By Gilles Comeau

Colorful Illustrations In Piano Method Books

A Pilot Project Investigating Eye Focus

Piano teachers rely extensively on piano method books[1] to teach students how to read music and how to play the piano. According to piano pedagogy textbooks (Agay, 2004; Baker-Jordan, 2004; Jacobson, 2006; Uszler, Gordon & Smith, 2006), the majority of piano teachers in North America construct their piano lessons for beginner students using these books. An examination of some of the most popular children's piano books immediately reveals a plethora of illustrative materials. These have contributed, over the years, to making the method books very attractive and appealing for young students. A simple content analysis reveals how decorative illustrations have become dominant by their attractive colors and by the space they occupy. From the 1930s to the early 1980s, piano books generally had simple sketches or, in some cases more detailed drawings, in black and white that were intended to be colored by students (Brubaker, 1996). After 1985, with computer-designed graphics and the evolution of the printing industry, illustrations grew to full-color pictures of impressive quality (Table 1). This is clearly the case for newer method books, but also for some older publications that have been re-edited with a revised layout and a more attractive graphic presentation (Table 2).

Method books*	Publication year	Black and white	Color
John Thompson's Modern Piano Course (Teaching Little Fingers to Play)	1936	x	
John Schaum Piano Course	1945	x	
The Leila Fletcher Piano Course	1950	x	
John Thompson's Easiest Piano	1955	x	
David Carr Glover Method for Piano	1967	x**	
The Leila Fletcher Piano Course	1973	x	
Music Pathways	1974	x	
Music Pathways	1983	x	
Bastien Piano Basics	1985		x
David Carr Glover Method for Piano	1988		x
John Thompson's Modern Piano Course (Teaching Little Fingers to Play)	1994		x
Alfred's Basic Piano Library	1999		x
Hal Leonard Piano Lessons	1996		x
John Schaum Piano Course	1996		x
John Thompson's Easiest Piano	1999		x
Piano Adventures	1996		x
The Music Tree	2000		x
Celebrate Piano	2003		x
Alfred's Premier Piano Course	2005		x
Piano Adventures	2011		x

*First book of each method only
**The David Carr Glover 1967 book is black plus one color, in this case red.

Table 1: Black and white and full-color illustrations in primers of various piano method books.

Method books	Black and white Edition	Color Edition
John Thompson's Modern Piano Course (Teaching Little Fingers to Play)	1936	1994
John Schaum Piano Course	1945	1996
John Thompson's Easiest Piano	1955	1999
David Carr Glover Method for Piano	1967 (black plus one color)	1988 (full color)
The Music Tree	1973 (no pictures)	2000 (full color)

Table 2: Original and re-edited publications.

Not only are decorative illustrations very attractive because of their colorful and high-quality design, they also occupy a large amount of space. In almost all the primer books we have reviewed, more than two-thirds (66 percent) of repertoire pages have pictures (Table 3 and Figure 1). In some cases, more than 90 percent of repertoire pages have pictures.

Name of method books	Pages with Pictures	Total rep. pages	Ratio
Music Pathways 1A (1974)	23	64	36%
David Carr Glover Primer Piano Library (1967)	17	46	37%
Music Pathways A (1983)	38	64	59%
John Thompson's Easiest Piano Part 1 (1955)	26	39	67%
John Thompson's Easiest Piano Part 1 (1999)	26	39	67%
Time to Begin (2000)	50	72	69%
Hal Leonard Student Piano Library 1 (1996)	44	63	70%
Leila Fletcher Book 1 (1950)	40	55	73%
Leila Fletcher Book 1 (1973)	46	62	74%
Little Finger (1936)	29	39	74%
John Schaum Piano Course Pre-A (1945)	34	43	79%
Piano Adventures Primer (1996)	50	63	79%
John Schaum Piano Course Pre-A (1996)	35	43	81%
Piano Adventures Primer (2011)	58	71	82%
Little Finger (1994)	32	39	82%
David Carr Glover Primer (1988)	25	30	83%
Bastien Piano Basics (1985)	56	63	89%
Alfred's Basic Piano 1A (1999)	57	63	90%
Alfred's Premier 1A (2005)	57	63	90%
Celebrate Piano 1A (2003)	76	79	96%
*First book of each method only			

Table 3: Number of repertoire pages with pictures.

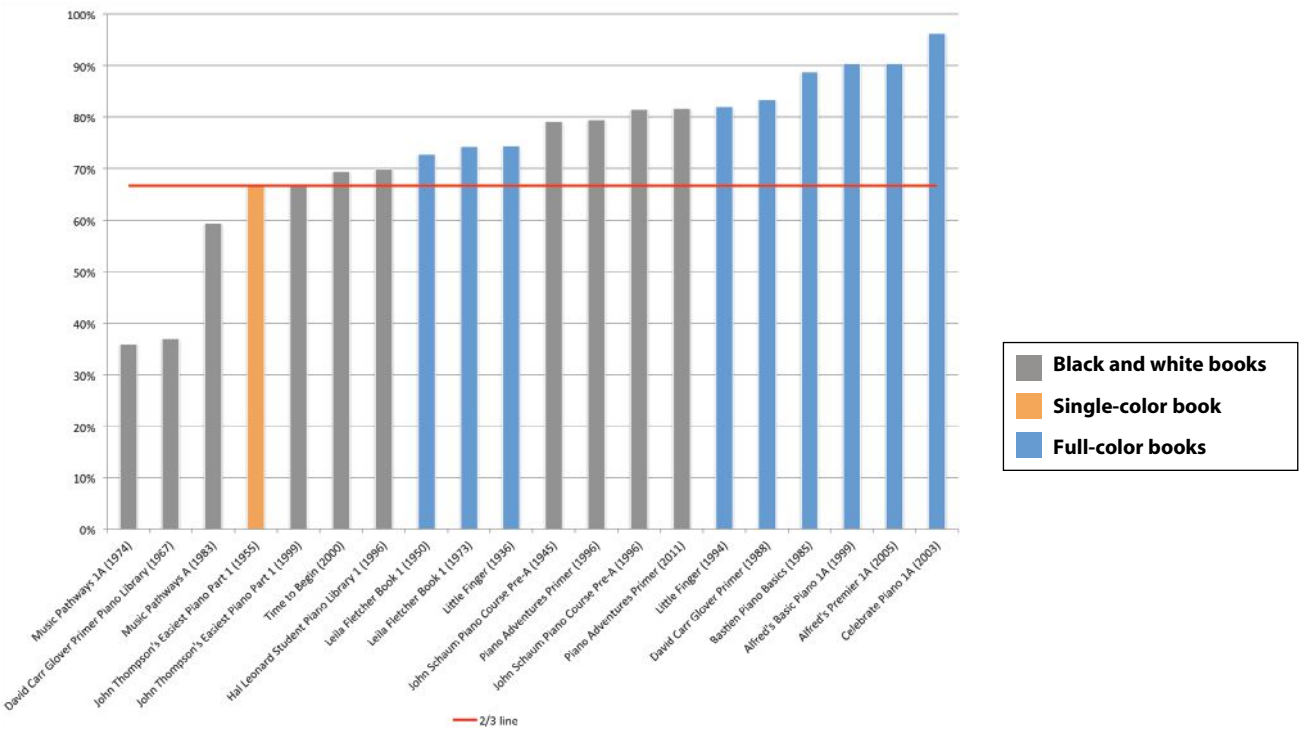


Figure 1: Percentage of repertoire pages containing decorative pictures.

The proliferation of illustrations in instructional material is very widespread: color illustrations on most pages are now considered a standard feature of piano method books, and nearly all children are taught to read music from books containing decorative pictures. However, we must not assume it must be this way. Maybe we should be concerned about the instructional value of these illustrations and question whether they impact reading. Learning to read music is a complex activity that requires time and effort in the early stages. The beginning student has to process an abundance of new visual information that needs to be decoded and transferred into proper physical gestures that take into account the topography of the instrument. The difficulty of acquiring reading skills is particularly acute for young pianists who must process reading on a horizontal and vertical plane, as the musical symbols are displayed over an upper and a lower staff that must be read simultaneously. Because reading-instruction materials use an abundance of illustrations, it is clearly important to study their effects on student learning. Without empirical evidence showing the real impact of illustrations on the acquisition of reading skills, we may perpetuate the production of instructional material that has questionable value for the learners. The possibility that illustrations could have a negative impact on the acquisition of music-reading skills must be considered.

Review Of Literature

Despite the widespread use of illustrations in piano method books, little research has been undertaken on the effects such illustrations might have; we were unable to find any studies that investigated the matter. However, since the 1960s, a considerable number of publications have looked into the impact of illustrations on text reading.[2] Because researchers believe music reading shares characteristics with text reading (Madell & Hébert, 2008), many of the studies on word decoding are of interest for this work.

In a 1963 study, Braun randomly assigned 240 kindergarteners who were learning to

read to a picture or no-picture condition and found that subjects in the no-picture condition acquired the sight vocabulary significantly faster than subjects in the picture condition. Harris (1967) also found that when words and illustrations are presented together, illustrations interfered with learning to read the words. Samuels (1967) conducted an experiment to test whether illustrations interfere with kindergarten children learning to read words, and his results showed that those children who were given no visual cues and had to rely on and pay attention to the print were more successful on the reading task than the children who learn with illustrations.

In 1970, Samuels reviewed a series of 23 studies that investigated the effects of pictures on learning to read words. His review covered the period from 1938 to 1969; the studies focused on learning to read words with or without pictures, and on acquiring a sight vocabulary with or without pictures. Samuels concluded that when learning to decode words and/or acquiring sight vocabulary, pictures interfere with learning to read. In 1980, Schallert reviewed a number of research studies and noted: "the use of pictures…does not facilitate a child's ability to decode text information" (p. 505). Also, according to Levie and Lentz (1982), there may even be situations "in which pictures function to attract attention *away* from the printed page…an apparent example is the use of pictures when young children are learning to read words" (p. 219). Based on existing research, they concluded: "the presence of pictures can be harmful when an instructional task such as the acquisition of sight vocabulary is the objective" (p. 225). Solman (1986) observed that when a child is presented with both an illustration and a word, the child goes to the illustration first. In his experiment, when children were shown words without illustrations, they were more successful in their ability to decipher words than the children who were given both words and the matching illustration. In 1990, when Adams reviewed the work by Samuels, he concluded that if the goal of teaching is to have the young child read the print, which is obviously the objective in the decoding stage, illustrations may be a diversion as the decoding stage requires the child to focus on the print.

The same concerns regarding the effect of illustrations on text reading have continued to be echoed in more recent papers. For Carney and Levin (2002), "empirical research evidence strongly indicates that storybook pictures may interfere with learning to read" (p. 5). Commenting on the findings of earlier studies, Torcasio and Sweller (2010) concluded that research has "demonstrated the negative effect that an illustration can have in the decoding process; if decoding is the goal, then presenting illustrations may hinder this process and increase extraneous cognitive load" (p. 662).

Research has also shown that in word-reading situations, the use of illustrations may be more detrimental to the poorest readers. (Levin, 1983) A study by Rose and Furr (1984) looked into the effects of illustrations in a reading task requiring the acquisition of new words. Results with learning-disabled students clearly showed that illustrations were correlated with lower reading performance rates and interfere with the acquisition of new words. Harber (1980) investigated whether the added visual cues of illustrations might distract learning-disabled children's attention from the printed text. She reviewed previous studies that looked into the role of selective attention in the reading process of poor readers, and findings suggested that "the presence of illustrations interferes with poorly achieving and low-ability children's performance on word recognition tasks and [those] illustrations are of questionable value to such children's performance on reading comprehension tasks" (p. 60). Poor achievers and low-ability children seem to have more difficulty maintaining their attention on the printed text when illustrations are present. Because reading in the initial stages requires that children concentrate their attention on the visual information of the reading task, increasing the complexity of the visual

information with illustrations or irrelevant print information interferes with poor readers' scanning and decoding of the visual symbols on the page (Harber, 1983; Rose, 1986; Samuels, 1967; Willows, 1974, 1978).

The role illustrations play in educational material designed to introduce children to text reading has been extensively studied and much of the empirical research tends to confirm that illustrations have a negative impact on the acquisition of decoding and word-recognition skills. Illustrations seem to provide even greater distraction to poorer readers. Thus the value traditionally attributed to illustrations has been proven wrong when the teaching objective is learning to read. All this evidence should raise concern regarding the abundance of illustrations in educational material intended to develop music-reading skills. Although little or no empirical data is available to compare the effect of developing music-reading skills from method books containing illustrations and other devoid of pictures, the scientific literature regarding the acquisition of text reading indicates the importance of looking into the matter.

Research Questions

Considering the popularity of piano method books, it is surprising that no research studies have examined how decorative illustrations affect learning. Young children beginning piano lessons are presented with a wide variety of music materials that are supplemented with numerous colorful illustrations. Some books even have illustrations within the score itself, for example the 1999 edition of the *John Thompson Easiest Piano Course,* or the musical notation is superimposed on colored background patterns like in the 2001 edition of *Piano Discoveries.* The cognitive impact of the relationship between illustrations and the musical score is complex, and little empirical data is available to evaluate the effect those illustrations might have on the development of music-reading skills. Our review of literature has demonstrated that we are fully justified in having concerns about the effect of illustrations on beginner music students.

To better understand the impact of illustrations, we are asking the following questions:

- What are young piano students looking at when they are reading from a page in a piano method book?
- To what extent are illustrations attracting a learner's attention when scanning a score in preparation for a sight-reading task and when playing a piece at sight?

We designed an experiment that provides information on which areas beginning music students visually attend to when reading a musical score from a page containing decorative illustrations. We know that eye-tracking technology[3] can give optimal and reliable measurements of a student's visual attention while performing a reading task, so it was possible to develop a testing procedure that provides direct evidence of a student's attention during a scanning task and a reading task. We were particularly interested in seeing which areas learners visually attend to and the length of time they inspect the illustration zones and the music zones. It has been demonstrated that there is a close relationship between where the eyes are fixated and where the cognitive attention is engaged while processing visual information (Hannus & Hyönä, 1999; Rayner and Morris, 1992). For that reason, we wanted to find out how students divide their attention between the music score and the decorative illustrations when scanning the page or playing at sight.

Methodology

We have seen how research investigating the effects of illustrations in a learning-to-read situation has concluded that illustrations interfered with the acquisition of word decoding (Braun, 1969; Carney & Levin, 2002; Samuels, 1967, 1970, 1979; Schallert, 1980; Torcasio & Sweller, 2010; Weintraub, 1966; Willows, 1978). According to many studies, the presence of pictures may act as a distraction from the text; children learning to read may have more difficulty focusing selectively on the reading task and ignoring

the extraneous stimuli (Adams, 1990; Hallahan, 1975; Krupski, 1981; Levie & Lentz, 1982; Rose & Furr, 1984; Solman, 1986). The strong consensus of these findings raised the possibility that the additional visual cues[4] provided by decorative illustrations in piano method books could also serve to call the children's attention away from the printed score. This is why we want to investigate whether the colorful illustrations found in beginner piano books could act as a distraction during the music reading process. This pilot study aims to observe young piano students' eye movements while reading piano pieces taken from popular method books. Eye-tracking technology is an optimal tool for recording the process of reading because it provides information about the location on the page a reader is visually attending to during the reading task[5]. It gives measurement of where a reader is gazing from moment to moment, contributing data on how long the eyes are fixated on different parts of a page and how many saccades occur from one area to another. Using eye-tracking technology, it is possible to evaluate how much time participants spend fixating on the picture zones. To our knowledge, no eye-tracking studies have ever looked at the effect of illustrations on music-reading acquisition.

Participants: Six participants (7–11 years old; mean age 9.2; 5 females, 1 male) participated in the experiment. Participants had all been taking piano lessons for a minimum of 3 years and a maximum of 5, and they all had a basic knowledge of music reading.

Participants	Gender	Age	Years of piano lessons	Piano level
A	Female	10	3 yrs.	RCM* 4
B	Male	7	3 yrs.	RCM 3
C	Female	10	4 yrs.	RCM 3
D	Female	8	3 yrs.	RCM 1
E	Female	9	5 yrs.	Suzuki 1
F	Female	11	4 yrs.	RCM 5
*RCM: Royal Conservatory of Music				

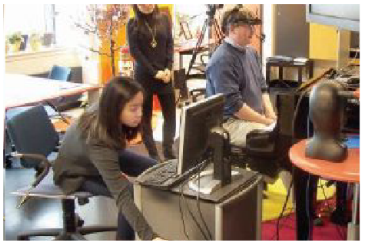
Table 4: Information on participants.

Apparatus: Eye movements were recorded with the SR Eye Link II eye-tracking system[6]. This tracking system consists of three miniature cameras mounted on a padded headband designed to be lightweight and stable.

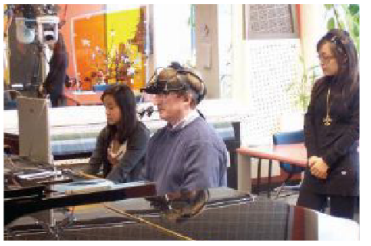
Eye-tracking system

Two eye cameras allow for the tracking of both eyes independently (binocular tracking) and an optical head camera allows acute tracking of the subject's gaze point. Musical stimuli were presented on a computer monitor positioned 1.5 feet (45.7 centimeters) from the subject's eyes. The musical excerpts were played on a 7'6" acoustic grand piano equipped with a MIDI operating system (Disklavier Pro, Mark III).

Set up for the experiment–1

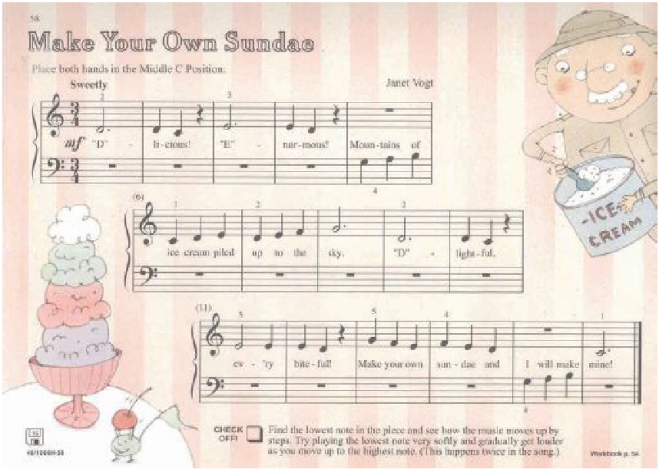


Set up for the experiment–2



Set up for the experiment–3

Stimuli: The musical stimuli consisted of 10 short musical pieces all taken from existing piano method books[7] for young beginning students. Each pieces consisted of at least 5 bars and no more than 16 bars. The selected pieces used the grand staff and each contained decorative illustrations. All illustrations appeared as color pictures and were representational in nature, such as ice cream man, sundae and cherries. No charts, keyboard charts or diagrams were included.

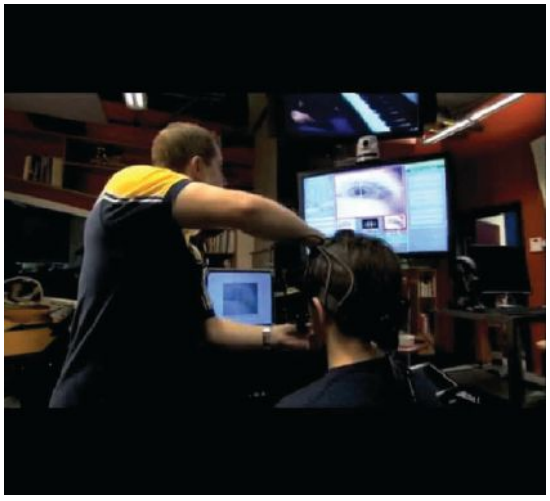


Vogt, J. & Bates, L. (2001). *Piano Discoveries: Discovering the world of music at the keyboard*. Dayton, OH: Heritage Music Press, p. 58.

Procedure: After consenting to the experiment and providing information on their music level, participants were briefed on how the eye-tracking system works in general and how the apparatus would be positioned on their heads.

Installation

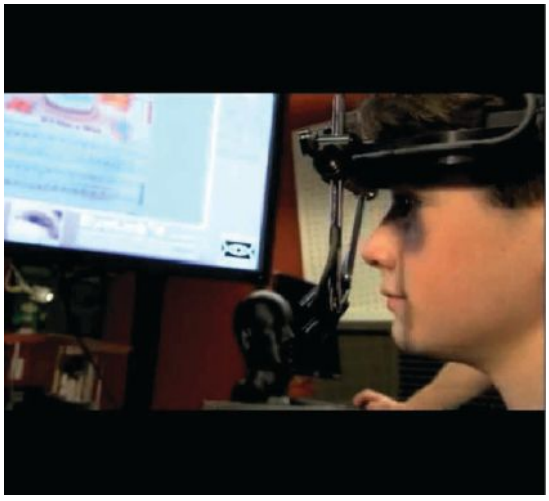
Next they were seated at the piano and the system was calibrated.



Calibration

Participants were then instructed on how the stimuli would be presented and where to look during the experiment. A practice musical simulation was presented to familiarize participants with the way the experiment would be conducted and to ensure they were comfortable with the eye-tracking system.

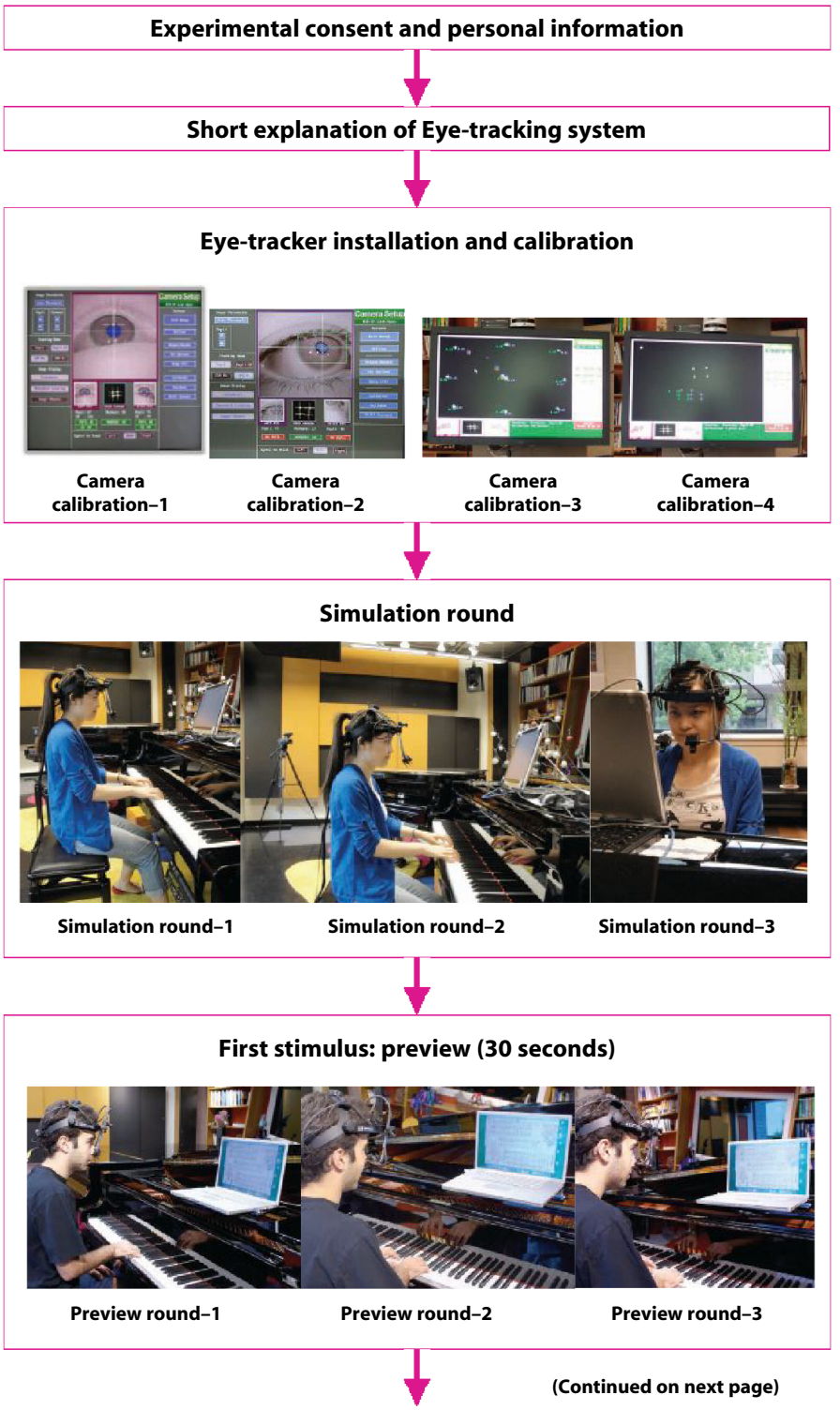
Experimentation 1



Experimentation 2

The results from the practice round were not recorded. The first stimulus was then presented. Participants were instructed to preview the musical score for 30 seconds in preparation for a performance of the piece. They then had to play the score at a speed of their liking. After the first preview and performance sequence, each participant took

a short break and then the second stimulus was presented, again for preview and performance. The musical stimuli were introduced in random order and each participant completed 10 pieces. The mapping of the experimental procedure can be seen in Figure 2 below.



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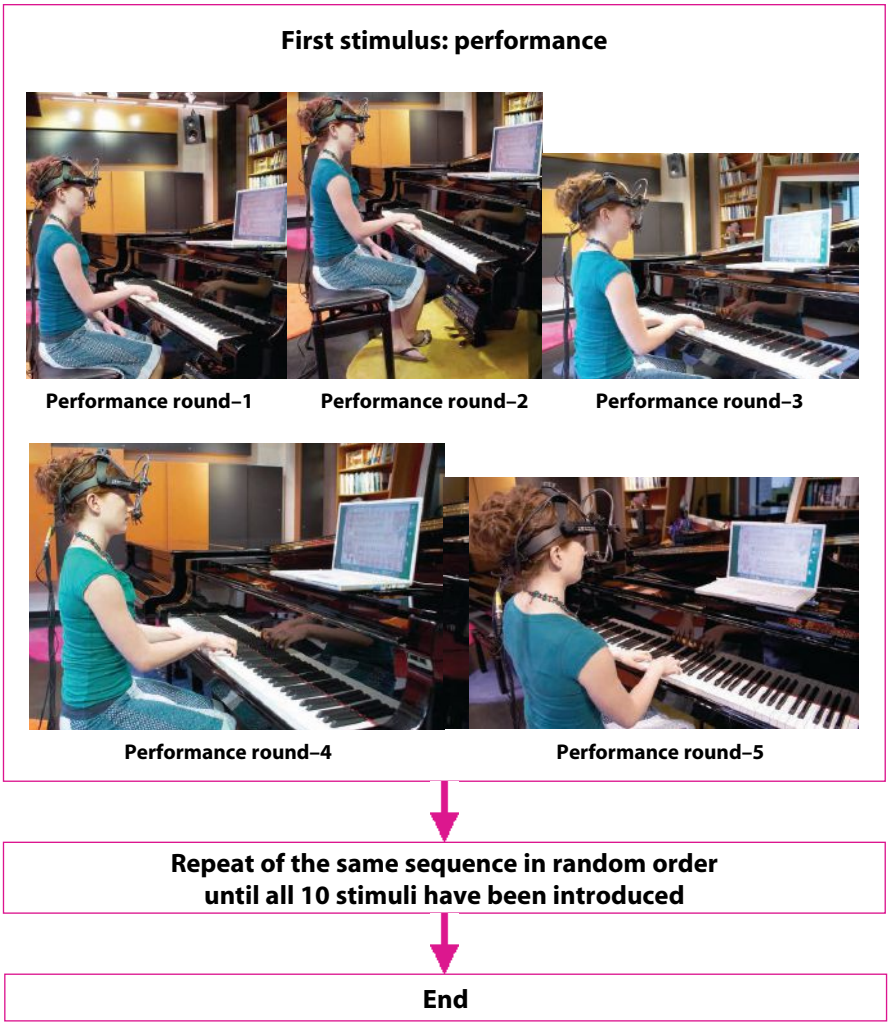
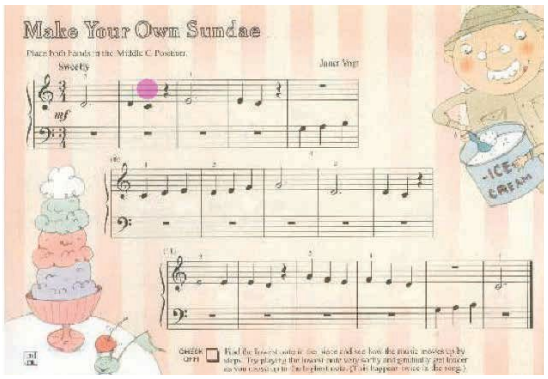


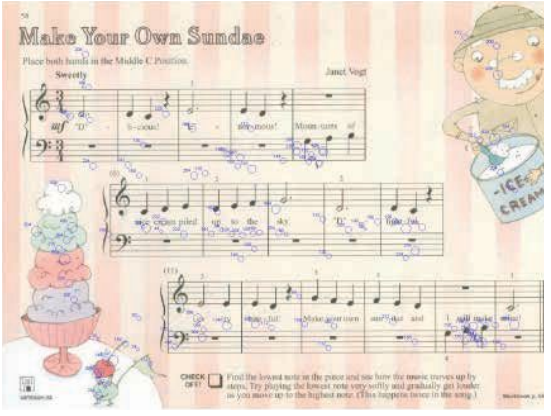
Figure 2: Procedure.

Data recording and data analysis: The cameras record all eye movements as the eyes fixate and move around while looking at the piece of music shown on the monitor.

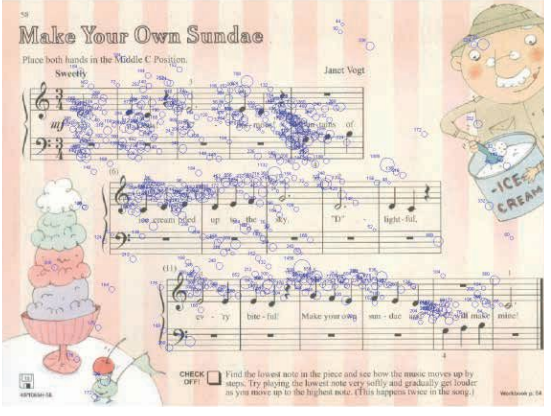


Eye movements of a participant previewing a piece for 30 seconds.

The data is then exported using the SR Eye Link Data Viewer software. The extracted data can be presented with an image of the musical score showing each eye fixation. The circles superimposed on the scores and on the illustrations represent the location of where the eyes stopped to process visual information. The diameter of the circles is proportional to the duration of the fixations they represent.

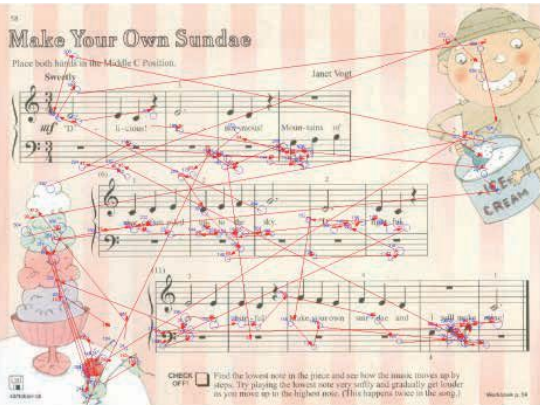


Preview session: showing fixations–1

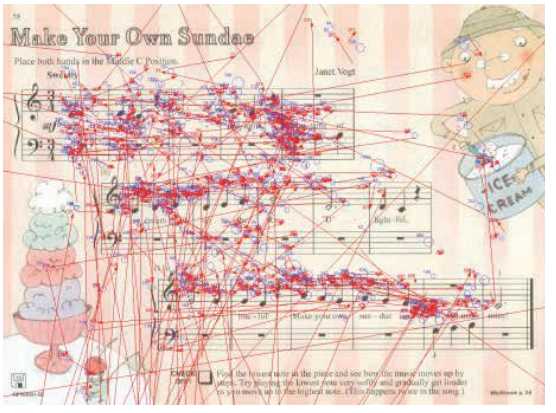


Preview session: showing fixations–2

It is also possible to show the different saccades (trajectory between fixations). Lines are showing the movements of the eyes from one fixation point to another.



Preview session: showing saccades (movement of the eye)–1



Playing session: showing saccades (movement of the eye)–2

Many types of data can be extracted with this software[8], but for the purpose of this study, we focused on the location and the duration of fixations. To examine where a participant's eyes are looking while processing a music reading task, each music page was divided into separate regions referred to as "interest areas": the music area and the illustration area. The software then provided us with the total number of fixations (fixation count) and the duration of all fixations (dwell time in milliseconds) for each interest area. The following table shows a summary report of one participant's trial of "Make Your Own Sundae" (*Piano Discoveries*, 2001, p.58)

Preview				
Interest area	**Fixations**	**Fixations %**	**Dwell time**	**Dwell time %**
Ice cream man graphic	8	7.41	2116	9.22
Sundae and cherries graphic	20	18.52	5084	22.15
Title of the piece	1	0.92	0	0.00
1st line of music	23	21.30	4404	19.18
2nd line of music	29	26.85	5252	22.88
3rd line of music	27	25.00	6100	26.57
Total	108	100	22956	100
Playing				
Interest area	**Fixations**	**Fixations %**	**Dwell time**	**Dwell time %**
Ice cream man graphic	8	2.02	2076	1.98
Sundae and cherries graphic	7	1.77	1476	1.41
Title of the piece	0	0	0	0.00
1st line of music	174	43.94	49644	47.33
2nd line of music	101	25.51	25680	24.48
3rd line of music	106	26.77	26016	24.80
Total	396	100	104892	100

Table 5: Summary report of on participant's trial of "Make Your Own Sundae" (*Piano Discoveries*).

Results

Data were collected during a preview task and a performing task. For each task, six principal variables were analyzed in this study: the percentage of the total fixations in each areas (musical zone, illustration zones and off zones) and the percentage of dwell time (durations of eye fixation) in each area. The data are represented on the following tables:

Preview			
Original pieces (with pictures)	**% of fixation in picture zone**	**% of fixation in music zone**	**% of fixation in off zone***
Piece 8	1.40	96.55	2.05
Piece 6	6.08	80.76	13.16
Piece 4	6.68	92.66	0.66
Piece 3	8.72	86.87	4.41
Piece 7	9.92	87.52	2.56
Piece 2	17.59	62.47	19.94
Piece 5	19.59	75.63	4.78
Piece 9	20.22	77.16	2.62
Piece 10	20.36	75.90	3.74
Piece 1	30.78	56.45	12.77
* The most common off-zone fixation is looking at the keyboard of the piano.			

Table 6: Percentage of fixations in each zone during the preview task.

Playing			
Original pieces (with pictures)	**% of fixation in picture zone**	**% of fixation in music zone**	**% of fixation in off zone**
Piece 4	0.42	77.15	22.43
Piece 3	2.64	90.53	6.83
Piece 10	3.45	87.00	9.55
Piece 2	3.88	69.26	26.86
Piece 7	5.04	89.39	5.57
Piece 8	5.05	73.46	21.49
Piece 6	5.33	71.83	22.84
Piece 5	7.37	84.94	7.69
Piece 9	9.92	78.75	11.33
Piece 1	14.38	71.78	13.84

Table 7: Percentage of fixations in each zone during the playing task.

When performing a music-reading task from pages containing decorative pictures, participants brought their gaze to the picture zone areas during both the preview task and the performing task. During the 30-second preview, between 1.4 percent and 30.78 percent of the participants' total eye fixations were on the picture zone, for an average of 13.14 percent. This means that during the preview period, on average more than 13 percent of the participants' total fixations were spent processing decorative illustrations. As expected, those percentages drop considerably during the much harder task of performing the piece. But still, during performance, between 0.42 percent and 14.38 percent of the participants' total eye fixations

were on the picture zone, for an average of 5.74 percent. On average, participants spend 8.14 percent more time fixating on illustrations when previewing than when performing.

Figure 3 shows the percentage of fixations in the picture zone during preview trials. Only 1 piece has less than 5 percent of the total number of fixations in the picture zone; 4 pieces have between 5 percent and 10 percent of the total number of fixations in the picture zone and it is more than 15 percent for half of the pieces of the sample.

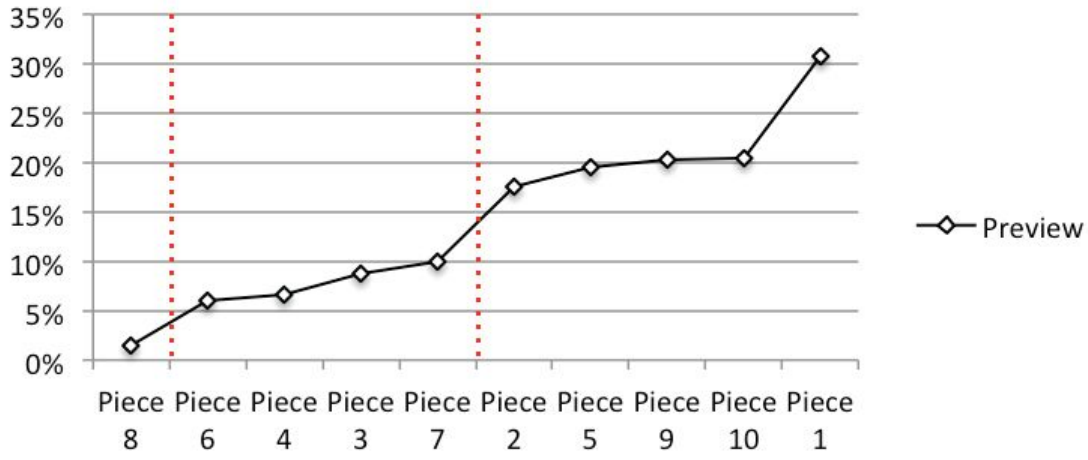


Figure 3: Percentage of fixations in the picture zone during preview trials.

Figure 4 shows the percentage of fixations in the picture zone during playing trials. Four pieces received less than 5 percent of the total number of fixation in the picture zone; 5 pieces received between 5 percent and 10 percent of the total number of fixations in the picture zone and 1 piece was above 10 percent.

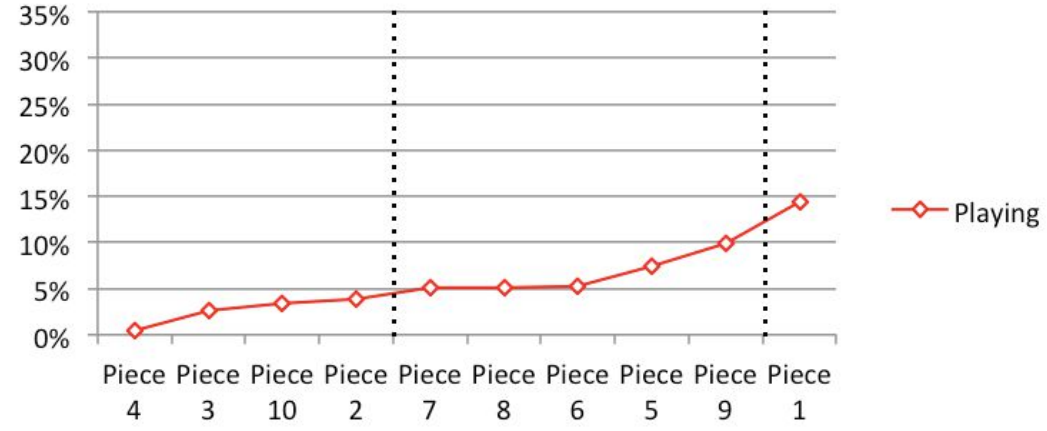


Figure 4: Percentage of fixations in the picture zone during playing trials.

Similar results can be observed in Tables 8 and 9 when analysing the dwell time in each area.

Preview			
Original pieces (with pictures)	**% of dwell time in picture zone**	**% of dwell time in music zone**	**% of dwell time in off zone**
Piece 8	0.89	97.83	1.28
Piece 6	3.23	86.99	9.78
Piece 4	4.81	94.98	0.21
Piece 7	7.34	91.27	1.39
Piece 3	7.57	89.29	3.14
Piece 5	8.68	81.75	9.57
Piece 9	17.87	80.44	1.69
Piece 10	19.66	77.78	2.56
Piece 2	20.06	60.53	19.41
Piece 1	31.77	57.58	10.65

Table 8: Percentage of dwell time in each zone during the preview task.

Playing			
Original pieces (with pictures)	**% of dwell time in picture zone**	**% of dwell time in music zone**	**% of dwell time in off zone**
Piece 4	0.32	86.15	13.53
Piece 3	1.78	94.31	3.91
Piece 10	2.30	92.85	4.85
Piece 5	2.51	91.18	6.31
Piece 2	2.63	80.45	16.92
Piece 7	3.02	92.40	4.58
Piece 6	3.31	84.47	12.22
Piece 8	3.41	83.75	12.84
Piece 9	7.16	85.46	7.38
Piece 1	13.79	75.03	11.18

Table 9: Percentage of dwell in each zone during the playing task.

During the 30-second preview, between 0.89 percent and 31.77 percent of the participants' total eye fixations were on the picture zone, for an average of 12.77 percent. This means that during the preview period, almost 13 percent of the 30-second preview was spent processing decorative illustrations. Here too the percentages drop during the playing task, but still between 0.32 percent and 13.79 percent of the participants' total dwell time were on the picture zone during performance, for an average of 4.19 percent. On average, participants spend 8.58 percent more time looking at illustrations when previewing than when performing.

During the preview period, participants spent the most amount of time looking at the illustration zone in piece number 1, one of the easiest pieces of the sample, for an average of 31.77 percent of the time. They spent the least amount of time looking at the illustration zone in piece number 8, one of the most difficult pieces of the sample, for an average of .89 percent. During the performance period, participants spent the most amount of time looking at the illustration zone in piece no. 1 again, for an average of 13.79 percent of the time. They spent the least amount of time looking at the illustration zone in piece number 4, another difficult piece of the sample, for an average of .32 percent. The participants' gaze is drawn to illustrations more frequently when viewing easier pieces than when viewing more difficult pieces.

The level of difficulty of a piece seems to be an important factor affecting the number of fixations and the amount of time spent on the picture zones. However, it is not the only factor as attraction to the illustration zones varies a lot between participants. Table 10 and Figure 5 show the percentage of fixations and dwell time in the picture zone during preview for each participant.

Preview						
	Fixations			Dwell time		
Original piece (with pictures)	**% of fixation in picture zone**	**% of fixation in music zone**	**% of fixation in off zone**	**% of dwell time in picture zone**	**% of dwell time in music zone**	**% of dwell time in off zone**
Participant D	5.63	78.3	16.07	6.73	81.01	12.26
Participant B	10.17	86.31	3.52	7.71	89.34	2.95
Participant A	13.83	77.12	9.05	11.2	82.72	6.08
Participant F	15.47	80.40	4.13	14.75	80.51	4.74
Participant E	15.72	80.94	3.34	16.25	80.60	3.15
Participant C	23.98	72.12	3.90	19.96	76.87	3.17

Table 10: Percentage of fixations and dwell time in the picture zone during preview.

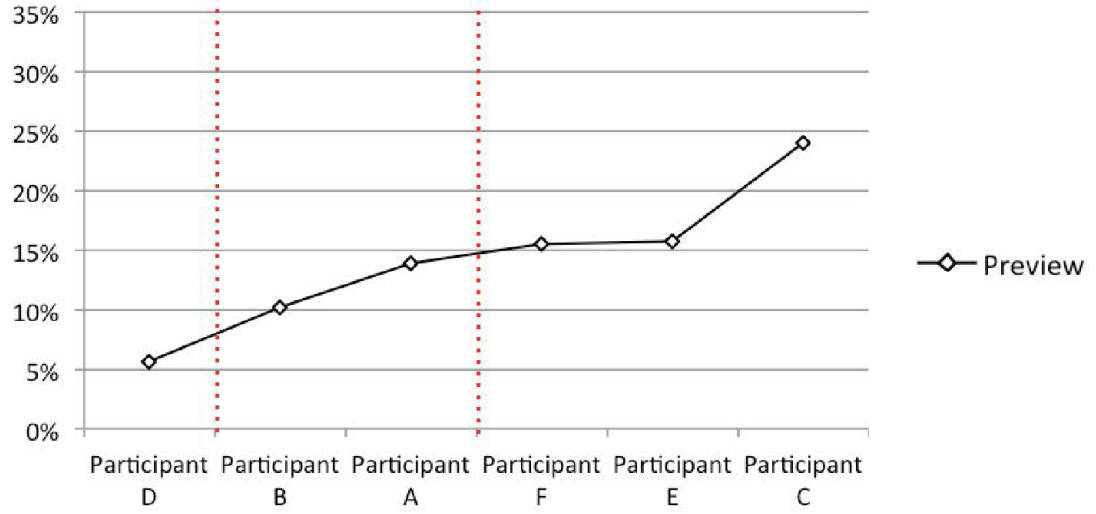


Figure 5: Percentage of fixations in the picture zone during preview.

When previewing a piece for a sight-reading task, only one participant (participant D) has less than 10 percent fixations in the picture zone. Two participants (B and A) are between 10 percent and 15 percent and three participants (F, E and C) have more than 15 percent. For the majority of the participants, more than 10 percent of their fixations are processing the picture zone. This is a lot of attention given to decorative illustrations when the task is to review a music score in preparation for performance at sight.

Table 11 and Figure 6 show the percentage of fixations and dwell time in the picture zone during playing at sight.

Preview						
	Fixations			Dwell time		
Original piece (with pictures)	**% of fixation in picture zone**	**% of fixation in music zone**	**% of fixation in off zone**	**% of dwell time in picture zone**	**% of dwell time in music zone**	**% of dwell time in off zone**
Participant D	1.96	84.01	14.03	1.26	91.19	7.55
Participant B	4.42	64.13	31.45	3.13	92.9	3.97
Participant F	4.51	79.08	16.41	2.79	85.81	11.40
Participant E	6.87	80.58	12.55	6.13	85.01	8.86
Participant C	7.81	80.81	11.38	6.79	85.13	8.08
Participant A	8.93	87.85	3.22	5.03	92.9	2.07

Table 11: Percentage of fixations and dwell time in the picture zone during playing.

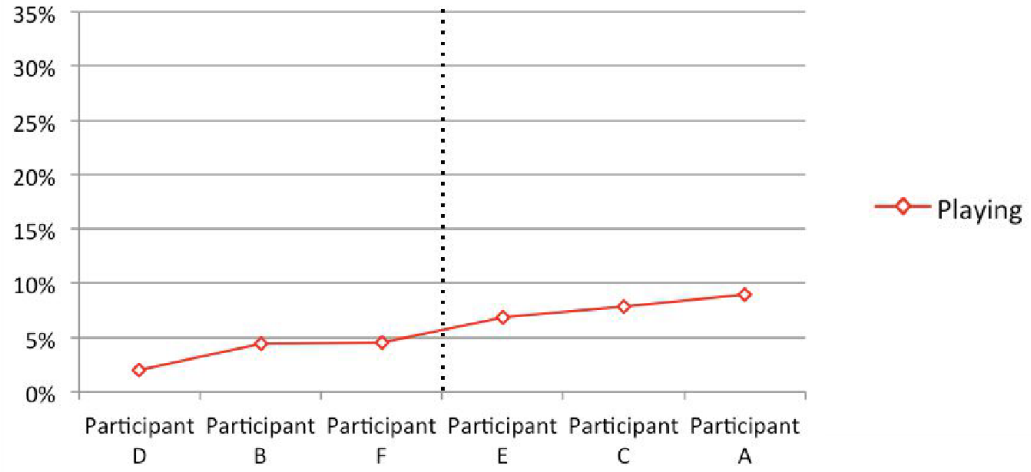


Figure 6: Percentage of fixations in the picture zone during playing.

As expected, the percentages of fixation in the illustration zones drop considerably during the performance task. Three participants (D, B and F) have less than 5 percent of fixations in the picture zone and three participants (E, C and A) have between 5 percent and 10 percent of fixations in the picture zone when performing. Half of the participants are processing the picture zone for more than 5 percent during the playing period. It is interesting to note that participants D and B, who have the least amount of fixations in the picture zone, are very consistent between the preview and the playing task. They keep their focus away from the illustration zones. These two participants have also been qualified by their teacher as good and strong readers. The placement of the other participants is less consistent. It is interesting to note also that participant C was identified as a weaker reader by the teacher and he certainly was attracted to the picture zones.

Discussion

For this study, we selected 10 pieces coming from different piano method books containing colorful decorative illustrations. We measured the cognitive attention of young piano students' by measuring their eye movements when previewing a piece for performance and when playing that piece at sight. We were able to show that students spend some time fixating the illustrations on the page when previewing the piece (mean average fixations of 13.14 percent; mean average of dwelling time of 12.77 percent), but are still attracted to pictures when playing the piece (mean average fixations of 5.74 percent; mean average of dwelling time of 4.19 percent). This is a clear indication students are dividing their cognitive attention between processing the musical signs on the page and processing the various colourful illustrations while attending to two specific tasks: scanning a score during a preview and reading a score while playing.

We were able to show that this reading behavior was not constant from one participant to another, but had great variances in terms of percentage of fixations in the picture zones (from 5.63 percent to 23.98 percent) and percentage of dwell time in the same zone (from 6.73 percent to 19.96 percent). Although we were not able to measure the reading ability of the participants, the comments of some of the teachers might indicate that poorer readers have more difficulty keeping their attention on the music zones and were processing more information from the picture zones while attending to a musical task.

We were able to identify that the level of difficulty of the piece might be a factor

affecting how much participants go back and forth between score and illustrations while previewing and performing. Students' gazes were drawn to illustrations more frequently when viewing easier pieces (piece 1 had 30.78 percent for preview and 14.38 percent for playing) than when viewing more difficult pieces (piece 8 had 1.40 percent for previewing and piece 4 had 0.42 percent when playing). However, it is interesting to note that although these last two pieces were more difficult, piece 8 still jumped from 0.42 percent fixation in the illustration zone while previewing to 5.05 percent when playing and piece 4 had 6.68 percent fixation in the illustration zones when previewing but dropped to 1.40 percent during playing. The difficulty of the piece only accounts for part of the attraction effects that illustrations might have as that effect is not constant between previewing and performing.

With such results, one must seriously question whether the presence of illustrations serves to call the child's attention away from the printed score. Although our pilot study was done with only 6 participants, we could clearly observe that during a music-reading task, our participants' gaze was going back and forth between the score and the illustrations. It is important to wonder whether the presence of pictures may act as a distraction from the music itself. There are theoretical grounds from text-reading studies (Torcasio & Sweller, 2010) that suggest it might not be beneficial to include illustrations in teaching materials when children are in the decoding phase and are learning to recognize and process the written signs. According to the cognitive load theory, processing unnecessary sources of information (like decorative illustrations) imposes an extraneous cognitive load that interferes with learning (Sweller, 2005). Removing nonessential information from the reading page, decreases the working memory load and can ameliorate the learning process: "If working memory resources are devoted to the illustrations rather than the text, as is likely with young children, those resources will be unavailable to decipher the text and, of course, learning to decipher text rather than looking at illustrations is the purpose of the exercise. The elimination of redundant illustrations may enhance learning to read." (Torcasio & Sweller, 2010, p. 661)

The implicit assumption for including decorative illustrations[9] in education material is that they serve a strong motivational function (Duchastel, 1980; Levin, Anglin & Carney, 1987) as they help to increase students' interest (Concannon, 1975, p. 254). The general belief is that pictures make the document more attractive and appealing to children, thus making the arduous task of learning to read more pleasant (Levie & Lentz, 1982; Samuels, 1970) and more enjoyable (Peeck, 1987). It is assumed that illustrations possess an affective function that can contribute to the development of a more positive attitude toward the reading material (Hannus & Hyönä, 1999; Peeck, 1987). Although the belief that children are more attracted to materials with beautiful illustrations is strong and pervasive, we have been unable to find any good research that would support these claims. In fact, the evidence in educational research seemed to show the beneficial effect of illustrations may be very narrow. In an experiment by Peeck (1987), children who were given illustrated reading books found them very attractive, but the control group with non-illustrated books enjoyed the reading experience just as much. In a review of a number of studies looking at the effects of illustrations in children's basic reading textbooks, Concannon (1975) concluded that when pictures are used as motivating factors, they do not really help a young reader to decode the textual information. Levie and Lentz (1982) also argue that while teachers may link attractive layout and beautiful pictures with instructional quality, "there is no necessary connection between beautiful and attractive illustrations and learning" (p. 195). In fact, they suggest that "many illustrations fail to enhance learning… consume a large portion of limited space that could be better devoted to content…[and] may have a detrimental effect when teaching young children to read" (p. 196).

Illustrations play an important role in marketing educational materials. There is no doubt that illustrations are a strong selling point as they encourage buyers to pick up the material, look through it and hopefully select a particular book series (Woodward, 1993). Levin (1981) refers to these marketability considerations as the remuneration function of illustrations. In many cases, illustrations may be the most striking feature that distinguishes one book series from another. It is interesting to note that publishers are usually very careful in the selection of their authors for a textbook series, and they show real concerns regarding the reading components being introduced. They often request the advice of consultants in the field to guarantee the quality of their reading primers. However, the layout production is still too often based on the "subjective feelings of the designer" and most importantly "the attractiveness of the finished product" (Brody, 1981, p. 93). The inclusion of illustrations in educational material is rarely guided by research (Woodward, 1993). During interviews conducted by Evans and colleagues (1987), publishers confirmed that research was not a factor in determining the number, the placement and the function of illustrations. This is echoed in comments in many research papers: "At present, it would appear that a great deal of instructional text design is guided by intuition, prior practice, trial-and-error approaches, and marketability considerations" (Houghton & Willows, 1987, p. v). As noted by Woodward (1993), "illustrations were more likely to be determined by marketing considerations, either prompted by teacher feedback or by innovations adopted by competing publishers" (p. 132).

Conclusion

Despite the widespread use of illustrations in music reading material, very little research on the effects of such illustrations has been undertaken. Knowing that the beginning reading materials commonly used to introduce young children to piano playing typically contain numerous colorful illustrations, the lack of empirical evidence regarding the effects of these illustrations is an important concern. For a number of years, studies in text reading have revealed that the presence of illustrations can have a negative impact on children learning to read as it distracts their attention away from the text. The sum of these research findings was a strong incentive to conduct a pilot project to study the effects of illustrations during two music tasks.

Based on the results and the analysis of our study, it is clear that decorative illustrations were guiding the participants' attention during the preview task and, to a lesser degree, during the performance task. Considering that the use of illustrations in music materials for beginners is pervasive, this topic clearly deserves further investigation. Without empirical evidence to clarify the real impact of decorative illustrations on music reading outcomes, the result may be the perpetuation of instructional materials "that may be of little value to the learners with whom they are used." (Rose, 1986, p. 544) If the initial acquisition of music reading skills is to be optimized, it seems clear that researchers, authors, editors, and designers of method books must interact with each other and develop educational material that capitalize on research-based knowledge.

Notes

1. The term *piano method books* refers to a series of lesson books and supplementary materials written to create a planned program of study (Akins, 1982; Albergo, 1988; Baker-Jordan, 2004; Uszler, Gordon, Smith, 2006). More specifically, the term "piano method" describes "a systematic, integrated and progressive piano course spanning the beginning and intermediate skill levels" (Brubaker, 1996, p. 7).

2. Text reading studies differentiate between word recognition and comprehension. The first term is used in relation to a student's acquisition of decoding and word-recognition skills *per se*, what is often called "learning to read" (Levin, Anglin

& Carney, 1987, p. 51). The second expression refers to prose comprehension or the comprehension of verbal materials, what is often called "learning from reading" (Brody, 1981, p. 94). Because of the nature of our study, this review of literature is only looking at papers in relation to the first meaning (learning to read).

3. Eye-movement technology is commonly used to understand the process of reading and to demonstrate the cognitive strategies used by readers. These studies may be done with regular text reading (Rayner, Cook, Juhasz, & Frazier, 2006) or with music sight-reading (Drai-Zerbib & Baccino, 2005; Goolsby, 1994a; Goolsby, 1994b; Sloboda, 1984; Wurtz, Mueri & Wiesendanger, 2009).

4. While the focus of this paper is on illustrations, we are also aware that in recent years, the pages in piano method books have become very "busy" with a lot of extra information: objectives of the lessons, explanation of a new concept, keyboard sketch, tips on how to practice, rhythm-clapping exercises, duet parts for teachers, theory exercises, note for the teacher, note for the parent, a reference to a page in a supplementary book, and the like.

5. Two main types of eye movements are typically studied: fixations and saccades. A fixation is a moment during which the eyes remain still and new information is acquired. Saccades are rapid eye movements that move the fovea of the eye from one point of fixation to another. No new information is acquired during this period.

6. Eye-tracking technology has commonly been used by researchers to evaluate adult musicians' processing of musical material (Furneaux & Land, 1997, 1999; Gilman, 2000; Truitt, Clifton, Pollatsek, & Rayner, 1997; Underwood and Waters, 1998). It has also been used to evaluate children's processing of text reading (Black, Collins, DeRoach, & Zubrick, 1984; Evans & Saint-Aubin, 2005; Justice & Lankford, 2002; Justice, Skribbe & Canning, 2005). However, we are among the first to use eye-tracking technology to study children's processing of musical material.

7. The learning materials used in this study all came from well-known piano method books used nationwide in North America: *John's Thompson's Modern Course for the Piano* (1994); *John Thompson's Easiest Piano Course* (Thompson, 1996); *Piano Discoveries* (Vogt & Bates, 2001); Yamaha Music School. *Junior Music Course* (Yamaha, 2007). They were selected because they are good representation of the general trends we find in all method books.

8. Examples: size of the pupils, number of eye blinks, velocity and amplitude of the saccades, number of regressions to and out of an interest area and the like.

9. Decorative illustration is defined in the literature as pictures that simply decorate a page, bearing little or no relationship to the text content: "When illustrations are selected to make a textbook look more attractive rather than to support learning in a specific way, then a decoration function is being served." (Levin, Anglin & Carney, 1987, p. 53). In our study, illustrations that would show hand position or indicate certain keys on a keyboard sketch were identified as "text-relevant" and considered as having a learning function. No pages with such illustrations were selected for our study. Colorful illustrations that had no direct connection to the teaching points other than illustrating the title of the piece or making the page more appealing were considered decorative, and these were the kind of pictures that were studied in this project.

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