Freedberg & Gallese, 2007; Massironi, 2000; Zavagno, 2011), which is probably the reason why so many different studies have been conducted on the relationship between art and emotions without reaching any definite result.

In this study we are mainly interested in the emotional response to the combined exposure to music and paintings. By emotional response we intend here a collection of emotions that deliver a positive aesthetic experience in terms of pleasantness (Kubovy, 1999). In particular, we want to investigate the interaction between music and the visual arts as a specific form of synaesthesia, which could differently modulate the aesthetic experiences (considered as a particular emotion) that arise from such domains of artistic expression. If the aesthetic appreciation of a combined exposure to a painting of a certain type (for instance a water landscape by Monet, Fig. 3a) and to music of a certain type (for instance Janáček's Sonata 1.X.1905, *The Presentiment*) is enhanced, it could be that such artworks share at some level similarities in their macro-structures. The hypothesis is rather daring and indeed not easy to investigate. Nevertheless, we attempt a first address to such a hypothesis by testing whether concepts used to categorize paintings as abstract or figurative can be extended to the domain of instrumental music.

Although the relationship between music and the visual arts received attention by many influential artists (for instance Kandinsky, 1926), there are only a small number of scientific studies devoted to this issue. In 1982 Parrott was the first to experimentally investigate emotional reactions to the combined exposure of music and paintings, trying to understand whether one sense modality (i.e. acoustical or visual) was dominant or, alternatively, acted as a distractor (or had an additive effect) on the overall emotional response to a combined music/painting presentation. To this aim he asked participants to evaluate six paintings (i.e. two paintings by each of three artists, Miro, Hopper and O'Keefe, all abstract in genre) and two pieces of music (by Grieg and Tchaikovsky, chosen as representative of "sad" and "happy" music, respectively) "under three different conditions: music alone, paintings alone and combined situation of music and painting" (Parrott, 1982). Results showed that the emotional effects of painting and music were basically additive. Furthermore, music judgments were more influenced by the presence of paintings than vice versa and significant interactions were reported for the 'goodness/badness of match' between music and painting, leading the author

to conclude that a possible pattern of a painting/music interaction could not be excluded, “where the emotional response depends upon a particular combination of such artistic expressions” (Parrott, 1982, p.636).

It therefore becomes crucial to understand whether there are combinations of music and paintings that are “better” than others, in the sense that they are perceived as “matching” and, if that is the case, what are the factors underlying a good match vs a bad one. A number of researchers have found agreement among participants as to which of several paintings (Cowles, 1935; Wehner, 1966) or visual patterns (Simon & Wohlwill, 1968) match particular musical excerpts, both in adults and children (Hasenfus, Martindale, & Birnbaum, 1983), but no study at present has found a general rule for “the good match”.

Limbert and Polzella (1998), in trying to understand the relationship between visual arts and music, matched four impressionist paintings with a two minutes excerpt by Ravel and four abstract paintings with a two minutes excerpt by Weber. They found that, with regards to paintings, matching music affected the level of aesthetic appreciation of paintings. However, they also noticed that “impressionist” music incremented the appreciation of paintings regardless of the paintings’ styles. Finally, Koning and van Lier (2013) conducted a study in which they matched landscapes by William Turner to classical music and abstract paintings by Wassily Kandinsky to jazz music, finding that matching music affected positively the aesthetic appreciation of both painting genres.

It should be noticed that in all the reported researches on the relationship between music and the visual arts, the choice of “matching” music was arbitrarily made by the authors, who follow the general rule of thumb –actually based on common sense – according to which classic music is a better fit for figurative artworks than jazz or “modern” (XX century) music, which in turn is a better fit for abstract artworks. It therefore appears reasonable to assume that admiring a painting while listening to music that matches “in style” the painting should increase its aesthetic appreciation, and for this reason in those studies participants were asked to report an aesthetic judgement.

To say that a music excerpt is “matching” a visual artwork means to suggest a crossmodal perceptual experience, originally studied by Köhler (1929) with his famous Takete/Maluma phenomenon, consisting in a bias in people’s matching of nonsense words to novel object shapes. In particular, nonsense words such as ‘takete’ and ‘kiki’ are associated with angular shapes while nonsense words such as ‘maluma’ or ‘bouba’ are associated with rounded shapes (Spence & Gallace, 2011; for a review see Spence & Parise, 2012), and this happens for people all over the world (Hinton, Nichols, & Ohala, 1994). An extensive literature has thus emerged over the last 80 years (with a renewed interest in recent years) on the topic of sound (or phonetic) symbolism, which has been defined by Hinton et al. (1994, p. 4) as “the direct linkage between sound and meaning”. The

majority of the research on sound symbolism published to date has focused on speech sounds (Hinton et al., 1994). The renewed interest in sound symbolism recently boosted research in neuroscience on crossmodal perceptual experiences. In the past, these crossmodal perceptual experiences were often referred to as synaesthesia (though this equivalence is not universally accepted, see Spence & Gallace, 2011), and thought to be rare. More recent research suggests instead that crossmodal perceptual experiences are more common than previously believed (Simner et al., 2006). Hence some researchers propose that connections across perceptual domains are gradually developed on the basis of crossmodal perceptual processing (“normative hypothesis”, Ward, Huckstep, & Tsakanikos, 2006, see Maurer & Mondloch, 2004). Although still a hypothesis to be tested, normative crossmodal neural processing offers a plausible mechanistic account for the arising of sound-symbolic relationships by means of natural connections between sounds and visual/spatial percepts. Within this theoretical framework, it is plausible to hypothesize that a connection between sounds and visual or spatial percepts could generate also the perceived “good match” between classic music and figurative artworks on the one hand, and jazz music and abstract artworks on the other. A possible explanation for the Takete/Maluma phenomenon (and, more in general, for the synaesthesia-like correspondences between speech sounds and the visual attributes of objects) has been suggested by Ramachandran & Hubbard (2001) and consisted in a supposed co-activation of motor or somatosensory areas involved in vowel articulation and visual areas involved in perceiving object shape. In a similar vein, we might surmise that classic (jazz) music and figurative (abstract) artworks share a similar “perceptual structure”, in the sense that some sounds typical of a music genre (e.g., jazz music) have been associated in early preverbal development with some visual or spatial properties typical of an artistic genre (e.g., abstract art), with the co-activation of the same areas involved in the sound symbolism (for a parallelism between preverbal and verbal synesthetic cross-modality correspondence, see Walker et al., 2010).

Therefore, it would be extremely interesting to define the perceptual similarities (if any) shared by different musical and visual artistic genres. To this aim we first need to be sure that naïve participants prefer the associations classic music/figurative artworks and jazz music/abstract artworks, given that in the literature reported above music and visual artworks have been arbitrarily matched by authors.

## Experiment 1

We here present a preliminary experiment in which we tested the effect of music genre on the aesthetic appreciation of paintings that were either figurative or abstract, trying to define a general rule for this supposed “good

match”. To this aim, we selected a large sample of paintings (120, of which 60 figurative and 60 abstract) and a large sample of musical excerpts (40, of which 20 classical and 20 jazz). We controlled selected stimuli so to include only instrumental excerpts and to avoid pictures containing close views of humans. Each painting could be seen in one out of three acoustic conditions: silence, listening to an excerpt of classic music, or to one of jazz. We expect figurative paintings to obtain a higher appreciation when seen while listening to classical music and, conversely, abstract paintings to be more appreciated when accompanied by an excerpt of jazz music. Given the high number of excerpts, we also expect to find some excerpts that give higher scores than others, so that we may start to look for possible perceptual similarities in their musical structure, which could aid future research aimed at defining “the general rule for the good match”.

## Method

**Participants.** Thirty participants (15 females; mean age = 22.33 years,  $SD = 2.34$ ) from the University of Milano-Bicocca received course credits for their participation in the study, being unaware of the experiment’s purpose. All had normal or corrected-to-normal vision, no auditory problems and were all right-handed (Oldfield, 1971). None of the participants had specific background in fine arts or in music (none painted or played an instrument).

**Ethics statement.** All participants gave a written informed consent before testing. The study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and fulfilled the ethical standard procedure recommended by the Italian Association of Psychology (AIP). All the experimental protocols were also approved by the Ethics Board of the University of Milano-Bicocca.

**Stimuli, apparatus, and procedure.** Stimuli consisted of reproductions of artistic paintings similar to those used in a previous work (Cela-Conde et al., 2004, 2009) and belonged to two main categories: figurative (impressionist, postimpressionist and realistic) and abstract paintings. To avoid the activation of facial-recognition brain mechanisms, pictures containing close views of humans were not included. Stimuli were adjusted for level of luminance and color spectrum (see Cela-Conde et al., 2004 for details).

Musical stimuli consisted of 20 classical pieces and 20 typical jazz pieces (Table 1), each lasting 15 seconds. We subdivided the paintings in 20 sets (one for each musical piece) of 6 images each (three abstract and three figurative). Each set was presented under the three “auditory” conditions: with classical music, with jazz music, or with no concurrent auditory stimulation (silent condition). Given the relatively large number of both pictorial and acoustic stimuli, we chose to randomly couple each painting to only two musical excerpts, one classical and one jazz. Hence, 40 blocks of 6 image trials each were generated, for a total of 240 trials.

Table 1

*Musical excerpts used in experiments 1 and 2.**Codes refer to music stimuli in experiment 2.*

<b>code</b>	<b>Classical</b>	<b>code</b>	<b>Jazz</b>
c1	Bartok, Piano Concerto #1, SZ 83 – 1. Allegro	j1	Bill Frisell, 1968
c2	Mozart, Symphony #40 In G Minor, K 550 – 1. Molto Allegro	j2	Enrico Pieranunzi, Thiaki
c3	Maderna, Quartetto per archi (c. 1946)	j3	Hiromi, XYZ
c4	Debussy, Quartet for 2 violins, viola & violoncello: Assez vif Tres Rythme	j4	Gene Ammons, Close Your Eyes
c5	Tchaikovsky, Swan Lake Suite, Op. 20A – Valse	j5	Herbie Hancock, Three Bags Full
c6	Chopin, Polonaise #3 In A, Op. 40/1, “Military”	j6	Miles Davis, Miles Runs the Voodoo Down
c7	Liszt, Hungarian Rhapsody #3 In B Flat, S 244/3	j7	John Coltrane, Liberia
c8	Bach, Orchestral Suite #3 In D, BWV 1068 – Overture	j8	Miles Davis, So what
c9	Janáček, Sonata 1.X.1905 – 1. The Presentiment	j9	Sonny Rollins, Strode rode
c10	Stravinsky, Symphonies Of Wind Instruments	j10	Dave Holland Big Band, The Razor’s Edge
c11	Stravinsky, Violin Concerto In D – 1. Toccata	j11	Art Blakey & The Jazz Messengers, Theory of Art
c12	Rachmaninov, Piano Concerto #4 In G Minor, Op. 40 – 1. Allegro Vivace	j12	Tirabassi, Boltro, Ferris, Mata Hari
c13	Schoenberg, Piano Concerto, Op. 42 – 4. Giocoso	j13	Wayne Shorter, Speak no evil
c14	Respighi, The Birds, P 154 – 2. La Colomba (The Dove)	j14	Charlie Haden, Bay City
c15	Beethoven, String Quartet in B-Flat Major, Op. 130	j15	Wynton Marsalis, Aural oasis
c16	Lutoslawski, Chain 2 – 2. A Battuta	j16	Thelonious Monk, Bemsha swing
c17	Marini, Eco A Tre Violini	j17	Pete Jolly Trio & Friends, My Favourite Things
c18	Mussorgsky/Ravel, Pictures At An Exhibition	j18	Herbie Hancock, The Sorcerer
c19	Ancillotti, Concerto N.5 – Allegro Non Molto	j19	Paolo di Sabatino Trio, It might as well be spring
c20	Debussy, 12 etudes, Pour les 5 doigts	j20	Charlie Haden, Relaxin’ at Camarillo

The timeline of an experimental block is presented in Figure 1. Participants were seated in front of a 15.500 PC (1280\*800 pixels) screen at an approximate distance of 57 cm, in a normal-lightened and silent room, and asked to perform a computerized rating task. Participants were required to express an aesthetic judgment (“How much do you like the image?”) for each presented painting. A blue horizontal rating bar appeared below each picture. Participants were informed that the bar was meant to express a 0–100% scale:

the left end of the bar corresponded to a zero level of appreciation whereas the right end of the bar corresponded to the maximum level of appreciation. Each trial started with the presentation of a white screen for three seconds: in the silent condition there was no auditory stimulation; in the music condition, music was presented with the onset of the white screen (thus preceding the onset of the paintings). After three seconds the first picture of the set was centrally presented (subtending a  $10^\circ \times 10^\circ$  of visual angle) and remained visible for two seconds within which time participants were expected to make their judgment. All participants expressed their judgements within the two second time frame. Hence, the second painting was presented. Participants were instructed to express their judgment by clicking with the mouse using their right hand. The mouse cursor was a fully vertical arrow that appeared underneath either to the left or to the right extreme of the line and moved only horizontally. The initial position (left or right) of the cursor was randomly assigned for each trial.

The whole experiment lasted approximately 25 min. E-Prime 2.0 (Psychology Software Tools, Inc., Pittsburgh, PA, USA) was used for stimuli presentation and data recording.

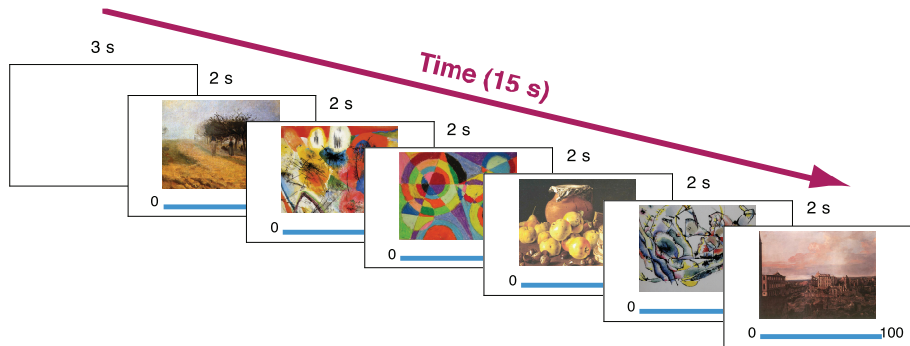


Figure 1. Time line of an experimental trial: the paintings shown during a 15 sec music condition were three for each style, presented in random order. The horizontal blue line represents the rating bar.

## Results

The position of the mouse cursor along the bar was automatically converted by the software to percentage rating scores, where 0% score corresponded to the mouse cursor positioned at the left end of the rating bar and a 100% score corresponded to the mouse cursor positioned at the right end of the rating bar.

Data were analysed with a General Linear Model Repeated Measure Analysis, with Genre (abstract, figurative) and Music (classical, jazz, none) as within subjects factors and Gender as between subjects factors (see Fig. 2). Results revealed a significant main effect of Genre ( $F_{(2, 28)} = 19.63, p < .005, \eta_p^2 = .41$ ) indicating overall higher liking for figurative art. The main effects of Music and Gender were not significant ( $p \geq .1$ ). The three-way interaction Genre\*Music\*Gender was significant ( $F_{(2, 28)} = 3.53, p = .036, \eta_p^2 = .11$ ). None of the two-way interactions reached significance ( $p \geq .1$ ).



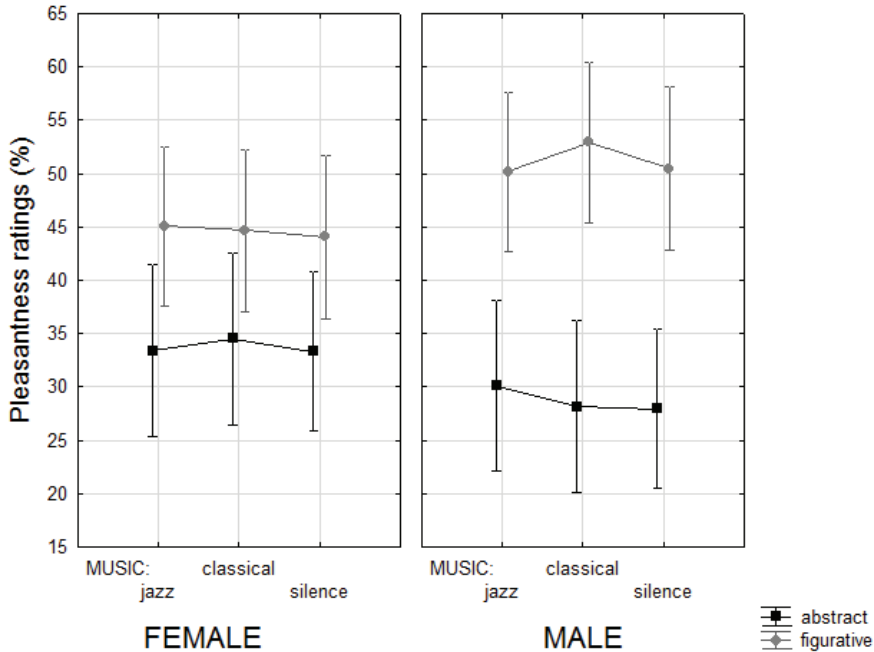


Figure 2. Percentage rating scores ( $\pm$  confidence interval) for the two Art Styles tested in Experiment 1 (i.e. figurative or abstract) as a function of the three music conditions (classical, jazz, none), divided by participants' gender (left panel: female; right panel: male). While female ratings were not affected by the combinations paintings style + music genre, male ratings showed a positive effect for the matches abstract+jazz and figurative+classical. Vertical bars denote 0.95 confidence intervals.

To understand whether or not music genre made a difference in the aesthetic appreciation of the artworks, we ran two ANOVAs for repeated measures (one per gender), excluding from the data the silence condition. With regards to female participants, the factor Genre produced a significant effect on aesthetic pleasantness ( $F_{(1, 14)} = 8.65, p < .05, n_p^2 = .38$ ), while Music and the interaction Genre\*Music were not significant ( $p \geq .2$ ). The factor Genre produced a significant effect also on the aesthetic appreciation of male participants ( $F_{(1, 14)} = 10.94, p < .005, n_p^2 = .43$ ), and while Music did not determine a significant main effect, its interaction with Genre produced significant effects ( $F_{(1, 14)} = 8.16, p < .05, n_p^2 = .36$ ).

A series of paired t-tests showed that male participants were sensitive to the combination of painting genre with music genre. In fact, appreciation was higher for Figurative/Classic than for Figurative/Jazz ( $t_{(14)} = -3.016, p < .01$ ); moreover, male participants also showed a positive effect of Jazz on the aesthetic appreciation of abstract paintings (Abstract/Classic–Abstract/Jazz,  $t_{(14)} = -3.016, p < .01$ ). In general, however, our female and male participants both showed to prefer figurative art over abstract art, irrespective of the sound condition the images were coupled with.

## Discussion

In general terms, we found that figurative art receives a higher degree of appreciation than abstract art among university students who are not involved in artistic activities. This result is consistent with previous literature showing, for example, that paintings depicting familiar objects determine higher appreciation (Muth, Pepperel, & Carbon, 2013). This difference in the level of appreciation of the two genres is enhanced in male students. Music did not have an effect on the aesthetic appreciation of paintings by female participants, but it did affect the aesthetic judgments made by male participants. In particular, classical music significantly enhanced pleasantness ratings for figurative art. The results of experiment 1 are therefore not fully in accordance with our hypothesis, revealing instead a gender difference, according to which the match between art genre and music genre is irrelevant for female art consumers but not for male ones, which can have a better experience of the artwork if the match is “good”, as identified in the literature. In other words, the initial hypothesis for which classical music is a better fit for figurative artworks on the one hand, and jazz music is a good match for abstract artworks on the other hand appears to apply only to our male participants. At our best knowledge, no study at present reported gender differences in the simultaneous presentation of music and paintings.

In accounting for this gender difference we could speculate, in line with Cupchik & Gebotys (1988) and Polzella (2000), about possible different perceptual styles for women and men, that might also affect their appreciation to the combined exposure of music and visual arts. However, we believe that the results of experiment 1 call for further investigations aiming at addressing this gender difference.

## Experiment 2

What if “figurative” and “abstract” are not simply names for paintings genres, but rather broader categories that might apply to music as well? If this were the case, the hypothesis of a synaesthesia between figurative paintings and classical music on the one hand and abstract paintings and jazz on the other should be tested by asking participants to directly associate music excerpts with one of the two broad category (i.e. figurative or abstract), using a procedure similar to that used in Takete/Maluma studies. To do this, we also need to solve the possible ambiguity raised by the two terms, trying to ascertain what does it really mean for observers to define a painting as “figurative” or “abstract”. Experiment 2 is a first step that addresses these issues by testing two questions: 1) How do people classify visual art that can fit in either category? and 2) Can the concepts “figurative” and “abstract” be extended to classify also music? We therefore planned an experiment divided into two sessions. In the first session participants were asked to classify paintings as either figurative or abstract. We used as stimuli not only paintings that are clearly abstract or clearly figurative, as in Experiment 1, but also paintings that are not clearly classifiable because created in a period in which artistic avant-gardes often deliberately fused and confused the concepts ‘figurative’ and ‘abstract’. These paintings, ambiguous

in terms of their classification, can aid us in understanding what constitutes the boundary between concepts such as abstract and figurative. In fact, given that we are asking participants to adopt categories that are defined in the visual arts domain (i.e. figurative and abstract), we need to understand what these categories mean for the layman. In particular, we hypothesize, basing on anecdotal observations, that the majority of participants would consider as “abstract” all the visual artworks that are neither resembling nor realistic, even though they should be considered as figurative according to a canonical definition of the term. One example of these visual artworks is *Champs de Mars* by Delaunay (Fig. 3c): this painting should be considered as figurative given that it represents a city view, though with a style that strongly departs from representational realism. We expect that people who are not familiar with modern art might classify it as abstract. If this should hold true, the possible synesthetic-like association that we are testing in our study ought to be weighted according to a subjective definition of the two terms “figurative” and “abstract”.

In the second session participants were asked to classify instrumental music excerpts either as abstract or figurative. In fact, we hypothesized that behind the possible “good match” between visual artworks and music there could be a conceptual categorization: concepts by which we categorize visual art, such as *abstract* and *figurative* might be extended to classify in a novel way also instrumental music, such as classical and jazz. In a way, we are testing the “Takete” and “Maluma” phenomenon at a much higher level while also reverting the question: we are not asking which shape is Takete or which is Maluma, but which combinations of sounds are more *abstract* and which are more *figurative*.

Our hypothesis is that most of the jazz music will be classified as abstract, while most of the classical music as figurative. However we do expect there to be exceptions; for instance, some of the jazz music may be more ‘melodic’ or ‘smooth’, thus structurally closer to standard classical music (and consequently classified as figurative), while some classical music, in particular from the XX century, being structurally closer to jazz, might be classified as abstract (because more sharp or ‘geometric’).

## Method

**Participants.** Twenty-four participants (14 females, mean age = 25.0 years,  $SD = 7.38$ ) from the University of Milano-Bicocca received course credits for their participation in the study, being unaware of the experiment’s purpose. All had normal or corrected-to-normal vision, no auditory problems and were all right-handed (Oldfield, 1971). None of the participants had specific background in fine arts or in music (none painted or played an instrument).

**Ethics statement.** All participants gave a written informed consent before testing. The study was conducted in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and fulfilled the ethical standard procedure recommended by the Italian Association of Psychology (AIP). All experimental protocols were also approved by the ethical committee of the University of Milano-Bicocca.

**Apparatus, stimuli, and procedure.** The experiment was carried out in a sound-attenuated room, dimly illuminated. Participants sat approximately 50 cm away from a 21-inch LCD monitor (acer® HN274H; Resolution: 1024×768 pixels; Refresh rate: 120 Hz) with their head placed on a chinrest in order to maintain a stable eye-to-screen distance. The monitor

was interfaced with an AMD Athlon™ Dual Core 2.00 GHz personal computer equipped with a NVIDIA® GeForce® GTX 560 Video Board.

Table 2  
*Artworks employed as stimuli in experiment 2*

Ambiguous	Figurative	Abstract
am1 Paul Klee, <i>Oriental pleasure</i> (1925)	f1 Evaristo Baschenis, <i>Still life with musical instruments</i> (1650)	ab1 Georges Braque, <i>Verre-bouteille et journal</i> (1912)
am2 Pablo Picasso, <i>Still life with fruit</i> (1942)	f2 Bernardo Bellotto, <i>The Ruins of the Old Kreuzkirche in Dresden</i> (1765)	ab2 Arshile Gorky, <i>Water of the flowery mill</i> (1944)
am3 Umberto Boccioni, <i>Visioni simultanee</i> (1911)	f3 Nicolaes Berchem, <i>Amsterdam</i> (1670–75)	ab3 Vasilij Kandinskij, <i>Composition VII</i> (1913)
am4 Alberto Burri, <i>Sacco-sz1</i> (1949)	f4 Brueghel the Old, <i>River landscape</i> (1608)	ab4 Paul Klee, <i>Image de Mai</i> (1925)
am5 Paul Cézanne, <i>Mont Sainte-Victoire</i> (1902)	f5 Canaletto, <i>Palazzo del Doge</i> (1725)	ab5 Kazimir Malevič, <i>Supremus 56</i> (1916)
am6 Robert Delaunay, <i>Champ De Mars</i> (1911)	f6 Caravaggio, <i>Canestro con frutta</i> (1597)	ab6 Agnes Martin, <i>Milk river</i> (1963)
am7 Paul Klee, <i>Southern gardens</i> (1936)	f7 Paul Cézanne, <i>Un coin de table</i> (1895–1900)	ab7 Piet Mondrian, <i>composition in blue, grey and rose</i> (1913)
am8 Joan Miró, <i>Nocturne</i> (1940)	f8 Claude Monet, <i>Water lilies. The clouds</i> (1903)	ab8 Jackson Pollock, <i>Lavander mist N. 1</i> (1950)
am9 Piet Mondrian, <i>Horizontal tree</i> (1911)	f9 Giovanni Segantini, <i>Landscape</i> (1896)	ab9 Bridget Riley, <i>Nataraja</i> (1993)
am10 Claude Monet, <i>Water lilies</i> (1920)	f10 Vincent van Gogh, <i>La Crau with Peach Trees in Blossom</i> (1889)	ab10 Emilio Vedova, <i>Senza titolo</i> (1962)

The experiment was divided into two sessions (separately described in the next paragraphs): in Session I participants were asked to evaluate paintings, while in Session II they evaluated musical excerpts. Instructions were verbally given before each session. Participants were individually tested in both experimental sessions; the whole experiment lasted about 25 minutes. The order of presentation of both paintings and musical excerpts was randomized.

**Session I: Paintings.** Pictorial stimuli consisted of 30 reproductions of paintings by 25 different artists (see Table 1), which have been selected by the authors so to have three different categories (genres) of paintings: (a) 10 clearly figurative; (b) 10 clearly abstract; (c) 10 ambiguous (i.e. neither realistic nor resembling but containing both figurative and abstract elements). In Figure 3 an example for each category is reported. To avoid the activation of facial-recognition brain mechanisms, pictures containing close views of humans were not included.

Each trial started with an image centrally presented subtending 10°x10° of visual angle. Participants were asked to indicate for each image whether it was “figurative” or “abstract” by pressing the “o” or the “p” key, respectively. After their response to an image, they have been instructed to express, for the same image, an aesthetic judgment (How much do you like the image?) on a 7 points Likert scale (1 for the minimum and 7 for the maximum level

of liking, respectively) by using the numbers on a standard keyboard. The pressing of the number started the next trial.

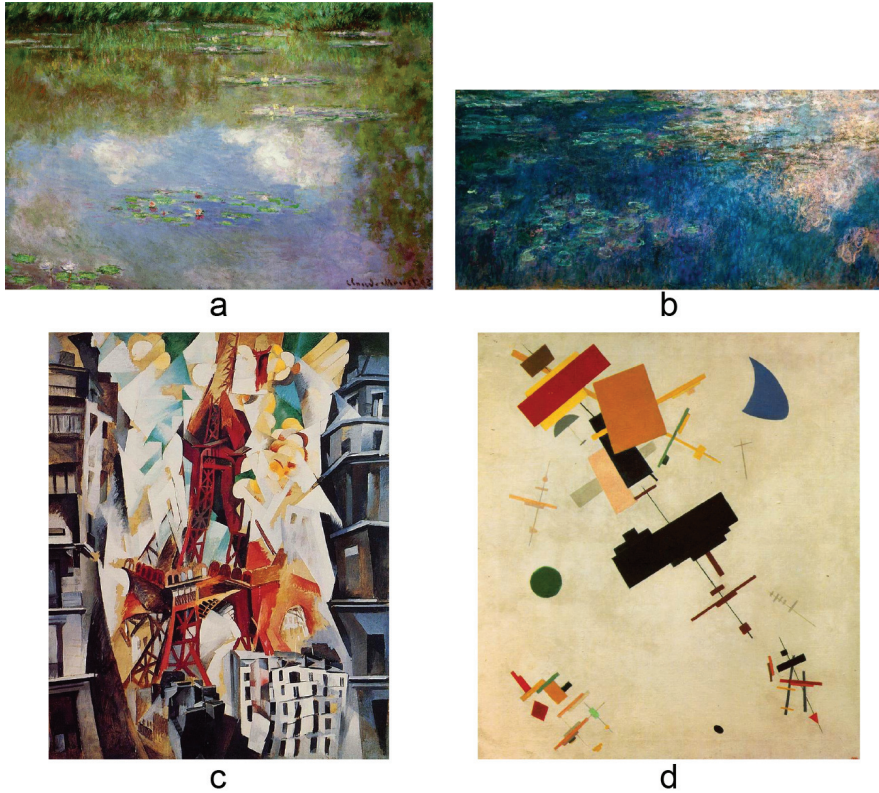


Figure 3. Artwork digital reproductions employed in experiment 2: a) Monet, *Water lilies. The clouds* (1903); b) Monet, *Water lilies* (1920); c) Delaunay, *Champ De Mars* (1911); d) Malevich, *Supremus-56* (1916). Picture *a* belongs to the group of figurative paintings; picture *d* belongs the group of abstract paintings; pictures *b* and *c* belong the group of ambiguous paintings.

**Session II: Music.** Acoustic stimuli consisted in 40 excerpts (15 sec each) from the same music pieces employed as stimuli in exp. 1 (see Table 1). Each excerpt was the eighth 15 sec interval from the start of the musical piece, which means that an excerpt consisted in the music from 120 sec to 135 sec.

Participant task was the same as in Session I: to indicate for each excerpt whether the music was “figurative” or “abstract” by pressing the “o” or the “p” key, respectively, and to express, for the same excerpt, an aesthetic judgment (How much do you like this musical excerpt?) on a 7 points Likert scale.

E-Prime2 (Psychology Software Tools, Inc.) handled timing, stimulus presentation and data recording.

## Results

Results for Sessions I and II are presented separately.

**Paintings.** A binomial test was conducted on the classification of all paintings. The 10 paintings selected as clearly figurative and the 10 as clearly abstract were classified as such ( $p < .001$ ). Of the paintings selected as ambiguous, only painting *am5* (see Table 2,  $p < .05$ ) was categorized as figurative by 75% of the participants, while paintings *am1*, *am6*, and *am10* did not reach a clear classification ( $p \geq .1$ ). All other ambiguous paintings have been classified as abstract. A Mann-Whitney test with Gender as grouping factor showed a substantial agreement between female and male classifications for all paintings, except for *am6* and *am7* (see Table 2) –  $Z = -2.32$ ,  $p < .05$  and  $Z = -2.14$ ,  $p < .05$  – the first classified as figurative by the majority of male participants, the second classified as abstract by all female participants but not by all male participants.

Data concerning the aesthetic pleasantness of the paintings (Fig. 4) were analysed with an ANOVA for repeated measures with Genre (3, ambiguous, figurative, abstract) and Paintings (30 reproductions) as within subjects factors, and Gender as between subjects factor. As one would expect, Paintings determined a significant effect on pleasantness:  $F_{(9, 198)} = 5.73$ ,  $p < .001$ ,  $n_p^2 = .2$ . More interesting, both the main effects of Genre and Gender were significant ( $F_{(2, 44)} = 8.19$ ,  $p < .001$ ,  $n_p^2 = .27$  and  $F_{(9, 198)} = 5.54$ ,  $p < .05$ ,  $n_p^2 = .2$ , respectively) as well as the interactions Genre\*Gender ( $F_{(2, 44)} = 4.52$ ,  $p < .05$ ,  $n_p^2 = .17$ , see Fig. 4) and Genre\*Paintings ( $F_{(9, 198)} = 4.58$ ,  $p < .001$ ,  $n_p^2 = .17$ ). The three-way interaction Genre\*Paintings\*Gender was not significant ( $p = .9$ ). T-tests for independent samples showed that ratings for male and female participants are statistically different for ambiguous ( $M_m = 3.61$ ,  $M_f = 4.65$ ,  $t_{(22)} = -2.8$ ,  $p < .05$ ) and abstract ( $M_m = 2.98$ ,  $M_f = 4.05$ ,  $t_{(22)} = -2.84$ ,  $p < .01$ ) paintings.

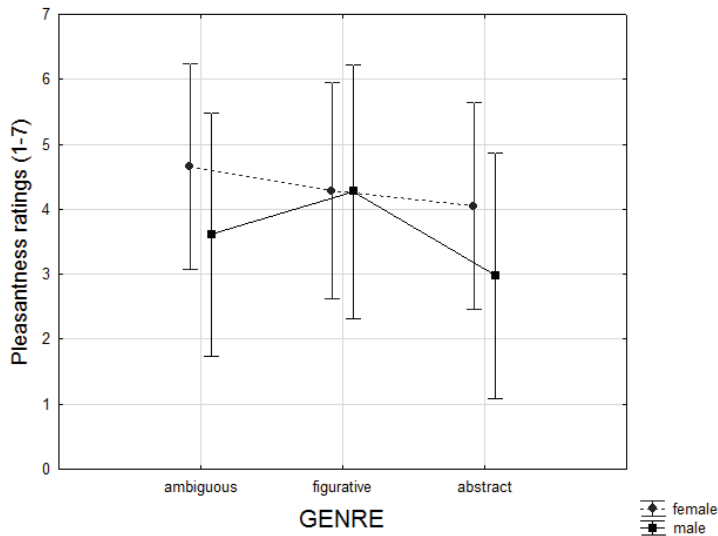


Figure 4. Ratings (Likert scale 1–7, ± confidence interval) relative to the aesthetic evaluation of the paintings employed in experiment 2, for female and male participants. The ratings are statistically distinguishable for ambiguous and abstract paintings. Vertical bars denote 0.95 confidence intervals.

**Music.** Table 3 shows classification percentages for all excerpts. Our working hypothesis was that most classical music would be classified as *figurative* and most jazz music as *abstract*. A binomial test was conducted on the classification of all musical excerpts, in which the proportion of the test was set to 45%. As for the classical excerpts (see Table 1), nine were clearly classified as figurative – c1 ( $p < .001$ ), c2 ( $p < .001$ ), c3 ( $p < .05$ ), c5 ( $p < .05$ ), c9 ( $p < .05$ ), c10 ( $p < .05$ ), c11 ( $p < .05$ ), c15 ( $p < .005$ ), c18 ( $p < .05$ ) – two showed a tendency towards figurative (c16,  $p = .08$  and c17,  $p = .06$ ), two excerpts showed a tendency to be classified as abstract (c12,  $p = .06$ , and c20,  $p = .06$ ), while the remaining seven excerpts remain ambiguous as far as their classification in abstract or figurative is concerned. The classification of the jazz excerpts follows a similar pattern, but in favour of the abstract categorization: eight excerpts were clearly classified as abstract – j1 ( $p < .001$ ), j2 ( $p < .005$ ), j4 ( $p = .05$ ), j6 ( $p < .005$ ), j13 ( $p < .05$ ), j16 ( $p < .05$ ), j17 ( $p < .05$ ), and j19 ( $p < .05$ ) – three excerpts showing a tendency towards abstract – j3 ( $p = .06$ ), j14 ( $p = .06$ ), and j20 ( $p = .06$ ) – one excerpt was classified as figurative (j12,  $p < .05$ ), and the remaining eight excerpts were ambiguous in terms of an abstract/figurative classification. A Mann-Whitney test with Gender as grouping factor showed a substantial agreement between female and male classifications for all music excerpts, with the following exceptions: c13 ( $Z = -2.77$ ,  $p < .005$ ), c14 ( $Z = -2.43$ ,  $p < .05$ ), j10 ( $Z = -2$ ,  $p < .05$ ), and j18 ( $Z = -2.72$ ,  $p < .01$ ), see Table 1.

Table 3  
*Abstract and figurative music classification percentages.*

classical	1	2	3	4	5	6	7	8	9	10
abstract	16.7	20.8	33.3	50	33.3	45.8	41.7	58.3	29.2	33.3
figurative	83.3	79.2	66.7	50	66.7	54.2	58.3	41.7	70.8	66.7
classical	11	12	13	14	15	16	17	18	19	20
abstract	33.3	62.5	45.8	50	16.7	29.2	37.5	25	50	62.5
figurative	66.7	37.5	54.2	50	83.3	70.8	62.5	75	50	37.5
<b>jazz</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<i>abstract</i>	79.2	75	62.5	66.7	50	75	58.3	58.3	62.5	54.2
<i>figurative</i>	20.8	25	37.5	33.3	50	25	41.7	41.7	37.5	45.8
<b>jazz</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
<i>abstract</i>	54.2	25	70.8	62.5	66.7	75	70.8	62.5	66.7	62.5
<i>figurative</i>	45.8	75	29.2	37.5	33.3	25	29.2	37.5	33.3	37.5

Data concerning the aesthetic pleasantness of the excerpts were analysed with an ANOVA for repeated measures with Genre and Excerpts as within subjects factors, and Gender as between subjects factor. As one may expect, Excerpts produced significant effects on aesthetic evaluations:  $F_{(19, 418)} = 4.04$ ,  $p < .001$ ,  $n_p^2 = .15$ . Surprisingly, the other two factors did not produce significant effects ( $p \geq .1$ ). The interactions Excerpt\*Gender and Genre\*Excerpt were significant:  $F_{(19, 418)} = 1.85$ ,  $p < .05$ ,  $n_p^2 = .07$  and  $F_{(19, 418)} = 4.67$ ,  $p < .0001$ ,  $n_p^2 = .17$ .

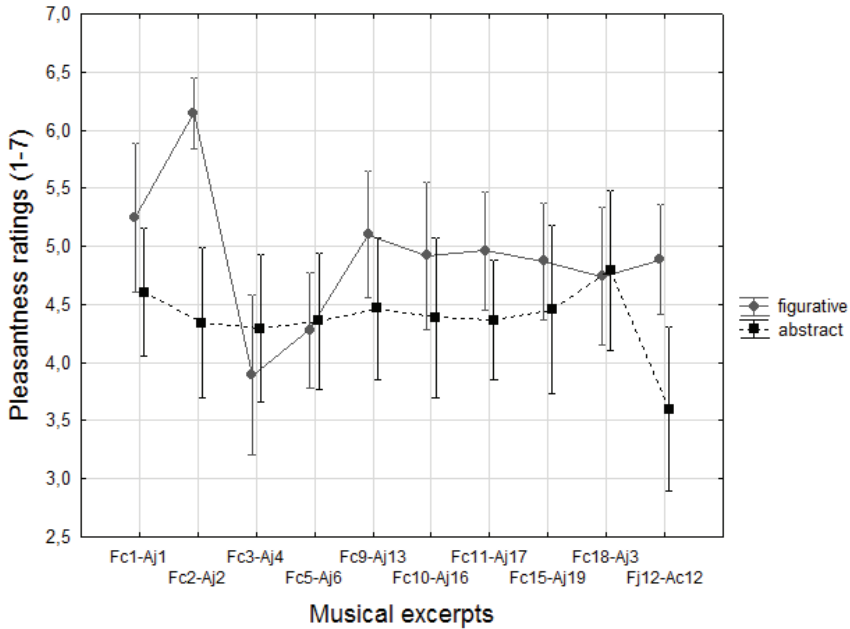


Figure 5. Pleasantness ratings (Likert scale 1–7,  $\pm$  confidence interval) for the 10 musical excerpts clearly classified as figurative and the 10 musical excerpts clearly classified as abstract: ratings for ‘figurative’ music are overall greater than ratings for ‘abstract’ music, a finding that mirrors ratings for figurative and abstract paintings both in experiments 1 (Fig. 2) and 2 (Fig. 4). Vertical bars denote 0.95 confidence intervals.

Based on the classification data, we grouped 10 of the excerpts classified as figurative (c1, c2, c3, c5, c9, c10, c11, c15, c18, and j12) and 10 of the excerpts classified as abstract (j1, j2, j4, j6, j13, j16, j17, j19, j3, and c12). Figure 5 displays the means for all twenty excerpts, distinguished by categorization. On the pleasantness ratings of these excerpts, an ANOVA for repeated measures was carried out with Classification (2 levels) and Excerpts (10 levels) as within subjects factors, and Gender as between subjects factor. Excerpts (as expected) determined significant effects:  $F_{(9, 198)} = 4.2, p < .001, n_p^2 = .16$ . More interesting, also classification produced a significant main effect:  $F_{(1, 22)} = 5.03, p < .05, n_p^2 = .18$ . While gender did not determine a significant main effect ( $p = .08$ ), it interacted significantly with Excerpts ( $F_{(9, 198)} = 2.53, p < .01, n_p^2 = .103$ ); the interaction Classification\*Excerpts was also significant ( $F_{(9, 198)} = 3.38, p < .001, n_p^2 = .13$ ).

## Discussion

The classification of the paintings selected as ambiguous led to a majority of the artworks being considered as abstract despite clear figurative features in most of the paintings, such as in the case of Boccioni’s *Visioni simultanee*.



This lends to speculate that people who do not have a certain acquaintance with XX century art tend to be rather conservative as for what they consider to be figurative. For instance, while Monet's 1903 *Water lillies. The clouds*, selected as figurative, was in fact categorized as such by all participants, Monet's 1940 *Water lillies* was classified as figurative by only 67% of the participants. Hence the concept *figurative* is narrower than we expected, as it appears to be strongly related to art style, pictorial realism, and indeed observers' expertise in art. Such finding is rather intriguing and deserves to be further investigated as it invests the concepts of figurative and abstract in more general terms, and the possibility to employ such concepts to classify other domains of the arts.

With regards to the aesthetic ratings of the paintings, female and male participants rated figurative art similarly, however male participants' ratings for the ambiguous and abstract paintings are significantly lower than those expressed by female participants. This result reflects those in exp. 1.

The results for music tend to confirm our work hypothesis that classical music would be classified as figurative and jazz as abstract. Furthermore, in line with the results for paintings, those excerpts that were classified as figurative received higher pleasantness ratings than the excerpts classified as abstract. This result therefore supports the hypothesis of a structural correspondence between painting and musical genres.

However, it must be pointed out that not all the classical music was classified as figurative, and not all jazz was classified as abstract. Even though this result is in line with our hypothesis (we hypothesized the occurrence of some exceptions), we think that it demands further investigation. Two different accounts are possible for these exceptions, and both accounts should be tested with an experiment specifically tailored on the two different possibilities (and with a larger number of participants). On the one hand, it could be, as we hypothesized, that the structure of some musical excerpts is somehow "inverted", being smoother for some jazz excerpts and sharper for some classical music. For instance, we expect some XX century classical music to be classified as abstract, and some jazz, for instance cool jazz, to be classified as figurative. On the other hand, it could be that the task was not as simple as we thought. For instance, it could be that structural similarities are only broadly captured within the macro categories 'abstract' and 'figurative'. This hypothesis is somewhat supported by the categorization results of the paintings belonging to the 'ambiguous' group: most of the paintings that could virtually be classified either way tend to be classified as abstract. In sum, we need to analyse more closely the structure of the music excerpts that have been classified as classic or figurative, and the structure of those music excerpts that did not receive a clear classification. This analysis should be done also in light of the fact that by picking as excerpts the 8<sup>th</sup> interval of 15 seconds of the selected music, we did not check whether in those intervals the musical structure was as clear as one might expect on the basis of the title and author chosen. In other terms, more experiments are needed in which excerpts are longer and taken from different points of a same musical piece.

## General Discussion

The aim of the present study was to investigate the interaction between music and the visual arts as a specific form of synaesthesia. We hypothesized that the combinations “classic music/figurative paintings” and “jazz music/abstract paintings” should enhance the aesthetic appreciation of paintings because of some perceptual similarities in the aesthetic structure of music and paintings that resemble the Takete/Maluma phenomenon. In exp. 1 we tested the first part of our hypothesis, based both on common sense and on the findings of other empirical studies (Koning & van Lier, 2013; Limbert & Polzella, 1998), that classical music is a good fit for figurative art, and jazz music for abstract art. We employed a wide selection of figurative and abstract paintings and 40 excerpts of instrumental classical and jazz music and asked participants to rate paintings’ pleasantness combined either with classical music or jazz, or viewed in a silent condition. Results showed a discrepancy between genders. In general, figurative art received a higher degree of appreciation than abstract art: this difference in the level of appreciation is enhanced in male students. Furthermore, while the aesthetic appreciation of artworks by female participants was not affected by any combination with music, the combinations classical music-figurative paintings and jazz-abstract paintings affected positively the aesthetic appreciation of artworks by male participants.

Previous literature reports gender difference in the appreciation of painting styles, but the direction of this difference is not clear and is not consistently reported. Bernard (1972), for example, found that women are more attracted to impressionist paintings than men, and men are more attracted to “modern paintings” than women. Neperud (1982) found that women showed less preference for artistic patterns than men, whereas men rate figurative, i.e., realistic, and abstract styles more favourably than women (see Polzella, 2000). In contrast, Farrell & Rogers (1982), Limbert & Polzella (1998), Lindauer (1990), and Koning & van Lier (2013) each found no evidence of gender differences. Besides, we are aware of no study reporting gender differences in the simultaneous presentation of music and paintings.

Given that findings for male participants were in line with our initial hypothesis, we then decided, before speculating on possible gender difference in the fruition of art, to test the second part of our hypothesis, i.e. that of a synesthetic-like association between music genres and painting styles that share some similarities in their macrostructure. To this aim, we adopted a procedure similar to that used in Takete/Maluma studies, asking participants to classify instrumental music excerpts either as abstract or figurative. In this way we were asking participants to categorize music (i.e. a pattern of stimuli pertaining to the acoustical domain) with concepts by which we categorize visual art. Our work hypothesis was that if such categorization were possible, then such concepts might comprise structural features common to both domains of the arts, visual and musical. In a more general view, the possibility to extend those concepts to other artistic expressions might also show that synaesthesia-like experiences

may in some cases be accounted for in terms of structural similarities – in gestalt terms – between stimuli pertaining to different sensory domains or continua, which would also account for crossmodal similarities between percepts pertaining to different sensory systems. Such hypothesis finds its logic in the goal of the visual systems, which is to generate a coherent model of the world (Zavagno, Daneyko, & Actis-Grosso, 2015), such that percepts from different sensory domains do not result in conflicting information, in particular if they must refer to a same perceptual object or event.

However, given that the two concepts “abstract” and “figurative” are appropriately used only by experts in visual art, Experiment 2 was also aimed at solving the possible ambiguity raised by the two terms, trying to ascertain what does it really mean for the layman to define a painting as “figurative” or “abstract”.

A first interesting result of Experiment 2 is indeed related with such ambiguity: of the 10 paintings selected as ambiguous and used in the first session of the experiment, 6 were classified as abstract and only 1 as figurative (the other three remaining ambiguous also in participants’ classification). This finding may depend on the low level of art expertise of our participants. Winston & Cupchik (1992) showed, in fact, that naïve observers tend to respond more emotionally to visual artworks while experienced observers tend to evaluate more dynamic experiences related to structural properties of the artwork. If this is true, we can imagine that in general terms it is easier for non-experienced observers – as are most of our participants to both experiments – to engage positively with figurative art than with abstract art. But what is to be considered as figurative art? The answer, we think, is anchored to three factors, two of which should be negatively correlated: artistic style and pictorial realism. The third factor is artistic expertise: the higher the expertise, the most likely artistic style will be evaluated more than pictorial realism. In our case, being the level of artistic expertise rather low, pictorial realism must have won over style, hence the majority of paintings were classified as abstract, or tended towards abstract.

Results for paintings’ pleasantness in Experiment 2 confirm the gender difference found in Experiment 1. In Experiment 2 pleasantness ratings are statistically distinguishable between genders only for ambiguous and abstract paintings, which female participants rated higher, while pleasantness ratings for figurative artworks was practically identical for the two genders. In other words, male participants showed a greater discrepancy between pleasantness ratings for paintings classified as figurative and those classified as abstract than female participants. In consideration of this finding, future research should use as stimuli only paintings which are consistently reported as “figurative” or “abstract” by all participants, which implies the necessity to establish a baseline for each participant before any experiment with paintings, or, alternatively, to create a database of paintings clearly classified either as abstract or figurative. This could also help in understanding the possible structural similarities between paintings and music.

Let's now consider the classification of the musical excerpts. Our results partially support the aforementioned hypothesis, with approximately 50% of the musical excerpts classified either as abstract or figurative. Such partial result could depend on the classification task being unnatural, but this seems not to be the case, given that participants found the task easy to do (no one asked for clarifications or expressed any perplexity). Rather, it could be that the task was not as simple as we thought: structural similarities might be only broadly captured within the macro categories 'abstract' and 'figurative'. This hypothesis is somewhat supported by the categorization results of the paintings belonging to the 'ambiguous' group: most of paintings that could virtually be classified either way tend to be classified as abstract. Furthermore, our partial results could depend on how the 15 seconds intervals of the excerpts were chosen. In fact, experiments 1 and 2 used the same excerpts, but these were taken from different intervals: in exp. 1 the first 15 seconds were employed; in exp. 2 the interval was the 8<sup>th</sup>. Such difference may be the actual reason why only 50% of the excerpts in experiment 2 resulted as classifiable in terms of abstract or figurative. If this were case then the overall similarity between aesthetic evaluations in experiment 1 for abstract and figurative paintings (see Fig. 2) and the pleasantness evaluations for those musical excerpts classified either as abstract or figurative in experiment 2 (see Fig. 5) would not just be a coincidence, but rather the result of crossmodal similarities between two different types of artistic expressions: one experienced with the ears, the other with the eyes. This would also mean that far from being "abstract concepts", the concepts *abstract* and *figurative* capture crossmodal structural similarities that we hypothesize to pertain to qualities such as *shape* and *form* as intended by Arnheim (1974). It would thus become crucial, for future research, to look for perceptual similarities not only between those musical excerpts that have been clearly classified in either ways and their correspondent visual artworks, but also between those "ambiguous" excerpts that could have a melodic structure perceived in turn as more smooth or 'geometric'.

We are aware of no research that has specifically attempted to directly match music to categories that are peculiar for visual artworks: this study demonstrates for the first time that this is possible. Future research should investigate more in detail whether this means, as we think, that crossmodal perceptual processing could be extended to include not only, as it is already demonstrated, the correspondences existing between speech sounds and visual- (but also gustatory-, Spence & Gallace 2011, and haptic-, Fontana 2013) attributes of objects or stimuli, but also the correspondence between sounds and visual/spatial percepts in the artistic domain. A possible development along this line could be to investigate possible connections between lyrics and visual artworks, combining speech sounds (e.g. with more vowels or consonants) and music with different melodic structure (e.g. opera as an example of figurative music with speech sounds with more vowels in it) with different visual artistic styles. These combinations, not so unusual in artistic performances, have never

been experimentally investigated and could help in tackling – and possibly deepening – the already mentioned hypothesis (Ramachandran & Hubbard, 2001) of a supposed co-activation of motor areas involved in speech articulation and visual areas involved in perceiving object shape. Furthermore, it could also help in connecting temporal aspects of musical structure (i.e. rhythm and tempo) with temporal aspects of visual perception (i.e. the kinematics and dynamics of motion, Viviani & Stucchi, 1989, Carlini, Actis-Grosso, Stucchi, & Pozzo, 2012), extending the interest to other motor areas – generally involved in body motion – and to other artistic domain, such as dance (Dittrich, Troscianko, Lea, & Morgan, 1996). Finally, future experiments might want to consider familiarity and style preferences, or even different levels of expertise in art and music history, as effecting liking ratings and aesthetic appreciation in general.

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