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# Short sentences, easy to read? Effects of connectives and layout on text comprehension by beginning readers

**Abstract:** The use of coherence markers, such as the connectives *because* and *but*, and presenting texts in an integrated layout support the text comprehension of students in secondary education (Land 2009; Van Silfhout 2014). For children in the early years of primary education, however, the picture is less clear. Children show a gradual increase in their ability to benefit from connectives in texts (Irwin and Pulver 1984), and making return sweeps at the end of lines is a relatively new skill. In a reading experiment among children in grade 2, we tested the effects of layout and the presence of connectives on children's text comprehension. It is shown that 7- and 8-year-olds benefit from connectives, but that layout (presenting sentences with or without line breaks) does not affect text comprehension. However, children perceive texts with an integrated layout as easier. A corpus-based study revealed that books designed for children in grades 1-3 often do not show such a layout, and that fragmented layouts are predominant in texts for grades 1 and 2. Possible explanations and implications for the design of educational materials for beginning readers are discussed.

## 1 Introduction

Children start acquiring markers of relational coherence just after their second birthday. Within a year, they are able to produce a variety of additive, temporal, causal and adversative connectives, such as *and*, *then*, *because* and *but* (Bloom et al. 1980; Evers-Vermeul 2005; Evers-Vermeul and Sanders 2009; Van Veen et al. 2009, 2014; see also Czech, *this volume*).

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**Acknowledgement:** The experimental part of this research was conducted in collaboration with Jentine Land and an MA-student from Utrecht University: David-Jan Punt (see Punt 2010). I would like to thank Marleen Pardoel for compiling the corpus of children's books.

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Despite children's early proficiency in using connectives, many publishers of Dutch school texts seem to believe that students in the early years of secondary education still have difficulties in interpreting sentences containing explicitly marked coherence relations. Especially in pre-vocational education, the majority of Dutch school texts consist of simplex main clauses with few or no connectives (Land 2009).<sup>1</sup> For example, the translated text in (1) comes from a Geography text book for 14-year-olds.

- (1) On February 1, 1953 there was a north-westerly storm.  
 It raged along the shore with wind-force 10.  
 The dikes didn't hold it any longer.  
 Large parts of Zeeland and South-Holland flooded.  
 Over 1,800 people died and many stocks of cattle drowned.  
 Thousands of houses were destroyed.  
 Dikes, dams and sea walls had to be built.  
 The Delta Works and the Zuiderzee Works now protect the Netherlands against floods.

Fragment (1) consists of short sentences, without subordinating clauses, and only one coordinating clause. Due to the lack of coherence markers, readers have to establish coherence relations themselves, or might end up thinking the text presents a mere list of facts. For example, in order to construct a coherent mental representation of the text (Kintsch 1998, 2013; Kintsch and Van Dijk 1978; Zwaan and Radvansky 1998), a cause-consequence relation should be established between the fourth sentence on the one hand, and the following two sentences on the other: the death of people and cattle and the destruction of the houses are caused by the flood. The fragmented nature of text (1) is strengthened by its layout, as each sentence is presented on a separate line.

In a corpus-based study, Land (2009; Land et al. 2008) has shown that 69% out of 126 school texts on the subjects History, Economics, and Geography used in the second year of pre-vocational education (comparable to grade 8 in the American school system) show such a fragmented layout. Only 22% of the 1,365 sentences in these texts contained coherence markers. Publishers told Land to prefer a fragmented layout with short sentences because it made the texts look simple,

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<sup>1</sup> Dutch secondary education is divided into three levels ranging from pre-vocational education (*vmbo*) to pre-university education (*vwo*). Dutch *vmbo* is divided into four levels, ranging from mainly vocational to mainly theoretical training. Fragmented text books are typically developed for the vocational levels of *vmbo*.

and because they thought it would make such texts easier to read for students in pre-vocational education.

However, Land (2009; Sanders, Land and Mulder 2007) has shown that such fragmented texts have the opposite effect on text comprehension: 13- and 14-year-old students understand texts with connectives and with an integrated layout better than texts without such coherence markers and with each sentence starting a new line. Similarly, Van Silfhout (2014) and colleagues found that both pre-vocational and pre-university students in grade 8 answer bridging inference questions better after reading texts with connectives than after reading texts without connectives. This held true for History texts (Van Silfhout et al. 2014b), as well as for Economy and Biology texts and narratives (Van Silfhout et al. 2015). Eye-tracking results indicate that connectives speed up students' processing, especially when texts have an integrated layout, and that students' processing slows down when they read texts with a fragmented layout. A significant positive correlation between reading times and scores on bridging inference tasks indicated that explicit texts with an integrated layout place fewer processing demands on students' working memory (Van Silfhout et al. 2014a).

In conclusion, connectives seem to benefit adolescents' text comprehension. However, the picture is less clear for students in primary education (see also Becker et al., *this volume*). Cain and Nash (2011) found that both 8- and 10-year-olds interpret connectives differently according to the type of coherence relations they signal: children were able to select appropriate temporal, adversative, and causal connectives to link two short sentences, although the 10-year-olds outperformed the 8-year-olds in the case of temporal and adversative relations. The fact that children's use of connectives in text comprehension is still developing during primary education is also shown by Irwin and Pulver (1984): they found main effects of adding causal connectives on text comprehension for fifth- and eighth-grade students, but not for students in grade 3. Hence, it remains to be seen how beneficial connectives will be for even younger children in primary education.

Similarly, it is not self-evident that young, less-skilled readers will benefit from an integrated layout, compared to a fragmented layout. Previous studies have shown that it is a complex maneuver to move eyes from the end of one line to the beginning of the next. The first word of a new line usually takes longer to read than other words (Haberlandt and Graesser 1985) and is often skipped, which sometimes requires the reader to make a corrective movement (Rayner 1998). This might suggest that the number of return sweeps should be kept at a minimum for young readers. However, as Van Silfhout et al. (2014a: 1038) have mentioned, an integrated layout may generate other reading problems. Proficient readers automatically segment the sentences of a text into syntactically and semantically

appropriate units or phrases (Just and Carpenter 1987; LeVasseur et al. 2006), but for many inexperienced, developing readers, parsing a sentence into phrases and clauses seems to be problematic (Fuchs et al. 2001; LeVasseur et al. 2006). For example, LeVasseur et al. (2006) found that when phrasal constituents were interrupted by a line break, 7- to 9-year-olds obtained lower fluency ratings and made more than twice as many false starts than they did with texts in which the end of a line corresponded to a clause boundary.

These findings raise the following question: what effect do layout and the presence of connectives have on the text comprehension by students in grade 2 in primary education? In this study, the focus is on grade 2, because that is the first grade in which children have mastered technical reading skills (identifying characters and words) to such a degree that they are expected to be able to focus on text comprehension beyond the word and sentence level (see Section 2).

In order to get an impression of children's experience with fragmented and integrated layouts, respectively, a corpus-based analysis was performed of text books developed for children in grades 1, 2 and 3 (see Section 3).

## 2 Method and results reading experiment

We conducted an off-line reading experiment in which children in grade 2 had to read two texts that were manipulated in two respects: layout and presence of connectives. The following subsections provide details about the participants and design, the materials used in the study, as well as the procedure followed while conducting the experiment.

### 2.1 Participants and design

Participants in the reading experiment were 213 children (51% boys, 49% girls) from grade 2. Children were recruited from ten classes at seven schools in The Netherlands, and were seven or eight years old (mean age 7.8, SD 0.6).

Each child read two texts, for example an explicit fragmented version of one text, and an implicit integrated version of another text. Text versions and text orders were randomly assigned to students.<sup>2</sup>

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<sup>2</sup> The original experiment tested five versions of each text, including an explicit version with subordinating connectives. Because this version was only developed in an integrated layout, it

Because text comprehension scores may vary with reading proficiency, we measured children's reading proficiency using a standardized Dutch reading proficiency test for students in grade 2. This resulted in proficiency scores on an ordinal scale ranging from insufficient (1) to good (5). The distribution of proficiency scores was equal across conditions ( $\chi^2(12) = 6.08, p = .91$ ).

## 2.2 Materials

The experimental texts were in Dutch, and were based on texts from recent Biology textbooks for children: one about gorillas and one about spiders. Each text was manipulated in two aspects: layout (integrated vs. fragmented) and the presence of connectives (explicit vs. implicit). A fragmented layout was created by presenting each sentence on a separate line. In the versions with an integrated layout, sentences continued on the same line, as far as page width allowed. In both types of layout, the sentences were grouped in subsections of three to seven sentences, without headings.

The presence of connectives was manipulated by adding frequent connectives such as the coordinating conjunctions *want* 'because' and *maar* 'but', and the adverbial *daarom* 'that's why' to the explicit versions. Compare, for example the implicit version in (2a) with its explicit counterpart in (2b). In the latter version, the consequence-cause relation between the running of the spider and his longing for food is made explicit, as well as the contrastive relation between the longing for food and his inability to chew. As (2b) illustrates, the sentences starting with a connective were presented as independent syntactic units, so that both the implicit and the explicit versions of the texts only contained single main clauses, and showed the same word order.<sup>3</sup> Such sentences are very common in books for 7- and 8-year-olds. The spider text consisted of 135 words in the explicit conditions and 121 words in the implicit conditions. The gorilla text consisted of 131 words in the explicit and 119 words in the implicit conditions.

- (2) a. *De spin rent naar de vlieg. Hij wil de vlieg opeten. De spin kan niet kauwen.*

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did not allow for testing effects of layout, and was therefore disregarded in the current study (44 cases for the gorilla text, and 41 for the spider text).

<sup>3</sup> In Dutch, the word order in subordinating clauses is different from the one in main clauses, as Dutch main clauses exhibit Verb Second, whereas the subordinating clauses have the finite verb at or near the end of the clause. Because word order might also affect processing, the current study only focused on the role of connectives in main clauses.

‘The spider runs to the fly. He wants to eat the fly. The spider cannot chew.’

- b. *De spin rent naar de vlieg. Want hij wil de vlieg opeten. Maar de spin kan niet kauwen.*

‘The spider runs to the fly. Because he wants to eat the fly. But the spider cannot chew.’

The excerpts in (3) show two translated sentences from the four resulting combinations of the Dutch gorilla text.

- (3) a. Fragmented, implicit version:  
*A gorilla has strong arms.  
 He is good at climbing trees.*
- b. Fragmented, explicit version:  
*A gorilla has strong arms.  
 That’s why he is good at climbing trees.*
- c. Integrated, implicit version:  
*A gorilla has strong arms. He is good at climbing trees.*
- d. Integrated, explicit version:  
*A gorilla has strong arms. That’s why he is good at climbing trees.*

Children answered two text appreciation questions per text. One question was about the text’s attractiveness: *I find the text about gorillas/spiders...*, with a five-point scale, presented in a multiple-choice format, ranging from *not nice at all* to *very nice*. The other question concerned the comprehensibility of the text: *I find the text about gorillas/spiders...*, with answers ranging from *very difficult* to *very easy*.

After each text, participants were also asked to answer eight text comprehension questions that tapped both literal and inferential information. For both texts, two questions addressed students’ text base representation (e.g., *What color does a gorilla have?*), asking for facts that had been presented in a single sentence in the text (compare the use of this type of question in Cain et al. 2004; Ozuru et al. 2009). In line with previous research (Kamalski 2007; McNamara et al. 1996; Van Silfhout 2014b, 2015), the comprehension test also contained open-ended bridging inference questions. These six questions per text tested children’s understanding of coherence relations in the text, and hence their situation model representation (Kintsch 1998). To answer such questions, children had to combine information

from at least two different sentences in the text. For example, students' comprehension of text fragment (4) was tested with question (5).

- (4) *Sommige mensen jagen op gorilla's. Zij schieten gorilla's dood. Daardoor leven er nog maar weinig gorilla's.*  
 'Some people hunt for gorillas. They shoot gorillas to death. As a result only few gorillas remain.'
- (5) *Er leven nog maar weinig gorilla's. Hoe komt dat?*  
 'Only few gorillas remain. How come?'

The maximum possible score per text was eight: two points for the literal questions, and six for the inference questions.

## 2.3 Procedure

All tests were administered at school, during morning hours. The experiment started with a spoken instruction of approximately five minutes, in which the procedure and task were explained to the group. Then, the first text and accompanying questions were presented in a booklet. The text was followed by a small puzzle (to avoid verbatim recall) and the two appreciation questions. Subsequently, children had to answer the comprehension questions. Participants were not allowed to re-read the text, so they could not look up the answers. This procedure was then repeated for the second text. There was no time limit for reading an individual text and answering the questions. After 30 minutes, all participants had finished the entire task. The experiments were conducted over a period of two weeks.

## 2.4 Results

Per text, the comprehension questions were moderately reliable (gorilla text:  $\alpha = .65$ ; spider text:  $\alpha = .46$ ). Because the reliability scores did not change as a result of deleting individual questions or grouping questions into literal vs. inference questions, sum scores per student per text were used for further statistical analyses. Table 1 provides the mean scores per version, irrespective of text topic because there were neither main nor interaction effects of text topic (all  $ps > .29$ ).<sup>4</sup>

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<sup>4</sup> Importantly, the main effect of connective use on comprehension surfaced in both texts (gorilla text:  $F(1, 155) = 6.45, p = .01; \eta_p^2 = .04$ ; spider text:  $F(1, 155) = 5.30, p = .01; \eta_p^2 = .03$ ).

**Tab. 1:** Mean comprehension scores (and standard deviations) per text version (max. = 8, N = 320)

Layout	Explicit	Implicit
Fragmented	6.67 (1.55)	6.15 (1.37)
Integrated	6.86 (1.20)	6.22 (1.42)

An ANOVA with reading proficiency as covariate revealed a main effect of connective use on comprehension ( $F(1, 311) = 12.19, p = .001; \eta_p^2 = .04$ ). There was no effect of layout on comprehension ( $F(1, 311) = 0.18, p = .67$ ), and no interaction effect of layout and connectives ( $F(1, 311) = 0.14, p = .71$ ). This means that the texts with connectives resulted in higher comprehension scores, but that layout did not affect the quality of the mental representation children made of text.

The results of the two appreciation questions per topic are provided in Table 2 – again without separating out the scores per text because of a lack of effects of text topic (all  $ps > .16$ ).

**Tab. 2:** Mean appreciation scores (and standard deviations) for attractiveness and perceived difficulty per text version (min. = 1, max. = 5)

	Attractiveness (N=308)		Perceived difficulty (N=302)	
	Explicit	Implicit	Explicit	Implicit
Fragmented	4.02 (0.95)	3.99 (0.82)	3.99 (1.05)	3.70 (1.01)
Integrated	4.08 (0.92)	3.95 (1.00)	4.32 (0.95)	4.18 (1.08)

An ANOVA with reading proficiency as covariate revealed no significant effects for attractiveness (connective use ( $F(1, 303) = 1.00, p = .32$ ; layout:  $F(1, 303) = 0.06, p = .81$ ; interaction connective use \* layout:  $F(1, 303) = 0.28, p = .60$ ). This means that children's appreciation of the attractiveness of the texts did not vary as a result of the layout or the use of connectives in these texts.

A significant effect was found for perceived difficulty: there was a main effect of layout ( $F(1, 297) = 7.08, p = .008; \eta_p^2 = .023$ ). No effect of connective use ( $F(1, 297) = 0.002, p = .97$ ) and no interaction effect of connective use and layout were found ( $F(1, 297) = 0.004, p = .95$ ). Children considered texts with an integrated layout easier to read than texts with a fragmented layout, irrespective of the presence of connectives. There was no correlation between children's appreciation of the attractiveness and the perceived difficulty of texts ( $r = .15, p = .008$ ).

### 3 Method and results corpus-based study

In order to get an impression of the layouts children get acquainted with during their first years of primary education, a corpus-analytic study investigated the layouts used in text books for grades 1, 2 and 3. Materials, analytical model and results are discussed in the following subsections.

#### 3.1 Materials

The corpus consisted of 96 books written for children in the first, second or third grade in primary school: 32 per grade. Books were labeled as written for grade 1 if they contained an age indication for 7-year-olds and/or a standardized readability index frequently used in The Netherlands: AVI-M3 of E3.<sup>5</sup> Books with an age indication for 8-year-olds and/or the readability index AVI-M4 or E4 were considered to be written for grade 2. Books were labeled as written for grade 3 if they contained an age indication for 9-year-olds and/or the readability index AVI-M5 of E5.

Per grade, books from two genres were collected: 16 narrative texts, and 16 expository texts. Narrative texts contained stories with speaking and acting characters; expository texts contained information on a subject and/or instructions how to do things.

#### 3.2 Analytical model

For each text, the layout was established. We distinguished texts showing a consistent use of an integrated layout from texts with no clear integrated layout. A text was considered to be integrated if new sentences within the same section started immediately after the previous one as far as page width allowed, as in examples (2), (3c) and (3d). If a text exhibited a fragmented layout – with each sentence starting a new line, as in (3a) and (3b) – or if it did not show a consistent layout, it was classified as having no clear integrated layout.

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<sup>5</sup> See <http://www.slo.nl/primair/leergebieden/ned/taalsite/lexicon/00029/> for a Dutch explanation of this readability index.

### 3.3 Results

Out of 96 texts, 91 texts exhibited a consistent layout. Four expository texts (three for grade 1 and one for grade 3) showed a mixture of sections with a fragmented layout and sections with an integrated layout. Compare fragment (6) from page 14 of an expository text for grade 1, and fragment (7) from page 15 of the same text book about islands.

- (6) *Op een nieuw gevormd eiland groeien nog geen planten en er leven geen dieren. Maar na verloop van tijd vliegen er vogels naar het eiland. Andere dieren zwemmen er naartoe.*

‘On a newly formed island there are no plants and no animals (lit. no plants grow and no animals live). But after some time birds fly to the island. Other animals swim there.’

- (7) *Door de wind of door de golven komen zaden op het eiland terecht.*

*De zaden ontkiemen en er gaan planten groeien.*

‘Through the wind or through the waves seeds end up on the island.

The seeds germinate and plants start to grow.’

For one text, the layout could not be determined because it presented only one sentence per page. This text was disregarded in the statistical analyses. Percentages of texts with a consistent integrated layout are mentioned in Table 3.

**Tab. 3:** Percentage of integrated texts per grade and genre, with actual number plus total number of texts between brackets (N = 95)

	grade 1	grade 2	grade 3
Narrative	0.0 (0/16)	12.5 (2/16)	43.8 (7/16)
Expository	53.3 (8/15)	37.5 (6/16)	93.8 (15/16)

A Logit analysis showed the distribution over layouts differed with grade ( $\chi^2(2) = 18.75, p < .001$ ), and with genre ( $\chi^2(1) = 14.19, p < .001$ ). There was no interaction effect of grade and genre ( $\chi^2(2) = 8.72, p = .19$ ). See Table A in the Appendix for more statistical details. Overall, the integrated layout occurs less frequently in narrative texts than in expository texts ( $z = -4.02, p < .001$ ). Also, the integrated layout is more frequent in texts for grade 3 than in texts for grade 1 ( $z = -3.45, p = .001$ ) and grade 2 ( $z = -3.57, p < .001$ ). This means that the number of integrated texts

increases with age/grade, and that the use of layouts is not consistent across genres.

## 4 Conclusions

Because children's use of connectives in text comprehension is still developing during primary education (Cain and Nash 2011; Irwin and Pulver 1984), and because making return sweeps at the end of lines is a relatively new skill for beginning readers, this study set out to test the effects of layout and the presence of connectives on the text comprehension and text appreciation of children in grade 2. A reading experiment among 7- and 8-year-olds revealed that informative texts with connectives resulted in higher comprehension scores than their implicit counterparts, but that layout did not affect the quality of the mental representation children made of a text.

The beneficial effect of connectives use on children's text comprehension is in accordance with previous findings among adolescents (Land 2009; Van Silfhout 2014; Van Silfhout et al. 2014b, 2015), and with the relatively high proficiency level of connective use found by Cain and Nash (2011). However, it goes against Irwin and Pulver's (1984) finding that the presence of connectives does not benefit the text comprehension of children in grade 3. First, this difference in findings may be attributed to a difference in task. As Irwin and Pulver (1984) indicate themselves, "the scores on these recall questions were fairly low, indicating that this task was difficult for these students" (p. 403). Second, Irwin and Pulver only examined effects of adding causal connectives, whereas the manipulation in the present study also included other types of connectives (e.g. adversatives). A third explanation comes from a difference in clause orders: the current study only contained connectives in main clauses that followed the corresponding main clause. Irwin and Pulver, however, also used experimental sentences with a reversed clause order, i.e. containing a pre-posed *because*-clause. It is known from processing studies that pre-posed adverbial clauses put a heavier burden on readers' working memory than do post-posed clauses (Gibson 2000). This also shows from Irwin and Pulver's (1984: 403) results: children in grade 3 scored better in the condition with post-posed *because*-clauses than in the condition with pre-posed *because*-clauses. Interpreting the difference in results from a processing perspective implies that beginning readers are able to benefit from connectives as long as these connectives are presented in sentences following their main clause. Additional research needs to be done to test this hypothesis. This might refine the overall developmental trajectory posited in other work: from unawareness of explicit

connectives, to awareness of explicit connectives and dependence upon them, to an active reading style in which relationships are inferred and explicit connectives are unnecessary (Becker et al., *this volume*; Johnston and Pearson 1982; Zinar 1990).

In the current study, children's comprehension scores were not significantly affected by layout: comprehension scores after reading a text with an integrated layout were comparable to the ones after reading a text with a fragmented layout. This result can be interpreted from two angles. It means that presenting a line break in the middle of a sentence does not have a negative impact on children's text comprehension, and conversely, that presenting each sentence on a separate line is not beneficial for children in grade 2. This is remarkable, because children in grade 2 are still refining their technical reading skills, including making a return sweep from the end of one line to the beginning of the next. Future studies using eye-tracking techniques will have to indicate whether effects can be found during reading, but the current study has already shown that no effects are present after reading, i.e. once the mental representation of the text is constructed.

The finding that children's text comprehension does not benefit from an integrated layout goes against findings among adolescents (Van Silfhout et al. 2014a). Perhaps children in grade 2 are not aware of the 'visual message' that is provided by presenting sentences without a line break: an integrated layout may trigger readers to infer that the sentences form a coherent whole, and hence may invite readers to look for coherence relations between clauses. An on-line processing study might reveal whether an integrated layout alters children's processing speed or re-reading behavior, and hence give indications of children's sensitiveness to this visual cue.

The present study, however, already provides indications that the current practice in texts for beginning readers is not particularly helpful for children in grade 1 and 2 in finding out what the visual message of layout may be. A corpus-based analysis of 96 text books reveals that the majority of texts for grade 1 and 2 show a fragmented layout, with sentences separated by a line break, whereas only in grade 3 the majority of texts exhibit an integrated layout. Moreover, the use of layouts was found not to be consistent across genres: integrated layouts were predominant in expository texts, while narratives were often presented in a fragmented layout.

A practical implication of these findings is that publishers might reconsider the layout they use in texts for beginning readers. At present, they seem to prefer a fragmented layout for the youngest age groups, even though an integrated layout does not have a negative impact on children's comprehension scores. Selecting an integrated layout, however, might help young readers to discover the visual

message provided by layout more easily. An integrated layout would also match children's preferences found in the current experiment: children in grade 2 considered texts with an integrated layout easier to read than texts with a fragmented layout, irrespective of the presence of connectives.

Another practical implication concerns the teaching of text structure. Williams and colleagues (e.g. Williams and Atkins 2009; Williams et al. 2005) have repeatedly found that children in the early grades of primary education are already able to benefit from explicit teaching of text structure (see also Hebert et al. 2016; Pyle et al. 2017). The current study underlines these findings: even 7- and 8-year-olds benefit from connectives in texts. Increasing children's awareness of coherence markers and the role of connectives in explicating text structure, and providing children with texts that exhibit a gradual increase in syntactic complexity (from single main clauses to post-posed adverbial clauses to pre-posed adverbial clauses) are crucial components if we want to help children become proficient readers who are able to construct a coherent mental representation of a text's content.

## Appendix: Logit-analysis on layout in children's books

Tab. A: Goodness of fit per model (with the best fitting model in bold)

Model	$\chi^2$ model	df	p model	$\chi^2$ factor	df	p factor
1. constant + layout	36.22	5	<.001	-	-	-
+ 2. layout*genre	22.03	4	<.001	14.19	1	<.001
<b>+ 3. layout*grade</b>	<b>3.28</b>	<b>2</b>	<b>.19</b>	18.75	2	<.001
+ 4. layout*grade*genre	0	0	<.1	3.28	2	.19

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