Old Paintings, New Technology: Does Instructive Animation Make Sense in Art Education?

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Multimedia educational products are gaining widespread consumer acceptance. At the same time, many of these products lack a sound theoretical background or instructional quality, and empirical data supporting their educational value are frequently missing. The present experiment with $N = 64$ participants examined the usefulness of multimedia applications in art education by constructing four different presentations of 12 representational paintings. Various visual effects, such as motion, fading, zooming, and dissolving, as well as spoken text were used to modify the viewers’ mode of understanding. The experimental conditions were varied on two dimensions: (a) The adequacy of the visual effects and (b) the additional presentation of verbal information. The findings support the notion that sophisticated multimedia applications assist the viewer in adopting a more elaborate mode of understanding. Few effects on viewers’ aesthetic interest in art or quality of aesthetic experience were found. In contrast to the sophisticated use of multimedia, the use of “flashy” multimedia elements did not have any instructional value.
Educators and researchers alike are always looking for more efficient ways of teaching and learning. Among the possible contributions to improved teaching, the potential role of instructional media has been of major interest ever since instructional illustrations, films, video applications, and computer programs became widely available (Clark & Salomon, 1986; Hasebrook, 1998). With the onset of the age of multimedia, it was claimed that this educational tool could contribute to make education more efficient and interesting (Stoney & Oliver, 1998; Clark & Salomon, 1986). Multimedia applications are currently being used in a variety of areas, for instance in second language acquisition (Cardillo, 1997; Plass, Chun, Mayer, & Leutner, 1998), math and science education (Crosby & Stelovsky, 1995; Keyvan, Pickard, & Song, 1997; Zech, Vye, Bransford, Goldman, Barron, Schwartz, Kisst-Hackett, & Mayfield-Stewart, 1998), and instruction for future medical doctors (Kolasa, Jobe, Miller, & Clay, 1999; McGee, Neill, Goldman, & Casey, 1998). While there are psychological theories describing the positive effects of multimedia (Mayer, 1997; Hasebrook, 1998), the educational value of current applications is often questioned. For instance, in his critical review, Lookatch (1997) stated that “today’s instructional designer vitas highlight multimedia experience and quasi-experiences and little, if any, instructional design accomplishments” (p. 112). Not surprisingly, perhaps, psychological research indicates that multimedia products sometimes fail to show any advantage over classical learning environments and that they may even prevent students from learning (Hailey & Hailey, 1998; Schnotz, Boeckheler, Grzondziel, Gärtnert, & Wächter, 1998).

In the authors’ view, the sometimes disappointing results found in studies of multimedia applications can in part be attributed to the weak theoretical underpinning of multimedia programs. The theoretical basis should consist of a flexible interplay of two aspects: On the one hand, clear educational strategies in a given domain are necessary for the development of successful learning environments (Lookatch, 1997). Domain-specific instructional goals have to be considered. For instance, while the desired outcome in some domains is an increase of knowledge or enhanced problem solving capacities (Plass, Chun, Mayer, & Leutner, 1998; Mayer, 1997), educational goals in other domains might be the changing of attitudes or fostering of interest. While there is a multitude of possible goals, mere “acceptance” of a multimedia application by users (Teichman & Richards, 1999) does not seem to be a particularly ambitious goal in most instances.

Second, having identified a suitable instructional goal, educational strategies which may or may not include the use of multimedia should be developed. When the use of multimedia is considered or opted for, a general educational or psychological theory concerning the use of multimedia as
an educational tool is required. This theory should, for instance, address the influence of multimedia presentations on the allocation of attention, the integration of information and student’s motivation to interact with a domain. However, different instructional strategies are necessary for different goals. Thus, if multimedia applications are to be used, they have to be designed to fit the specific characteristics of a given domain.

In the present article, we concentrate on multimedia effects in a specific educational domain, namely art education. The use of multimedia effects in museums and art education materials such as CD-ROMs has become widespread over recent years (Cason, 1998; Infogrames Deutschland, 1996; Krick Fachmedien, 1999). However, there have been few theoretical considerations of this approach and even fewer empirical attempts to evaluate the quality of such programs. Therefore, in accordance with the research agenda outlined, we identified domain-specific goals and developed an instructional strategy which drew on the general framework of multimedia effects proposed by authors such as Mayer (1997), Salomon (1994), and Hasebrook (1998). We then designed and evaluated an experimental educational multimedia application which directly addressed domain-specific educational goals within art education.

Goals in Art Education

Several different goals of art education, such as joy, understanding, knowledge, capacity to judge, and so forth, have been discussed in the available literature (Csikszentmihalyi & Robinson, 1990; Stone, 1996; Williams, 1996). In our research we concentrated on two important goals: increasing the level of understanding and providing viewers with a pleasant aesthetic experience, which should enhance the learner’s interest in art.

**Level of understanding.** The level of understanding is the core variable in Parsons’ (1987) developmental account of aesthetic development. In his empirical studies, Parsons found a typical developmental sequence in participants’ reactions toward paintings, which led him to propose five stages of aesthetic development. Young children judge a painting according to their own subjective experience; whether they like or dislike it largely depends on their favorite colors (stage one). Children in elementary school look for subject matter, beauty, and realism; a painting is “good” if it is a good and beautiful representation of reality (stage two). For art viewers at stage three, subject matter is the most important factor—they look for an
idea that is expressed in the painting: anger, love, or beauty, for example. As soon as they find an idea, they are happy with it; they do not double-check. Basically, people at stage three are regular, “naive” art consumers. Without special education in the arts, most people reach this stage. In contrast, viewers at stage four do not rely on their first impression. They distinguish between the literary appeal of the subject and what is achieved in the work itself. Thus, formal elements such as the medium, form, and style of a work of art only become significant at this stage. Finally, stage five is characterized by a reconciliation of the viewer’s own subjective response with his or her abstract knowledge about a particular work of art. Given Parsons’ account of aesthetic development, art educators should aim to promote more elaborate forms of aesthetic encounters, that is, higher stages of aesthetic development.

Weidenmann (1988) draws a similar distinction between more and less elaborate modes of understanding. His so-called “first order mode of perception” is characterized by a primarily automatic and holistic decoding of the depicted content. The question is: “Which extract of the real world does this painting show?” The process of understanding stops as soon as the viewer believes that he or she understands the content of the painting. In contrast, the “second order mode of perception” is characterized by an attempt to understand the visual argument: “Why did the painter use a specific technique, perspective, or color?” Thus, while the first order mode of perception is similar to stages one to three in Parsons’ model, second order mode of perception closely resembles stages four and five.

Both Parsons (1987) and Weidenmann (1988) contrast less elaborate modes of perception (i.e., stages one to three and first order mode of perception, respectively) with a more expert way of looking at paintings (i.e., stages four to five and second order mode of perception, respectively). In this article, the latter will be termed “expert approach to art.” Obviously, art education should help viewers to achieve this more elaborate viewing mode. Parsons emphasizes that the viewing modes are not to be seen as mutually exclusive. Rather, as viewers progress from one stage to another, they gain an additional access to art. Thus, the critical question is how much importance viewers place on a specific viewing mode.

Interestingly, multimedia approaches to art education often concentrate on explicit knowledge as the outcome variable (Smith, 1998). They provide information about a depicted object or the artist and make rare references to formal aspects. Retention measures of declarative knowledge are then used to evaluate learning. It is important to note that an expert approach to art as defined above is not dependent on a rich knowledge base. Instead, the
important step from a naive to an expert approach to art is taken when one progresses from being satisfied with one’s own subjective impression of a work of art to stressing the importance of the formal means that produce this impression. Of course, knowledge and the mode of perception are likely to be interwoven. For instance, when presented with a work of art, art historians can retrieve information from a huge knowledge base which may guide their exploratory behavior. Top-down processes are thus involved in the viewing process (for empirical evidence, see Biederman, 1987; Zangemeister, Sherman, & Stark, 1995).

**Aesthetic experience and interest in art.** Apart from heightening the cognitive level of understanding, a second set of goals in art education pertains to the pleasure derived from the works of art. Several different concepts have been employed to characterize this aspect. The variables under scrutiny include, for example, exploratory behavior as indicated by viewing time, and positive versus negative affective reactions as indicated by ratings of liking or beauty (Berlyne, 1974).

From a psychological perspective, the pleasure arising from the contact with works of art can be subsumed under the construct of interest. It is helpful to distinguish between two aspects of interest: situational interest and dispositional interest (Renninger, Hidi, & Krapp, 1992). In this context, situational interest can be defined as an individual’s short-term motivation to reflect on a work of art. This interest can be generated, for instance, by the work’s novelty or intensity. Specific attributes of the work can manifest a catch-component, thus increasing the individual’s situational interest and momentary satisfaction. On the other hand, dispositional interest is aroused when an individual experiences the encounter with the work as meaningful (hold-component), and further contacts with art are thus prompted.

There are many studies indicating that different viewing conditions can alter the perception of paintings (Berlyne, 1971; Limbert & Polzella, 1998). For instance, Limbert and Polzella examined the influence of music on the perception of paintings. Their results suggest that different styles of music can significantly affect the viewers’ aesthetic experience. On the other hand, some studies found that differences in presentation conditions only had minor influences on perception (Martindale, Moore, & Borkum, 1990; O’Hare & Gordon, 1976). O’Hare and Gordon provided participants with varying amounts and qualities of art-historical information on the paintings presented. Although this did have some influence on the way the participants thought about the paintings, their ratings of the beauty of the paintings remained unaffected.
The effect of multimedia presentations on viewers’ interest in art and their motivation to visit exhibitions is of important practical value as the development of multimedia applications is very expensive (Lookatch, 1997). Considering the costs of creating multimedia educational tools, it would be desirable for multimedia applications to elicit both situational and dispositional interest.

In this section, two domain-specific goals have been established: first, enhancing an expert approach to art, and second, eliciting a higher level of interest. Having established these domain-specific goals, in the next section the general theoretical foundations of multimedia education are addressed.

**General Approaches in Multimedia Instruction**

Mayer’s (1997) theory of multimedia learning integrates dual coding theory (Clark & Paivio, 1991) and generative theory (Wittrock, 1974, 1989). Although Mayer’s research concentrates on the understanding of scientific explanations and is limited to the perception and integration of presented information, his theory nevertheless constitutes a general model of multimedia learning which is applicable to a wide variety of domains. Mayer’s theory of multimedia learning posits that positive effects of multimedia presentations result from the fact that learners’ attention and cognitive processing of information are guided by the coordinated presentation of explanatory text and pictures. Learners are provided with guidance concerning the selection, organization, and integration of information. For instance, Mayer and colleagues (Mayer & Anderson, 1992; Mayer & Moreno, 1998) presented students with scientific explanations which differed in their mode of presentation. Materials varied in whether they were animated or not, and in the way the verbal explanation was offered (text vs. narration). Overall, Mayer found that sophisticated multimedia applications had several positive effects on retention rate, matching tasks, and problem solving tests.

In his so-called supplantation theory, Salomon (1984) directly addressed the potential of instructional animation to alter the viewers’ mode of thinking. In Salomon’s view, instructional media can effectively be used to model mental operations which the learners can then adopt. For instance, when confronted with an instructional text in a textbook, many readers do not know where important information is typically to be found. Instructional media could be used to model an effective way of reading the text and collecting the most important pieces of information.

The theories advanced by Mayer (1997) and Salomon (1984, 1994) as well as other general approaches (Hasebrook, 1998) provided a general
understanding of the ways in which learners may benefit from multimedia learning environments. When it comes to specific educational domains, such as art education, these approaches need to be revised and supplemented.

The Present Investigation

In the previous discussion, two central goals of art education were posited: to encourage naive art consumers to adopt a more elaborate way of looking at the formal structure of paintings, and to elicit more interest in the paintings presented. In the authors’ view, the use of instructional animation seems to offer a viable means to achieve these goals, as it offers a wide variety of visual effects, which can both attract a viewer’s current interest and guide his or her attention to specific aspects of a painting.

When naive viewers are presented with a painting, they primarily look for an idea expressed in the painting (as previously stated). The perception of the painting is organized according to subject matter. Naive viewers do not possess a cognitive style that encourages them to look for special formal aspects of a painting or the visual strategies, which are needed for such an approach. Multimedia elements, however, may deepen the viewers’ understanding. In order to guide the viewers’ attention to formal aspects, techniques such as zooming, animation, or the insertion of graphic elements which highlight and emphasize formal aspects can be used. Moreover, paintings can be modified by retouching and changing of colors or perspective. In this way, the viewer is able to acknowledge a painting as the product of a host of decisions made by the painter.

In sum, the selection, organization, and integration of information about a painting can be influenced by the wide variety of visual and auditory possibilities offered by multimedia techniques. These techniques can be expected to establish catch-components within a painting, attract the viewers’ interest and guide their attention to formal elements of the artwork. An increased understanding and dispositional interest should follow from this more meaningful encounter with the painting.

To sum up our hypotheses, we expected that a sophisticated use of multimedia would encourage naive art consumers to place a higher priority on a more “expert” approach to art. Based on research by Hailey and Hailey (1998), Schnotz, Boeckheler, Grzondziel, Gaertner, & Waechter (1998), and Lookatch (1997), we did not expect to find any benefit when multimedia was used solely in a “flashy, fashionable, and entertaining” way (Lookatch, 1997, p. 112). Moreover, we expected a sophisticated multimedia presentation to heighten the viewers’ interest in the paintings.
METHOD

Material (Multimedia Presentations)

Twelve paintings (from the 17th to 20th century) were chosen from popular art history textbooks for inclusion in the experiment. All paintings were of representational nature; abstract art was not included. The paintings were digitalized and four different multimedia presentations were created on a Macintosh PPC 7600/132 using Macromind Director 5.0.

Following the theoretical framework introduced previously, the first presentation used sophisticated multimedia effects to emphasize the formal elements in the 12 paintings included in the presentation. A spoken narration accompanied each painting. This narration was adapted from art history books and concentrated on formal aspects of each painting, thus inviting the listener to focus on aspects usually associated with an expert approach to art. Together with the narration, a variety of visual effects was used, including retouching the paintings, using additional lines and arrows to mark important aspects, and emphasizing some parts of the paintings with color effects. In the first presentation, the visual effects (the animation) were used to underpin the verbal explanation (the narration). This presentation was assumed to be a sophisticated multimedia tool, suitable for enhancing an expert approach to art, and will therefore be termed the “sophisticated multimedia presentation.”

Three control conditions were constructed to test the efficiency of the different components of the sophisticated presentation. First, it might be argued that simply providing learners with a verbal explanation of formal elements will enable them to focus on the formal aspects of a painting, and that visual animation provides no further benefits. To test this possibility, a “narration/no animation” presentation was created using the same verbal explanations as the sophisticated multimedia presentation, but without animation. Second, the role of arbitrary visual effects was tested by combining the same narration with an arbitrary visual animation that did not emphasize formal aspects of the paintings, but highlighted other parts of the narration (“arbitrary multimedia effects”). The inclusion of this form of presentation allowed the dissociation of sophisticated from “flashy” use of animation. Finally, as a baseline condition, a presentation using neither narration nor animation was constructed to present the 12 paintings, but merely consisting of the sequential presentation of the paintings plus the artists’ names and the titles of the paintings (“no narration/no animation”).
Figure 1 gives an example of a painting and its sophisticated multimedia presentation. For technical reasons, the painting by German artist Otto Dix has been rendered as a drawing in this article. Participants in the “no narration/no animation” group saw the painting without verbal or visual explanation. Participants in the “narration/no animation” condition heard a verbal explanation which focused on the blood-red halo around the General’s head—a critical imitation of the halos known from paintings depicting saints. No animation was used in this condition. Thus, this treatment condition resembles the audioguides frequently used in museums. In the “arbitrary animation” condition, the General emerged from the background and grew bigger and bigger, an allusion to his potential power and importance. This animation was used to attract visual attention. However, it does not elucidate the formal aspects of the painting in any way. In the “sophisticated multimedia” condition, on the other hand, viewers were provided with two additional, retouched versions of the painting, drawing their attention to the halo, an important formal aspect of the painting.

Figure 1. A painting by the German artist Otto Dix depicting a World War One General with a blood-red halo around his head (see middle painting). The sophisticated multimedia presentation includes two versions of the painting in which some parts of the painting have been left out. In the version on the left, the background (including the halo) has been erased. In the version on the right, only the background (including the halo) is visible.
The second example shows a painting by the French artist Paul Cézanne depicting his wife in a fauteuil. Cézanne is known for the structure inherent in his paintings, and this aspect is illustrated in the sophisticated multimedia presentation. In a step-by-step approach, the geometric elements used in the painting are highlighted (Figure 2).

![Figure 2. Presentation of the painting by Paul Cézanne in the sophisticated multimedia condition. Viewers’ attention is focused on the basic structural elements using a step-by-step presentation format.](image)

In all groups, participants saw the paintings in a fixed yet counterbalanced order. Participants in the three narration conditions saw the paintings for about eight seconds before the narration started. Depending on the painting, the narration took between 40 and 70 seconds; narration was of equal length in each of the three groups. Following the narration, participants were free to move on to the next painting as soon as they wanted. Participants in the “no narration/no animation” condition were not given any verbal or visual explanation, and were thus free to move on to the next painting right away.

**Participants**

Sixty-four college students (48 females, 16 males) participated in the experiment. Depending on their own choice, participants either received course credit or were paid DM 15,- (about $7). Students majoring in the arts or art history were not included. The mean age of the total group was $M = 23.7$ years ($SD = 5.03$). Participants were randomly assigned to one of the four experimental conditions.
Measures

**Expert approach test.** Due to a lack of known measures of viewing modes, a specific measure was designed to assess the importance that participants placed on formal aspects of paintings. Three representational paintings that had not been used in the presentation were shown on the computer screen. A total of 13 narrated explanations were given for the three paintings. These explanations differed in terms of whether or not they addressed formal aspects of the painting. Participants were asked to rate the importance of each explanation on a seven-point Likert scale. The ratings for the five explanations which primarily concentrated on formal aspects formed the “interest in formal explanations” subscale (Cronbach’s $\alpha = .59$), while the ratings for the other eight explanations constituted a measure of “overall endorsement of explanations” (Cronbach’s $\alpha = .65$). Thus, by computing the mean ratings given to each set of explanations, an “interest in formal explanation” score and an “overall endorsement of explanations” score was calculated for each participant. On the basis of our hypothesis, participants in the sophisticated multimedia presentation group were expected to have higher scores on the first subscale than participants in the other conditions, thus indicating a keener interest in formal aspects. Moreover, no difference between the groups was expected for explanations with no emphasis on formal aspects, hence the overall endorsement tendency was expected to be the same in all groups.

**Interest measures.** Participants were asked to rate the beauty of each of the 12 paintings in the presentation (“In my opinion, this painting is beautiful”) on a seven-point Likert scale ranging from 1 (“not true at all”) to 7 (“completely true”). Such beauty ratings are commonly used in empirical aesthetics (Limbert & Polzella, 1998). A mean beauty rating for all paintings was calculated for each participant. To examine whether any of the paintings were differentially rated across the four experimental conditions, qualitative differences in the responses were calculated using the specific pattern (profiles) of the beauty ratings of each condition.

A rating of the interest in each painting was given on the same seven-point Likert scale (“In my opinion, this painting is interesting”). For each participant, the ratings were averaged across the 12 paintings. In addition, the tendency to form a more stable interest in paintings was measured using a single item: participants were asked whether they would like to receive further information about an upcoming exhibition which purportedly included the paintings shown in the presentation.
Finally, the time participants looked at each painting was assessed (viewing time). Participants were free to look at each painting for as long as they wanted. In the conditions with narration, the total viewing time for each painting consisted of a fixed time during which the explanation was given (and the participants were not able to move on to the next painting), and the optional time following the explanation, before the participant decided to move on to the next painting. As there was no explanation in the “no narration/no animation” condition, these participants were free to switch to the next painting as soon as they wanted. For all interest measures, higher values in the sophisticated multimedia presentation condition were expected.

**Satisfaction with the presentation.** Participants also rated some specific features of the presentation, reporting their satisfaction with the length and difficulty of the verbal explanation on seven-point Likert scales.

**Background variables.** A number of further questions addressed the participants’ personal background and interest in and prior contact with art and computers.

**Procedure**

To obtain ecologically valid results a cover story was devised. Participants were told that the experiment was part of a collaborative project with a well-known museum in a nearby city, and led to believe they were helping to improve the educational program and publicity efforts for an upcoming exhibition. As revealed by a post-trial inquiry this manipulation proved to be successful. Participants were asked to watch a computerized presentation which would take about 10 to 15 minutes. The presentations were shown on a 17” EIZO F56 CRT-monitor. Subsequently, participants were asked to look at the paintings again and, to rate the perceived beauty and indicate their degree of interest for each painting. Several questions pertaining to the presentation and to the use of computers in art education followed. In addition, participants were asked whether they would like to receive further information about the upcoming exhibition. The expert approach test was then administered. Finally, participants’ age, sex, and interest in art and computers were registered. After the experiment, participants were debriefed. Participants in the control groups were given the opportunity to see the sophisticated multimedia presentation.
RESULTS

As comparisons of background variables revealed, the randomization procedure proved to be successful. No significant differences between the experimental groups were found with respect to age, $F(3, 60) = 0.88, ns.$, or sex, $\chi^2(3) = 0.50, ns.$ In addition, prior contact with art was comparable in the four groups; no significant differences were found for self-reported interest in art, $F(3, 60) = 0.54, ns.$, sketching and painting classes taken in leisure time, $\chi^2(3) = 0.37, ns.$, or possession of art books, $F(3, 60) = 0.34, ns.$ Similarly, interest in computers, $F(3, 60) = 1.75, ns.$, and attitude toward computers, $F(3, 60) = 1.33, ns.$, proved to be comparable in all groups.

If the sophisticated multimedia presentation did indeed encourage a more sophisticated viewing process, participants in this condition should place a higher value on information concerning the formal aspects of the paintings. Thus, it was expected that participants in the sophisticated multimedia condition would give higher scores on the interest in formal explanations subscale, but not on the overall interest in explanations subscale. Means and standard deviations for these two subscales in all four experimental conditions are presented in Table 1.

Table 1
Interest in Formal Aspects and Overall Endorsement Tendency in the Four Experimental Conditions. Means and Standard Deviations (in Parentheses)

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Interest in formal explanations</th>
<th>Overall endorsement of explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>No narration/no animation</td>
<td>5.36 (0.83)</td>
<td>4.22 (1.03)</td>
</tr>
<tr>
<td>Narration/no animation</td>
<td>5.45 (1.00)</td>
<td>3.62 (0.69)</td>
</tr>
<tr>
<td>Arbitrary animation</td>
<td>5.28 (0.90)</td>
<td>3.63 (0.60)</td>
</tr>
<tr>
<td>Sophisticated multimedia presentation</td>
<td>5.95 (0.68)</td>
<td>3.90 (1.32)</td>
</tr>
</tbody>
</table>

Because the hypotheses formulated previously suggested that the sophisticated multimedia presentation would be superior to each of the other conditions, one-tailed $t$-tests are most appropriate for examining the differences between the experimental groups. As hypothesized, participants in the “sophisticated multimedia” group proved to be more interested in formal aspects than participants in the “no narration/no animation” group, $t(30) = 2.19, p < 0.05$, and the “arbitrary animation” group, $t(30) = 2.39, p < .05$. The difference between the “sophisticated multimedia” presentation condition and the “narration/no animation” condition bordered significance,
\(t(30) = 1.65, p < 0.10\). These results indicate that a sophisticated multimedia presentation helps to foster a second order mode of perception.

To exclude rival explanations, several additional analyses were performed. Data analysis showed that the effect reported above is not due to an overall higher endorsement of explanations of all kinds in the “sophisticated multimedia” condition; there were no significant differences between the “sophisticated multimedia” group and the other experimental conditions (Table 1). Furthermore, it might be argued that the narration was adequate for the multimedia group but too short or too difficult in the other conditions. However, no differences in satisfaction with the difficulty of the explanation were found between the “sophisticated multimedia” group and the other two conditions with narration \(t(30) = 0.00, ns\., for both direct comparisons). Moreover, the length of the explanation received similar ratings in the “sophisticated multimedia” condition and both the “narration/no animation” condition, \(t(30) = -0.09, ns\., and the “arbitrary animation” condition, \(t(30) = 0.09, ns\.). Finally, a regression analysis was performed to establish the relative importance of the experimental manipulation. Experimental condition (the “sophisticated multimedia” condition vs. the other conditions), age, sex, interest in art, participation in leisure-time art classes, and interest in computers were simultaneously included as predictors. Table 2 presents the results of the regression analysis. As expected, the experimental manipulation proved to be a significant predictor. In addition, participants who had previously participated in leisure-time drawing or painting classes gave higher importance ratings to formal explanations.

Table 2

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Beta</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-.100</td>
<td>.391</td>
</tr>
<tr>
<td>Sex (female = 0; male = 1)</td>
<td>-.126</td>
<td>.267</td>
</tr>
<tr>
<td>Experimental condition (other = 0; “sophisticated multimedia” = 1)</td>
<td>.292</td>
<td>.010</td>
</tr>
<tr>
<td>Sketching / painting classes taken</td>
<td>.411</td>
<td>.001</td>
</tr>
<tr>
<td>Interest in art</td>
<td>.151</td>
<td>.189</td>
</tr>
<tr>
<td>Interest in computers</td>
<td>.050</td>
<td>.659</td>
</tr>
</tbody>
</table>

The second set of analyses was performed to analyze the effects of multimedia presentations on aesthetic experience and interest in art. Overall, a higher level of interest was expected in the “sophisticated multimedia”
Somewhat contrary to expectations, relatively weak relations were found: the difference between the “sophisticated multimedia” presentation condition and both the “narration/no animation” condition, \( t(30) = 1.53, p < 0.10 \), and the “arbitrary animation” condition, \( t(30) = 1.51, p < 0.10 \), only bordered significance, and no difference was found between the “sophisticated multimedia” condition and the “no narration/no animation” condition.

**Table 3**

Perceived Beauty and Situational Interest Ratings and Total Viewing Time in the Four Experimental Conditions. Means and Standard Deviations (in Parentheses)

<table>
<thead>
<tr>
<th>Perceived beauty of paintings</th>
<th>Situational interest</th>
<th>Viewing time</th>
</tr>
</thead>
<tbody>
<tr>
<td>No narration/no animation</td>
<td>3.95 (0.74)</td>
<td>4.41 (0.65)</td>
</tr>
<tr>
<td>Narration/no animation</td>
<td>3.81 (0.55)</td>
<td>4.31 (0.62)</td>
</tr>
<tr>
<td>Arbitrary animation</td>
<td>3.78 (0.69)</td>
<td>4.41 (0.82)</td>
</tr>
<tr>
<td>Sophisticated multimedia</td>
<td>4.17 (0.77)</td>
<td>4.42 (0.62)</td>
</tr>
</tbody>
</table>

Despite the overall similarity in beauty ratings, there is still the possibility that the participants in the four groups rated the beauty of the individual painting differently. Therefore, qualitative differences in responses were calculated by summing the beauty ratings for each painting across all participants in each condition, thus producing a specific pattern (profile) of the beauty ratings in each condition. Highly significant correlations between these profiles were found (ranging from \( r = .77 \) to \( r = .95 \)), indicating that the experimental manipulations did not have any differential influence on aesthetic experience.

Moreover, contrary to expectations, participants in all conditions reported almost identical interest in the paintings (Table 3). Thus, situational interest as indicated by ratings of interest was not favorably influenced by the “sophisticated multimedia” presentation. A similar result was obtained for the interest measure tapping the development of dispositional interest: participants in the “sophisticated multimedia” condition were no more interested in receiving further information about the upcoming exhibition than the other three groups, \( \chi^2 (2) = 1.03, ns. \)

With regard to the average time that viewers spent on a specific painting, the total viewing time did not vary across the three conditions involving narration (Table 3, all \( p \)-values > .10). Total viewing time was longer in
the “sophisticated multimedia” condition than in the “no narration/no animation” condition, $t = 6.5$, $p < .001$, but because there was no explanation in the “no narration/no animation” condition, care should be taken in comparing the viewing time of this group with the viewing times in the other conditions.

**DISCUSSION**

In the experiment reported, the effects of a sophisticated multimedia learning environment on central goals of art education were tested. The results reveal positive effects of a sophisticated instructional environment on the level of understanding, and small effects on the interest in art. Taken together, the results seem to support the assumption that art education may profit from elaborate multimedia applications.

The first and central goal was to encourage a more expert approach to art (Parsons, 1987; Weidenmann, 1988), characterized by a higher perceptual emphasis on formal aspects. Compared to participants in the other experimental conditions, participants in the “sophisticated multimedia” condition indeed placed a higher emphasis on formal aspects. This effect proved to be significant and of marked magnitude (effect sizes ranged between $d = .59$ and $d = 1.29$ for the comparison of the “sophisticated multimedia” condition and the three control groups). Thus, a comparatively short treatment of about 15 minutes produced a rather impressive educational gain. In theoretical terms, this effect can be explained as stemming from the particular potential of multimedia to guide a formerly naive viewer’s selection, optimization, and integration of knowledge (Mayer, 1997). Multimedia effects such as retouching can draw the viewer’s attention to previously unattended aspects and introduce a viewing process imitating that of experts. The mental capacity is used in an optimized way. In addition, the findings supported the call for sophisticated instructional designs (Lookatch, 1997; Mayer, 1997; Schnotz et al., 1998): When multimedia was used in a “flashy” way, solely designed to attract and heighten attention, no positive effects of multimedia were found.

Contrary to the second hypothesis, several indicators of interest in the paintings showed that the effects of multimedia presentations on viewers’ interest were rather sparse. First, participants rated the perceived beauty of the paintings. In our experiment, the differences between the “sophisticated multimedia” condition and the other conditions were only marginally significant or not significant at all. This finding supports O’Hare and Gordon’s (1976) notion that ratings of beauty are relatively unaffected by verbal explanations. It could be, however, that experimental treatments other than
narration or animation are more successful in affecting the aesthetic experience. For instance, when presenting paintings and music at the same time, the characteristics of the music seem to have a critical, differentiating impact on aesthetic experience (Limbert & Polzella, 1998; Moreno & Mayer, 2000). It would be worthwhile including background music as an additional variable in future research on instructional applications in art education.

With regard to the other indicators of interest, even smaller differences were found between the “sophisticated multimedia” condition and the other groups. Average ratings of situational interest remained unaffected, and participants in the “sophisticated multimedia” condition did not show a higher level of dispositional interest (as evidenced by their wish to receive further information about the upcoming art exhibition). The failure of the sophisticated multimedia instructional environment to foster a higher degree of situational interest might in part be due to the fact that the interest ratings were not administered immediately after the paintings were presented, but in a second round of questions. Where dispositional interest is concerned, it is perhaps overly-optimistic to expect a 15-minute presentation to foster a higher degree of dispositional interest.

Taken together, our research is well in line with research projects on multimedia applications conducted in other domains, which repeatedly have attested to the special accomplishments of multimedia learning environments (Mayer, 1997; Plass et al., 1998). This positive summary notwithstanding, future research is needed to give further support to our conclusions. First, in art education, there are few well-established measures to judge the effectiveness of educational interventions. While the instruments used in this study were based on theoretical considerations, future research should refine some of them and employ additional instruments. For instance, the degree to which a participant adopts an expert approach to art might be tapped by asking the participant to talk about a painting, rather than rating the importance of different explanations. In addition, the interest variable might be split into several components. For instance, participants could judge the complexity of a painting and its art-historical value, and indicate whether or not they would like to receive further information on the painting in question.

Future research might also examine the stability of educational effects. Many educational interventions lose their positive effects shortly after the end of the treatment. Therefore, it should be examined whether the sophisticated multimedia presentation has a long-term effect. For instance, testing could be repeated after an interval of several days or weeks.

Furthermore, due to methodological considerations, there was a rather low level of interactivity in our research. For instance, viewers were not
able to change their perspective on a painting, zoom into a painting, and so on. Further studies should examine the influence of various forms and degrees of interactivity (Sims, 1997).

References


Note

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Part of this research was presented at the 15th congress of the International Association of Empirical Aesthetics in Rome, September 21-24, 1998. The authors would like to thank Olaf Koeller, Marcus Hasselhorn, and Ulrike Wehrhahn for their helpful comments at various stages of the manuscript.