Text Coherence and the Multimedia Principle

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1. The research problem

Different studies provided evidence on the positive effects of pictures on recall and comprehension. Pictures help readers to understand difficult concepts, can illustrate abstract concepts, help to organize complex information. The presentation of information by both a verbal and a visual format combines two qualitatively different kinds of representation which complement one another (Schnotz, 1993; 2005).

Much has been done to decrease extrinsic cognitive load and to facilitate the integration of text and graph, by working on factors like text-and-graph spatial or temporal contiguity, by eliminating irrelevant information (unneeded sentences, irrelevant pictures and sound) from the presentation (Mayer, Heiser & Lonn, 2001). Qualities of linguistic text presentation such as the amount of requests for inference and, on the contrary, the explicitness of the consequential connections or causal chains between information items were not accurately studied. The effect of text coherence was only ascertained by eliminating information items which were not connected to the cause-and-effect explanation or details which didn't state main ideas (Ayres & Sweller, 2005; Pollock et al. 2002).

2. The hypothesis

Our general research question can be so formulated: which is the role of the quality of the verbal component in the comprehension and recall of a multimedia consisting of written text and static pictures?
Since the capacity of working memory is increased by linking information items to each other as much as possible, can we improve the recall of a multimedia:

• by improving the coherence through making explicit the linguistic links,
• and by making so the text component as comprehensible as possible?

Our hypothesis is that the recall of a multimedia can be improved by manipulating the linguistic formulation so as to :

• make the consequential connections between information items more explicit (e.g., by formulating the prior knowledge items necessary to draw the inferences needed to reconstruct them)
• make anaphors and other linguistic connectives more easy to be used to maintain referential continuity.

The connectedness in the text (external representation) might increase the amount of connections or links between text information items in the representation stored in working memory (internal representation) and consequently might increase the recall overall, i.e. the recall of the whole multimedia.

A special kind of germane cognitive load is identified in the outcome of the manipulations listed above. Any integration inserted into the external representation is assumed to makes the construction of a coherent internal representation more likely.

3. The experiment

Two groups of 17 participants matched on a standardized reading comprehension test scores examined a multimedia presentation on lightening formation on a computer screen.
The experimental material has been already used in many published experiments (Mayer, 2001, 2005). It included 14 static pictures depicting the main steps of the explanation, each integrated with a brief written description.
While the pictures were kept unvaried in both conditions, in the revised version the original Mayer's written text was integrated by making connective inference explicit and by inserting phrases which could help the elaboration of anaphors and other linguistic connectives linking the different pieces of text.
One group of participants examined Mayer's original version and the other one examined the revised version.

3.1 Material
Here is an example of the original and revised version of the written description which corresponds to the second picture:
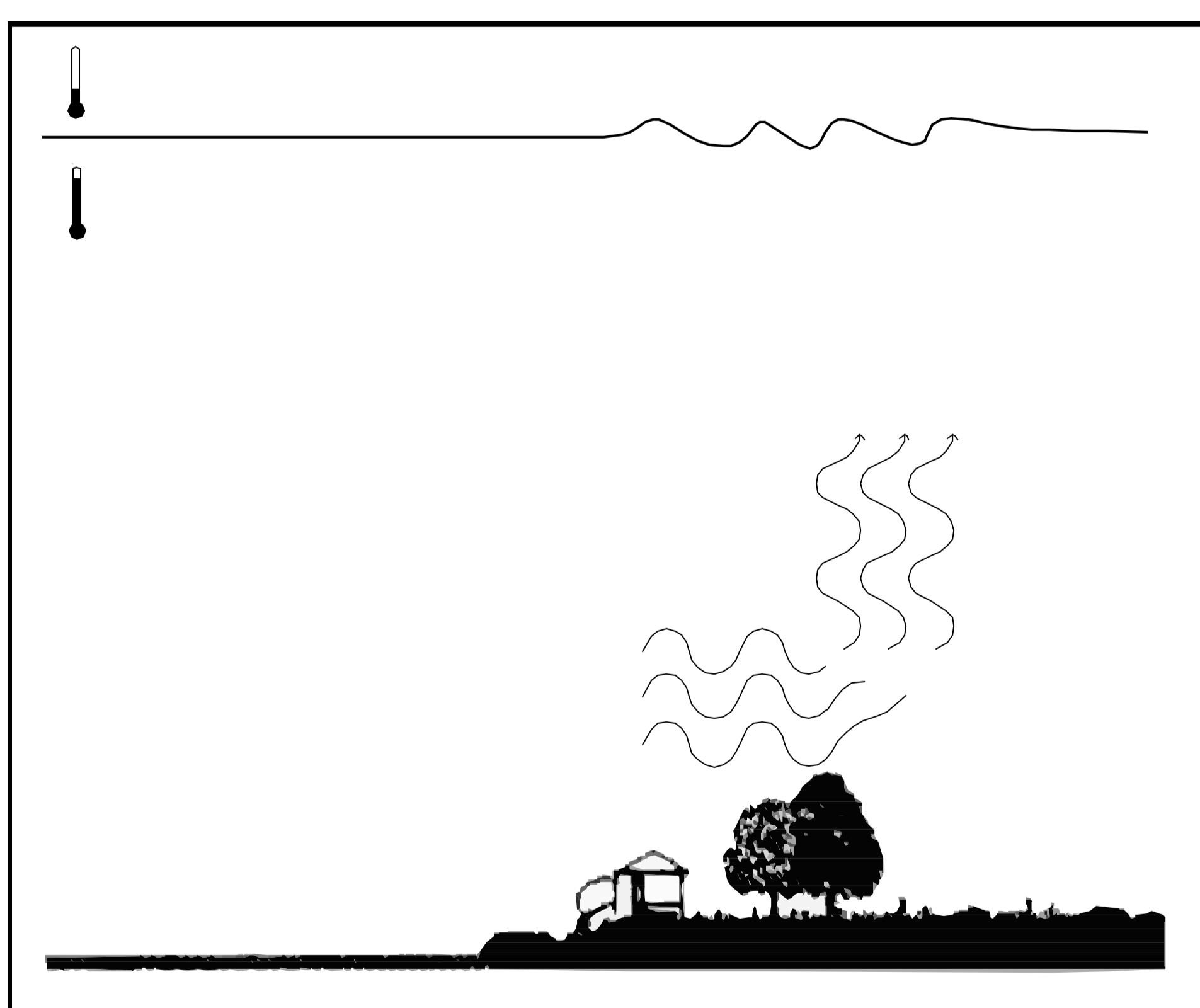
Original version: Warmed moist air near the earth's surface rises rapidly

Revised version: Warmed moist air near the earth's surface rises rapidly by forming an updraft. This updraft is formed because the warmer air is lighter and therefore tends to rise.

In the revised version we recover the explicit reference to an argument which is referred to in the beginning of the subsequent fragment, 3. In fact in the original written fragment, we find an anaphora ('in this updraft') which has to be connected to the phrase 'rises rapidly', while in the revised version the referential continuity is facilitated by anticipating the explicit reference to the updraft.
Besides, the integration should help the participants to build a coherent representation: in fact the reference to the relationship between becoming warmer and becoming higher explains why the updraft builds in 2.

3.2. Procedure and scoring
Participants were asked to pay a special attention to the chain of cause-and-effects described in the presentation.
After reading the multimedia presentation, the participants were asked to write what they remember about the process described and were invited to pay attention to the link between the events described.
Recall was analyzed and coded through two systems of analysis: one described by Mayer (2001) with 8 factual information items; the second produced ad hoc for the experiment by drawing it from the definition of coherence or connectedness in text comprehension and therefore by listing the chain of antecedents and consequences explained in the written component of the multimedia.
The answers were coded assigning the score 1 to each correct answer and the score 0 to each incorrect one.

3.3 Results
The recall performance was analyzed in a one-way ANOVA with text-version as between subject factor. A significant main effect of text revision on comprehension of consequential connections ($F=1,32= 4,8346$, $p<0.05$) was found in a direction consistent with our expectation, with a significant improvement of the performance for the participants who examined the revised version of the text (mean score=6,6; d.s.=2,45) vs. those who had the original version (mean score=4,6; d.s.=2,69).

No effect of the revision on factual recall (Fig. 4) was found: the increase in the amount of items of information, which could be expected to be a source of cognitive load, was counterbalanced by the enhancement of text coherence.
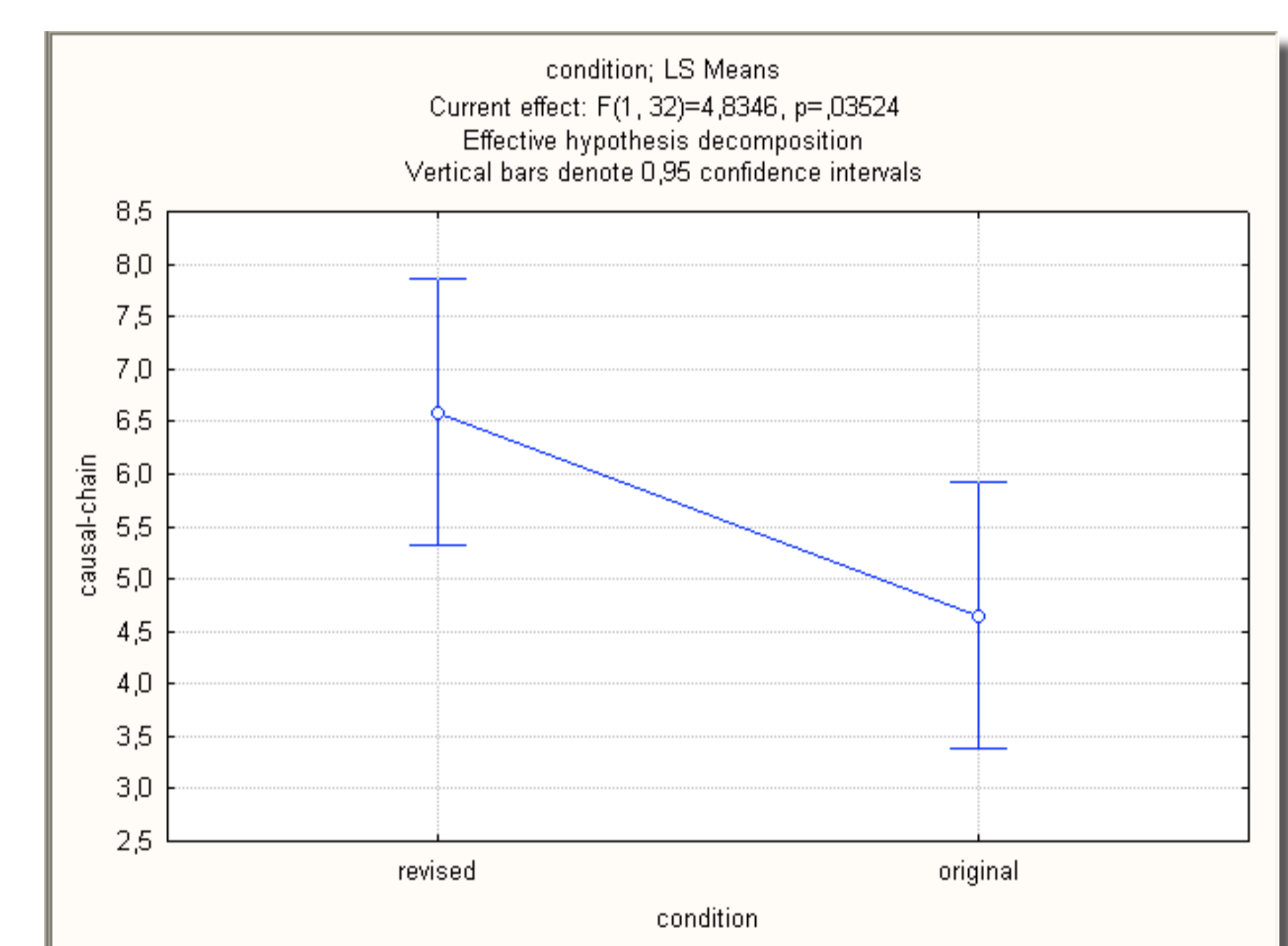

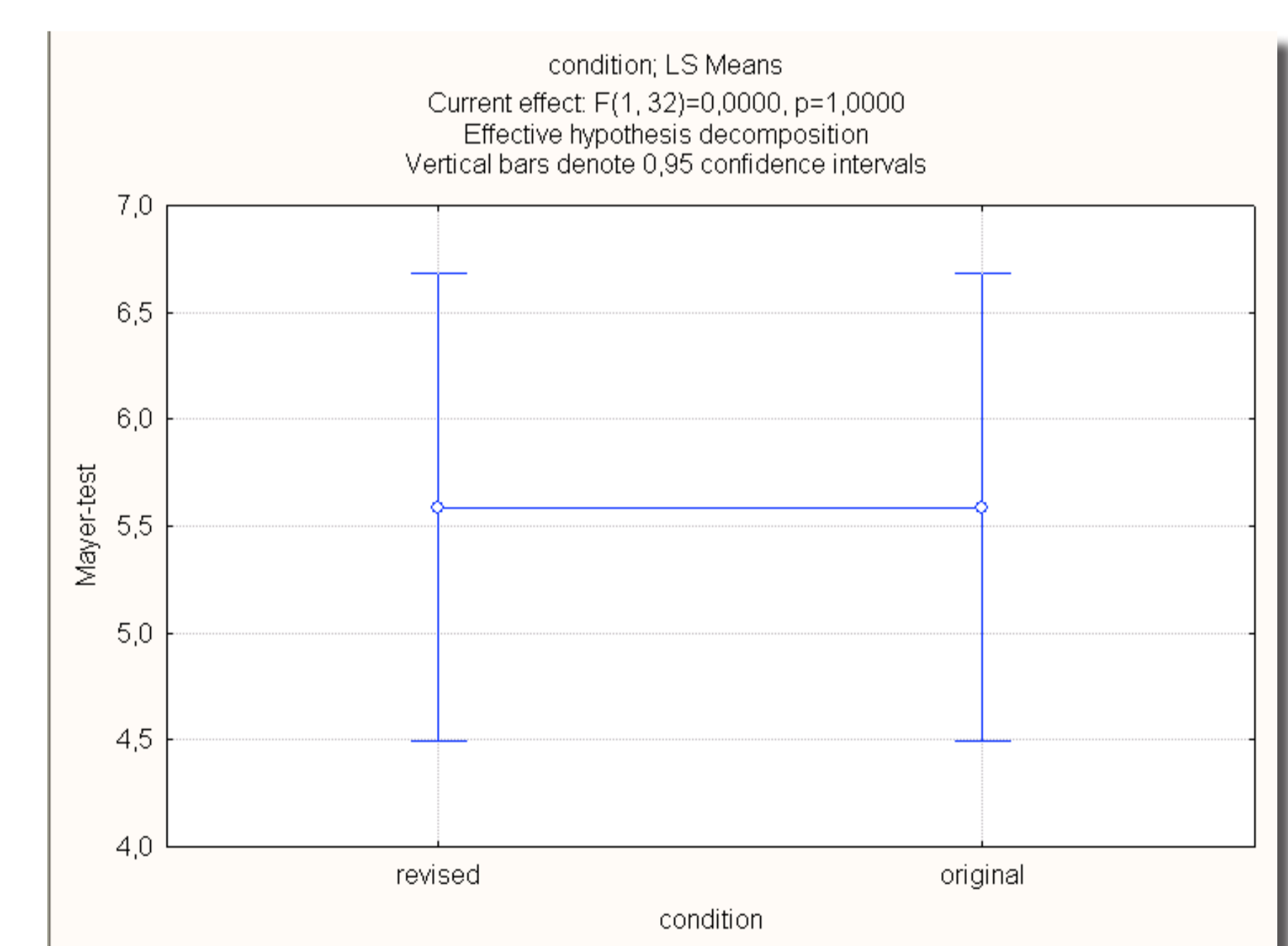*Fig. 3 Mean scores on comprehension of consequential connections.*

Fig. 4 Mean scores according to Mayer

References

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4. Conclusions

Our pattern of data confirmed the positive role of text coherence on the recall of a multimedia: participants who processed the revised version of the text had a better performance in reconstructing the chain of connections.
We have shown that the recall of multimedia can be improved by manipulating the quality of written text component so as to make the construction of a coherent internal representation more likely.