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Improving text recall with multiple summaries

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Background. QuikScan (QS) is an innovative design that aims to improve accessibility, comprehensibility, and subsequent recall of expository text by means of frequent within-document summaries that are formatted as numbered list items. The numbers in the QS summaries correspond to numbers placed in the body of the document where the summarized ideas are discussed in full.

Aim. To examine the influence of QS summaries on participants' perceptions of text quality (i.e., comprehensibility, structure, and interest) and recall, an experimental – control group design compared the effects of a QS text with a structured abstract (SA) text.

Sample. Forty psychology students participated voluntarily or received course credits.

Method. Students first read a control (SA) or experimental (QS) text on flashbulb memory (FBM). Next, their perceptions of text quality were measured through a questionnaire. Recall was assessed with an open answer test with items for facts, comprehension and higher order information.

Results. Perceptions of text quality did not vary across conditions. But QS did lead to significantly and substantially ($d = 1.57$) higher overall recall scores. Participants with the QS text performed significantly better on all item types than participants with the SA text.

Conclusion. Studying a QS text led to a substantial improvement in recall compared to an SA text. Further research is needed to examine how readers study QS texts and whether a text model hypothesis or a repetition effect hypothesis accounts for the effectiveness. The first hypothesis posits that the QS summaries support the reader in constructing a text schema. The second attributes the effects of these summaries to their repetition of text topics.

Designers constantly strive to increase the attractiveness, readability, accessibility, and comprehensibility of expository text. Among the features that have been tried are organization signals such as abstracts, headings, and summaries. An innovation that

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Background: Flashbulb memories (FBMs) are memories of our personal circumstances when first hearing of a very surprising and consequential event. They are seen as engaging and provocative.

Aim: The text explains the popularity of FBM studies and further aims to call into question the assumption that FBMs and first-hand experiences have similar underlying memory processes.

Method: Narrative literature review.

Results: Dissimilarities between FBMs of public events and traumatic first-hand experiences lie in the greater consequentiality of momentous personal experiences and in the existence of a thematic relationship between the circumstances and the personal experience. Global comparisons between memories have questionable validity because indices of quality (e.g., consistency) and of predictor variables (e.g., rehearsal) vary considerably across studies. In direct comparisons between memory events, different techniques and methods have been employed. These studies show the role of type of participation and rehearsal of the event on retention.

Conclusion: The distinction between FBMs of newsworthy public events and of momentous first-hand experiences appears to be meaningful on both conceptual and empirical grounds.

Figure 1. A structured abstract (SA) as it appears below the title and before the main body text.

was first recommended in the biomedical literature (Ad Hoc Working Group for Critical Appraisal of the Medical Literature, 1987; Huth, 1987) and has since become predominant in the major clinical journals is the structured abstract (SA) (Hartley, 2004a). Also in other research journals, the SA is quickly gaining favour over the traditional, unstructured abstract.

The main difference between the two types of overviews lies in the explicit makeup, or organization, of the prefacing text.[1] In an SA, key words like background, aim, and method are added to the overview to address and signal important information categories in a text. Added white space and presenting key words in bold further support this structure (see Figure 1).

Empirical studies reveal that readers and authors favour SAs over traditional abstracts, because they are more informative (Sharma & Harrison, 2006) and easier to search and read (Guimarães, 2006; Hartley & Betts, 2007). In addition, expository text is better recalled when it is preceded by an SA than by a traditional abstract (see Hartley, 2004a). The SA is now the *de facto* standard in health journals, and gaining acceptance in psychology journals.

Every now and then another innovation enters the scene, aspiring to become another accepted method within the repertoire of design solutions for improving text quality. QuikScan (QS) is such an invention. It is a new design method that aims to increase the accessibility, comprehensibility, and subsequent recall of expository text. This paper first introduces the basic features of QS and then reports on an empirical study that examines the claim that QS improves recall.

[1] *When we speak of abstracts, overviews, and summaries in this paper, we mean texts that are presented before the main body text. In referring to empirical studies we also concentrate on signals that precede, rather than follow, the text.*

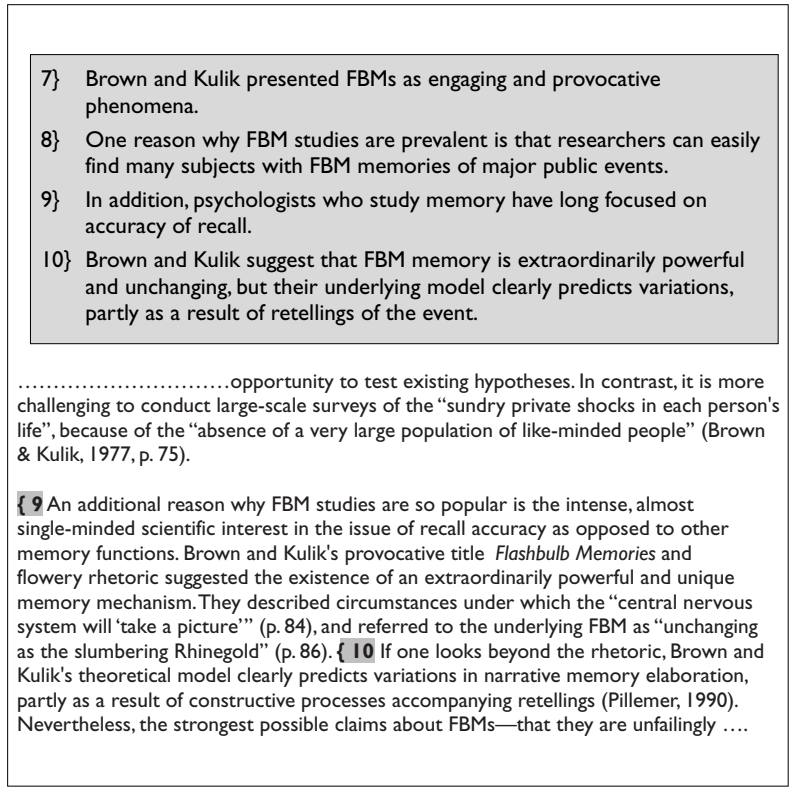

Figure 2. A QuikScan summary with the items presented in a numbered list. The numbers refer to the starting location of the topic discussion in the text.

What is QuikScan (QS) and how can it help the reader?

QS was invented by Zhou and Farkas from the University of Washington (Zhou, 2008; Zhou & Farkas, 2010). A stimulus for its development came from the observation that people often have much to read and little time for doing so. This prompted a search for a method that could make expository texts more accessible and that would also facilitate text comprehension and recall. The QS solution for these issues is both simple and elegant. QS frequently provides text summaries, in the form of numbered list items, throughout the document.

The numbering of items is intended to facilitate text access. A number visibly connects a QS summary statement with a text segment in the main body of the document (see Figure 2). Readers can use the number to look up where the text explains a statement from a QS summary. Numbers are presented on a light-grey background to make them stand out from the regular text. A brace further enhances their salience and distinguishes a QS number from any regular number that appears in the text.

QS is also designed to enhance text comprehension and recall. Empirical research shows that readers benefit from a single overview and that this benefit derives from several related functions that overviews serve. One of these is that an overview distinguishes text topics and provides concise labels for these topics. In addition, it marks topics the author deemed important, and emphasizes their organization in a text (e.g., Hartley & Trueman, 1985; Kintsch & Van Dijk, 1978; Lorch & Lorch, 1996a; Ritchey,

Schuster, & Allen, 2008; Sanchez, Lorch, & Lorch, 2001; Spyridakis, 1989a, 1989b). The QS summaries also serve these functions, but instead of doing so only once at the start as is customary, QS does this multiple times. QS thus provides the reader with more information about the text structure and signals more topics as being important. In comparison with a single overview, this should enhance text comprehension and recall.

How effective is QS?

To date, only one empirical study has tested the effect of QS on text recall. Zhou (2008) found that a QS group outperformed a no-overview control group on immediate and delayed text recall. QS' significant influence on immediate text recall was also found to be substantial ($d = 0.71$). Participants indicated seeing QS as being helpful for understanding and remembering the text. The findings support the claim that QS improves text recall, but several methodological shortcomings in Zhou's study call for caution.

One problem is that reading time was not recorded, or controlled for, in any other way than by a predefined maximum. Participants were instructed to stop at will, but before a 45-min limit. This makes it conceivable that subjects in the control condition stopped earlier, simply because they had less to read. If participants in the QS condition spent more time, but still remained within the time limit, their surplus reading time could very well have accounted for their higher recall. Another problem is that QS participants received a short one-page explanation on how QS summaries are created and how to use these to process the text. The instruction informs participants about a beneficial reading strategy. If they applied this strategy as instructed, effects cannot be ascribed solely to the presence of QS, but only to the combination of the presence of QS summaries and advance knowledge of how to use these for text comprehension and subsequent recall. The QS instructions also flagged that treatment as experimental. Participants were told that the QS summaries were designed to improve reading for understanding and the instructions emphasized their processing: 'During your reading, make the most use of the summaries to help you comprehend the report. Please read the summaries carefully because you will fill out a survey concerning these summaries at the end of today's study' (Zhou, 2008, p. 278). In contrast, participants in the control condition were merely instructed to read the text 'and answer some questions about the content' (p. 279).

The study can also be criticized for its choice of control treatment. This condition presented a text without overview. While this helps keep unwanted variance down, it is at odds with the prevalent practice of including an abstract or summary as text preview. More importantly, the design makes the control condition a weak contender, because overviews significantly contribute to reader comprehension and recall (e.g., Hartley, 2004b; Kardash & Noel, 2000; Lorch & Lorch, 1996b; Ritchey *et al.*, 2008).

Research questions

The current study examines the claim that QS enhances perceptions of text quality and text recall. Special attention is given to dealing with the methodological problems of Zhou's (2008) original research. The experiment consisted of two conditions. In the experimental condition, participants received an expository text with QS summaries. In the control condition, the same text was preceded by an SA. Reading time was recorded to be treated as a covariate in the comparisons between conditions, if necessary. Participants in both conditions received the same instructions. All groups were told that

the study examined the influence of text design on recall for which they would be tested after reading. There were no hints on how to use QS or SA.

The main research questions of the current study were:

Question 1: *Is there a difference between conditions on measures of text perception*? The QS summaries were predicted to yield more positive appraisals of text quality measures (i.e., comprehensibility, structure, and interest) than the SA. The argument is that these summaries provide the reader with structural information of the text. Only skilled readers are likely to spontaneously generate these, but less skilled readers can and do appreciate their value for developing text comprehension (compare Meyer & Poon, 2001; Meyer, Talbot, Stubblefield, & Poon, 1998). In addition, research consistently shows that summaries receive high student ratings on familiarity, likelihood of use, and value (Marek, Griggs, & Christopher, 1999; Weiten, Deguara, Rehmke, & Sewell, 1999; Weiten, Guadagno, & Beck, 1996). The measure of topical interest was not included in the study of Zhou (2008). It was added because research shows that it can moderate effects of reading (e.g., Ainley, 2006; Ainley, Hidi, & Berndorff, 2002; Alexander & Jetton, 1996; Krapp, Hidi, & Renninger, 1992) and effects of signals (Meyer *et al.*, 1998).

Question 2: *Is there a difference between conditions on measures of text recall*? The prediction was tested that the QS condition yields the highest score on text recall. Important questions can be raised about the ways in which people process QS summaries, but these are moot if it is not first established that QS yields better recall. We will return to this issue in the discussion.

Method

Participants

The 40 participants in the study were psychology students from the University of Twente in the Netherlands. The study attracts more women than men. This is reflected in the number of male and female participants. In the SA condition there were 13 women and 7 men. In the QS condition, there were 15 women and 5 men. The University enrols students from the Netherlands and Germany for whom the English of the provided texts is not their first language. Most of the study texts for these students are in English, however. Distribution over conditions was random, except for native language that was stratified. Students volunteered or received course credits for participation in the study. During the experiment, four participants (one in SA, three in QS) failed to complete reading within the time limit and were replaced.

Instruments

The *text* described the phenomenon of flashbulb memories (FBMs), the instant memory that people have of the personal circumstances in which they first hear of some shocking news. The text was a complete chapter from a psychology textbook (Pillemer, 2009). It is an English study text that forms no part of any assigned readings in the University psychology curriculum. The structure of the original text, a subdivision into four main sections signalled by a header, was maintained. The references within the text were also left untouched, but the reference list at the end was omitted. Other changes in the original text concerned the removal of the case descriptions in the introduction and the summary at the end. The main body text consisted of 5,674 words.

The control text (SA) included one abstract presented before the main body. The SA (see Figure 1) consisted of 170 words. The formatting followed the suggestions of Hartley (2000), leading to a division into five sections (i.e., background, aim, method, results, and conclusion) with an extra white space between sections and key words presented in bold. The control text (SA) was presented on 11 A4 pages.

The experimental text (QS) included nine abstracts dispersed across the main body. The QS summaries added up to a total of 735 words. Five of these are standard summaries that appear immediately after a heading. These summaries pertain to an entire section of a text up to the next heading, or until another QS summary appears. Four floating summaries appeared when there was a logical division or transition point within a long expanse of text without a heading. All QS summaries were kept short. The longest one in the present study consisted of six list items. All others presented three or four list items (see Figure 2). The background of the QS summaries was slightly greyed (15%) to make them stand out from the regular text. The numbers of the list items in the QS summaries provided entry points for where the summarized ideas were discussed in the main body text. About 80% of these list items referred to the first sentence of a paragraph. This accords with the finding that this sentence usually presents the key notion that is discussed in a paragraph (Hyönä & Lorch, 2004). The QS summaries in the text document were all in the vicinity of the text itself. The maximum distance was one page. The presence of the QS summaries increased the volume of the text to 13 pages.

A *background questionnaire* gathered information about participant characteristics and background, such as gender, age, year of study, native language, and self-appraisal of English language proficiency. One question was a treatment check 'In which condition do you think you have participated? (control/experimental/don't know)'. [The results showed that there was confusion about experimental treatment for about half of the participants.]

A *text perception questionnaire* assessed the participants' appraisal of text comprehensibility (e.g., 'I had no problem understanding this text' and 'The text was comprehensible'), text structure (e.g., 'I liked the way the text was formatted' and 'The text was well structured') and topical interest (e.g., 'I found the topic appealing' and 'I have become curious about the topic of the text'). The questionnaire consisted of 18 statements, 6 for each aspect. Answers could be given on a 7-point Likert scale, which ranged from *completely disagree* (1) to *completely agree* (7).

The *recall test* contained 12 open answer questions. Five questions about factual knowledge asked for a reproduction of facts presented in the text (e.g., 'What example is mentioned in studies on the consistency of FBMs?'). For these questions a total of seven points could be obtained. Four questions inquired after comprehension. These questions asked for an interpretation or description in the student's own words of a concept (e.g., 'What are the two most important differences between memorable FBMs and memorable first-hand experiences?'). The maximum score for comprehension questions was nine points. Three questions dealt with higher order information processing such as analysis and synthesis. These questions required some (re)ordering of information, or for a presentation of the most pertinent arguments for a stance (e.g., 'Why is the validity problematic when comparing FBMs and memorable first-hand experiences?'). The maximum score for these questions was nine points. An overall test score (maximum 25 points) was computed, as well as a score for the three item types that were assessed.

Scoring was done with the aid of a codebook. This codebook presented the main information units that each answer should contain and the scoring for these units. In addition, it distinguished between answers that described the principle involved (higher

valuation points) and answers that consisted of an example or mentioned a concrete feature. The first author and a research assistant tested the codebook by independently scoring a set of recall tests obtained in a pilot. The results were discussed and the codebook was adjusted where needed. This procedure was repeated until the coders agreed. The recall tests of the experiment were scored by the same coders. To ensure blind coding, the questionnaires and recall test contained identification numbers. After scoring, the files were coupled.

Procedure

Participants were told that the experiment pertained to the influence of text design on comprehension and recall. Participants were asked to carefully study the text for a maximum of 45 min. Thereafter, they would be asked to answer recall questions. Note taking was not allowed. After reading, participants first filled in the questionnaires and then took the recall test.

Data analysis

Good reliability was found for the text quality measures of comprehensibility, interest, and structure with Cronbach alpha scores of, respectively, 0.87, 0.82, and 0.90. Chi-square tests revealed no significant differences between conditions for any measure of the background questionnaire (e.g., year of study and self-appraisal of English language proficiency). Checks on gender differences for recall revealed that within conditions men and women had a nearly identical outcome on the overall recall test score, and similar results for item types. With just over 1 min of difference, an analysis of variance (ANOVA) analysis of reading time showed it to be virtually identical in both conditions, $F < 1$, n.s. Participants in the SA condition needed 36.1 min ($SD = 6.14$) to process the text, whereas those in the QS condition spent 37.4 min ($SD = 7.19$). In other words, the QS summaries only slightly increased reading time. This finding signals that it is unlikely that reading time differentially affects the scores in the two conditions. A multivariate analysis of variance (MANOVA) preceded the analyses of variance on the comparisons for the three item types in the recall test. All analyses were two sided with alpha set at 0.05. For effect size, we report Cohen's (1988) *d*-statistic.

Results

Effect of condition on perceptions of text quality

Participants favourably judged the three perception measures of the text. The overall mean was positive, as were the scores for each distinct measure (see Table 1). The scores for the QS text are consistently higher than for the SA, but only slightly so. There were no

Table 1. Means (standard deviation) for measures of text perception[a]

	SA condition	QS condition
Comprehensibility	4.26 (1.01)	4.68 (1.28)
Structure	4.43 (1.34)	4.61 (1.29)
Interest	4.34 (1.14)	4.51 (1.07)

[a]Scores on text quality measures were given on a 7-point scale; higher scores reflect higher appreciation.

Table 2. Means (standard deviation) for measures of text recall

	SA condition	QS condition
Overall test (max 25)	6.79 (1.81)	9.58 (1.84)
Factual knowledge[a] (max 7)	2.26 (0.99)	3.19 (1.12)
Comprehension[b] (max 9)	2.75 (1.17)	3.54 (1.07)
Higher order knowledge[c] (max 9)	1.77 (1.03)	2.85 (1.24)

[a] $F(1,38) = 7.66$, $p < .01$, $d = 0.87$.
[b] $F(1,38) = 4.84$, $p < .05$, $d = 0.70$.
[c] $F(1,38) = 8.82$, $p < .01$, $d = 0.94$.

statistically significant differences between conditions on comprehensibility, $F(1, 39) = 1.31$, n.s., interest, $F(1, 39) < 1$, n.s., or structure, $F(1, 39) < 1$, n.s.

These findings do not confirm the prediction for the first question. QS does not yield an important advantage over SA for judgements of text quality. The finding also signals that it is unlikely that differences in text recall, should these occur, can be ascribed to differences in text perception.

Effect of condition on recall

Table 2 shows the scores for text recall. The difference between the two conditions on the overall test score was statistically significant, $F(1, 39) = 23.30$, $p < .001$. The QS participants reached a substantially higher learning effect, outperforming the SA participants with a difference of more than one-and-a-half standard deviation, $d = 1.57$. The MANOVA for the three item types in the recall test (reproduction, comprehension, higher order) was statistically significant, $F(3, 36) = 7.61$, $p < .001$. Subsequent analyses showed that the QS condition yielded superior recall for all types. In addition, effect size was consistently high.

The findings clearly support the prediction that text recall is enhanced by the presence of QS summaries. The scores for the three item types in the recall test further indicate that the effect is not restricted to a simple recollection of facts from the text. QS also led to improved scores on test questions for comprehension and for higher order processes such as analysis and synthesis.

Discussion

This study confirmed one of the two examined claims for QS. No support was found for the prediction that QS would raise the reader's perceptions of text quality. On aspects of text comprehensibility, structure, and interest participants held favourable opinions, but no more so for QS than for SA.

The prediction for text recall could be confirmed. There was a statistically significant effect of QS on what participants remembered from the text. Just as in Zhou's (2008) original study, the gain was substantial. Detailed analyses indicated that a significant effect was obtained for facts, comprehension as well as higher order knowledge development and that for each of these item types the difference between conditions was also substantial. The question is why QS readers recalled more information. What can explain the difference? In the discussion we attend to the following issues: (1) the presence of

two explanations for effects of QS and (2) the various reading strategies, or scenarios of use, afforded by QS.

Text model construction and/or repetition effect

Empirical research on overviews has examined a variety of factors that can explain effects on text recall. Two prominent accounts that seem worthwhile examining for QS are the *text model hypothesis* and the *repetition effect hypothesis*. The first hypothesis states that overviews support the reader in constructing a schema or text model. The second signals that higher recall scores may be due to the fact that the listed items in QS bring about a rehearsal of important topics, as these are presented twice.

Construction of a text model

Readers may benefit from QS because it offers a representation that helps them in building a structural overview, where in its absence they need to construct such a schema on their own. Empirical studies show that most readers, students included, do not spontaneously construct such an overview (Lorch & Lorch, 1996b; Ritchey *et al.*, 2008). They tend to be relatively 'insensitive to the topic structure of the text' (Lorch, Lorch, Ritchey, McGovern, & Coleman, 2001, p. 172). Instead, readers are more easily lead by secondary, and occasionally misleading, indicators of topic importance such as elaboration, serial position and familiarity. The presence of an overview can influence this behaviour. A strategy shift may take place with readers attending more to the primary indicators of importance signalled in an overview or headings.

The design of QS poses a unique research opportunity and challenge for examining its support to constructing a text model. This stems from the fact that, apart from the numbering system, QS employs *multiple* overviews. Regular and SA overviews present a text model only for the highest information level in a text hierarchy. In contrast, the QS summaries present information on the superordinate level as well as on subordinate levels. Future studies should examine whether the summaries from QS bring about changes in reading strategies that lead to the construction of a *mixed-level* model that covers superordinate as well as subordinate text levels. Better text models (i.e., mixed level) signal better comprehension that, in turn, should aid subsequent recall.

Repetition of topics

Effects of QS summaries on text recall can also be explained by a repetition effect hypothesis (compare Lorch & Lorch, 1996b). This hypothesis predicts that text recall is positively affected by overviews because readers encounter key information twice. Just as in regular overviews, an ordinary QS reader is likely to encounter both a succinct description of a topic in a QS summary and a detailed one in the main body text. The QS summaries thus provide some form of repetition of key content. Depending on the reading scenario that is adopted, it may be the text or the QS summary that repeats the information (see below).

Reading strategies or scenarios of use in QS

Another pertinent question that this study raises is how QS affects the reading strategies of the participants. How do readers process the QS summaries and text? In this initial stage of research on QS, the processing strategies of the readers have not been systematically observed, but it is important to do so in follow-up studies to increase both our understanding of how readers employ QS and of how such usage may connect to

the functions that QS can serve. In speculating about usage and functionalities, several scenarios of use seem plausible.

Scenario 1. 'Reading from start to finish'. Readers may process the text linearly. That is, they read the QS summaries and then continue reading the main body text. In this scenario, there are no look-backs. The summaries merely serve as a local preview of what is discussed in more detail in the text that follows.

Scenario 2. 'QS previewing before text reading'. Readers may decide to first process all the QS summaries before reading the main body text. In this scenario, the QS summaries primarily serve to create an overview of the text content. By beginning with the QS summaries the reader first constructs a text model with superordinate and subordinate information. That model then subsequently helps in interpreting and integrating specific information from the text itself (compare Lorch & Lorch, 1995; Murray & McGlone, 1997; Nevid & Lampmann, 2003).

Scenario 3. 'Backtracking after difficult sections'. Study texts often vary in complexity. Where some text segments can easily be processed in one single read, other segments require more processing effort and need rereading. After a complex text segment, readers may want to return to QS to verify understanding, or to get their bearings back.

Scenario 4. 'Reviewing by QS rereading'. After processing the QS summaries and text, with or without intermittent backtracking, readers may decide to use the QS summaries to review and test their knowledge. This scenario would be in line with a common strategy employed by students who prepare for a test. After having studied the basic materials, students further mainly rely on summaries (either given or their own) to review the subject matter. The review strengthens retention of the main points conveyed in a text, aiding recall during testing. In this case, QS provides the summaries that students can study for review.

All of the above scenarios assume that readers put some effort into connecting the listed items in the QS summaries to the text. Not all users may do so, however. Just as some students concentrate only on overviews to prepare for exams, so may some readers decide to rely only on the QS summaries to prepare themselves for recall. This leads to another scenario.

Scenario 5. 'Processing QS summaries only'. This scenario is probable only for readers who are already acquainted with QS, but some readers may even adopt this approach on their first encounter. When readers regularly encounter QS summaries and find these good and reliable as overviews, they may use these summaries as shortcuts to getting to know the text. This scenario of use is, especially, likely when study time is limited.[2]

More generally, in considering the various QS scenarios it is important to bear in mind that frequent exposure to QS summaries is likely to affect the reader's processing strategies. Readers may engage in some scenarios only in the long run.

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[2] *Zhou and Farkas (2010) also anticipate a scenario of processing QS summaries only in business sessions. Executives, who do not expect to be tested, will often prefer to be able to easily access text when the need arises. QS is eminently suited for that purpose. With QS summaries readers can get more detail just when they want.*

Conclusion

QS is a new document design meant to facilitate text access, comprehension and subsequent recall. This study has concentrated on the latter and found that QS led to a substantial improvement in text recall compared to a single overview (i.e., SA). QS seems to be a valuable innovation that may find its place among other document design measures such as abstracts and headings. Future research is needed to further substantiate QS' effectiveness and to reveal how QS summaries influence text comprehension and subsequent recall. A condition that is likely to be important in these studies is topic familiarity (or prior knowledge). It is conceivable that a QS text increases the reader's recall more for an unfamiliar text than for a text that the reader is conceptually more familiar with. Language fit between reader language and text is probably not a critical variable. That is, Zhou (2008) found that QS advanced text recall for students who received a QS text in their native language and this study reported a similar finding for students reading a QS text in their second language.

A final question worth asking concerns adoption. What are the chances that QS will become an accepted practice in document design? SAs have found their ways into scientific journals because they are well aligned with the existing practice of presenting an abstract, are immediately understood by the reader, and enhance the quality of the abstract. Against these benefits, the extra cost of a slightly increased text length is only a minor disadvantage. Just like the SA, the QS summaries are immediately understood; readers do not need an explanation to benefit from their presence in a text. But, as QS increases text length with about 10–13%, editors and publishers probably will not look upon this innovation with a favourable eye when so much is being written and space is at a premium. Does this then mean that the future for QS lies only in ebooks and websites where space is less costly? Only the future can tell.

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