

ARE WRITING PROCESSES  
ACTIVATED SEQUENTIALLY OR IN PARALLEL?  
THE APPROPRIATE WAY  
TO USE KELLOGG'S THREE TASK METHOD

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INTRODUCTION

The "three-task method" devised by Kellogg (1994) provides a powerful tool for investigating the time course of processes involved in writing (planning, translating, and reviewing). This method also enables researchers to investigate cognitive effort allocated to each of writing processes. In that method, participants are instructed to engage in a writing task (the Main Task). In parallel, they have two other tasks. First, participants must respond as quickly as possible to a sound probe (the Reaction Time Task). Second, after responding to a probe, participants must indicate what they thought they were doing at the sound of the probe (The Retrospection Task).

A major criticism of this task is that participants are compelled to categorise one - and only one - writing process after responding to the tone. However, they might have been simultaneously engaged several processes. Thus it is possible that the three-task method actually hides or alters the very processes it seeks to illuminate.

Building on a parallel account, Levy (1997) has argued that the activation of an effortless (automatic) process occurs jointly with a more (effortful) conscious process. Since the automatic processes do not require conscious attention, resources remain available for the execution of other processes. Kellogg (1996) himself has recently proposed a revised parallel-processing account of writing. Therefore, while executing what s/he has translated, a writer can, at the same time, plan or monitor the text being written. From this analysis, it is possible to hypothesise that some of the processes involved in writing are engaged in parallel, a possibility we wanted to investigate in our study.

The present study has two aims. The first aim is methodological: We need to assess if asking writers to account for their mental activity with only one process biases the results. The second aim is to collect new data concerning two main issues, namely : (a) Which processes are the most frequently activated in parallel ? (b) Is the cognitive effort allocated to the activation of two processes greater than that allocated to the activation of one only process ?

To achieve these two goals, we set up two experimental conditions : the first is called "One-Choice condition" and the second "One-Two Choices condition". For the sake of convenience, this condition will hereafter be called "Two-Choices".

Writers in the One-Choice condition were requested to choose the most important process during the retrospection training task. During the writing task, they had to categorise their mental activity with only one process.

Writers in the Two-Choices condition were requested to choose two processes during the retrospection training task. During the writing task, they had to categorise their mental activity with one or, if they think it is necessary, two processes.

METHOD

The present experiment involved the following phases

Phase 1 : Participants were trained on the retrospection task.

Phase 2 : Participants had to react to a sequence of 30 tones and we used the last 25 tones as baseline reaction time.

Phase 3 : A writing task was proposed. Subjects had to develop an argumentative text about the increase of academic tuition. While writing, the participants had to perform the

two added tasks : the reaction time task and the retrospection task. The pace of the reaction time task was 15 to 45 seconds after the previous retrospection.

Within the context of this research, training on retrospection is a crucial point of the experiment. It needs to be efficient enough to insure that participants and the experimenter use the same criteria to categorise processes involved in the different thinking-aloud expressions. In the present study, two specific points should be noted. Compared to Kellogg's paradigm, we introduced two differences in the experimental procedure. They concerned the nature of directed retrospection and the training on directed retrospection.

Kellogg uses three types of processes : Planning, Translating and Reviewing. Each of these 3 categories of processes refers to different subprocesses. And, as it turned out in many studies, these subprocesses can be activated simultaneously. It is thus necessary to give participants the opportunity to express these subprocesses. Based on an elaboration of Kellogg's model (1996), we proposed the 5 following processes in our study

"Planning : Planning is said to occur when the writer generates ideas in order to know what to write. Planning is also referred to when the writer thinks about the best way to organise ideas and this organisation is made as a function of the topic and the audience.

Translating : Writing translation of ideas means that ideas are converted into words, into sentences, into paragraphs and text. Mental translation of ideas into a linguistic form means selecting syntactical forms, words, and spelling.

Executing : Executing means to write down on the paper the content to which the writer refers. In other words executing means a concrete transcription of the referred words and sentences and that were translating into a linguistic form.

Evaluating : Evaluating means that the writer will judge what s/he thought about and what the writer translated. The writer can ask himself/herself if ideas or projects are satisfying. The writer examines if the written output is appropriate in terms of content, organisation, sentences, words, and spelling.

Revising : Revising means transformation for the purpose of correction that follows the detection by the writer of inadequacy in his/her ideas or in his/her writing. Thus the writer will change his ideas or his/her writing in term of content, organisation, sentences, words, and spelling".

In the instructions, each participant is informed that s/he will have to write a text, that the aim of the study is to establish what s/he thinks s/he is doing while he is writing. S/He is told that, generally, when writing a text one performs several different kinds of activities (or processes).

The experimenter then gives a definition of each of the 5 processes as above. Thereafter, to ensure the participant has understood these definitions in the same way as the experimenter s/he is requested to read and to categorise 13 pieces of thinking aloud produced by other writers. In fact, these are classical instances of verbal protocols. For each verbal protocol, participants had to indicate which process it referred to. Finally, the experimenter gives further explanation if a disagreement appeared about a categorisation.

Following this, participants are told that when writing one could undertake compounded mental activities. Writers could activate not only one but also two processes in the same time. As such, participants were faced with a new list of thinking aloud, each referring to the description of two processes.

The group "One-choice" had to indicate the process judged the most prominent. This group was trained more or less in the same way as Kellogg's participants. Subjects know that mental activity during writing could be complex. However, they had to categorise only one process, the most prominent.

In contrast, the "Two-Choices" group had to label two processes for each thinking aloud. As before, if a disagreement appeared concerning any one of the two categorisations, a further explanation was given to the participant.

After the training, participants were shown a computer keyboard on which were pasted different coloured labelling corresponding to each process. Participant were to

indicate what they thought about what they were doing by pressing on designated keys (SCRIPTKELL software, Piolat, Olive, Roussey, Thunin & Ziegler, in press).

In the One-Choice group, it has been said to press one of these keys to indicate what s/he thought s/he was doing when interrupted by the probe. In the Two-Choices group, it has been said to press one or two of these keys to indicate what s/he thought s/he was doing when interrupted by the probe.

The main dependent variables are

- Overall performance (Duration for completing the triple task; Verbal performance: number of words produced),
- Frequencies of processes (The global number of times a writing process has been selected; The number of times a writing process has been selected (across the first, the second and the third writing time),
- Cognitive effort (The reaction time minus basic motor Rt),
- Duration for directed retrospection (The duration of retrospection after each reaction time to specify one or two process(es)).

## RESULTS

The main hypothesis is

Constraining a writer to indicate only one process during the directed retrospection could produce a methodological bias. The One-Choice and Two-Choices conditions must be significantly different on the dependant variables.

The duration for completing the triple task and the number of words produced do not differ significantly between the One-Choice (26 min & 286 words) and Two-Choices Condition (29 min & 290 words;  $t = 1,24$ ,  $p = .22$ ;  $t = 0,24$ ,  $p = .84$ ).

When calculating the frequencies, all labelling, including the single and the double, were counted. These values do not significantly differ between the One-Choice and Two-Choices Conditions (Three processes:  $F(1,33) = 0,15$ ,  $p = .69$ ; Five processes:  $F(1,33) = 0,83$ ,  $p = .37$ ). Translating is the most designated process (Three processes:  $F(2,66) = 103,41$ ,  $p < .0001$ ; Five processes:  $F(4,132) = 28,46$ ,  $p < .0001$ ). This result is a standard one.

The pattern of activation processes in the three writing phases is not significantly different between the One-Choice and Two-Choices Conditions (Three processes:  $F(4,132) = 0,16$ ,  $p = .95$ ; Five processes:  $F(8,264) = 0,15$ ,  $p = .99$ ).

We can observe through the 3 phases of writing a decrease of the planning process and an increase of the reviewing process (Three processes:  $F(4,132) = 26,97$ ,  $p < .0001$ ; Cf. Figure 1; Five processes:  $F(8,264) = 14,95$ ,  $p < .0001$ ). This result is a standard one.

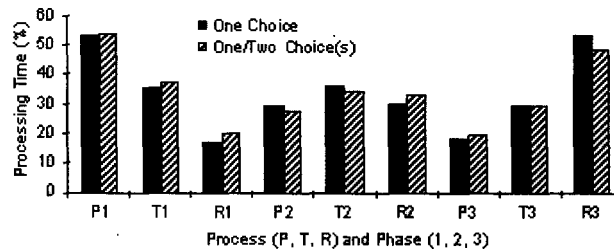


Figure 1 : Mean percentage of time devoted to planning (P), translating (T), and reviewing (R) across thirds of writing time under One Choice and One/Two Choice(s) conditions

<sup>1</sup> In order to compare our results to those of Kellogg, we regrouped the five processes to obtain 3 categories (Planning = Planning; Translating = Translating + Executing; Reviewing = Evaluating + Revising). Statistical analyses were performed on both sets of data.

The mean reaction time is not significantly different between the One-Choice (581 ms) and Two-Choices Conditions (515 ms; Three processes:  $F(1,33) = 1,33, p = .26$ ; Five processes:  $F(1,33) = 1,49, p = .23$ ; Cf. Figure 2).

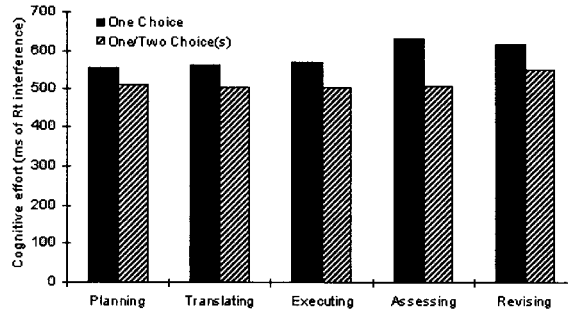


Figure 2 : Mean cognitive effort (Rts) devoted to the five processes under One Choice and One/Two Choice(s) conditions

We can observe that the reviewing (577ms) process is more costly than the translating process (T=534ms; P=533ms; Three processes:  $F(2,66) = 3,33, p < .04$ ; Five processes:  $F(4,132) = 2,48, p < .05$ ). This result is a standard one. On the other hand, the planning process seems less costly than has been classically reported.

Concerning the directed retrospection, a new variable has been introduced : the mean duration for directed retrospection. It is not significantly different between the One-Choice (1514ms) and Two-Choices Conditions (1740ms; Three processes:  $F(1,33) = 1,46, p = .23$ ; Five processes:  $F(1,33) = 1,54, p = .22$ ; Cf. Figure 3).

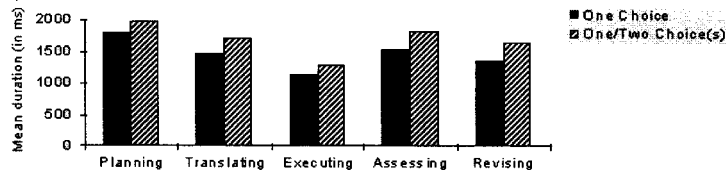


Figure 3 : Mean duration for directed retrospection about the five processes for One Choice and One/Two Choice(s) conditions

We have to notice that the time to indicate the planning (1871ms) and reviewing (1584ms) processes is significantly longer than to indicate the translating process (1397ms; Three processes :  $F(2,66) = 12,76, p < .0001$ ; Five processes:  $F(4,132) = 10,37, p < .0001$ ). This is a new result.

Nothing can be concluded about this absence of significant results. However, in contrast with a widely held idea, it would appear that

- The writer's activity seems not to be biased when s/he is requested to label with only one process category.

- Moreover, given the writer's opportunity to designate 2 categories of processes does not provoke a significantly different performance both for the length of and the time allocated to the written production.

The results presented now concern only the data obtained in the Two-Choices Condition. The question was : Does opportunity to indicate one process or two processes during the directed retrospection yield new data ?

The main expectation is about a parallel activation of the writing processes. The issues are

- (a) Are there more double than simple retrospection ?
- (b) What are the most frequent double retrospection ?
- (c) Is the cognitive effort associated with a double retrospection more important than the cognitive effort associated with a simple retrospection ?

Writers do not produce significantly more double retrospection (57%) than simple retrospection (43%;  $t = 1.26, p = .23$ ).

However, we should note an important variability between writers.

Cognitive effort allocated is not significantly different between double (506ms) and simple retrospection (540ms;  $t = 1,78, p = .09$ ).

Table 1 : Mean percentage of double retrospection types under One/Two Choice(s) condition

Translating/Revising	1
Planning/Evaluating	2
Translating/Evaluating	2
Planning/Revising	3
Executing/Revising	4
Planning/Executing	5
Evaluating/Executing	10
Planning/Translating	11
Evaluating/Revising	15
Translating/Executing	44

44% of double retrospection combine Translating and Executing processes ( $F(9,135) = 25,41, p < .0001$ ; Cf. Table 1). Following that, the most frequent combinations Evaluating/Revising; Planning/Translating; Evaluating/Executing only occur on about 10-15% of the time.

## CONCLUSION

Two main conclusions can be drawn from our results.

1) First, there is a strong consistency in terms of time processing and associated cognitive effort between the two experimental conditions "One-Choice" and "Two-Choices".

Given this consistency, we brought evidence that the standard paradigm of the triple task is highly reliable. Moreover, using this triple task procedure is very easy. In effect, with this method and in less than one hour, the experimenter can get more than one written page by participant. Data concerning cognitive effort and time processing are immediately available without the need of judges or of sophisticated softwares to categorise writing processes.

An additional benefit is to use the method with writers (e.g. young ones) not familiar with the word processor. The use of the triple task related to the recording of writing with a graphic tablet is also possible with the G-Studio software.

A final benefit using this method is that it allows to easily adjust some aspects of the procedure such as the distribution of probes, the nature of the retrospection task by changing the categorisation of processes, and so on.

2) A second important conclusion to be drawn from our studies is the observation that the most frequent pair of processes associated by the participants is Translating and Executing, followed by Evaluating and Revising.

The first association Translating and Executing was already described in Hayes and Flower's (1980) model. But these two processes are dissociated in Kellogg's (1996) model. The second combination "Evaluating and Revising" appears in both models. Given this

discrepancy in the models, it would be useful to propose a novel categorisation of the major writing components which would better fit observed regularities.

Planning and reviewing have been shown to be relatively autonomous. In effect, they rarely appear simultaneously in our study. The high cost of these processes in working memory, particularly as concerns reviewing could explain this serial mobilisation.

Future experiments should verify the generality of our findings. It would be interesting for example to check if some writers with a large working memory span activate in parallel processes which have been shown to be independently activated in other experiments. Therefore the two choices feature of the triple task is highly reliable too.

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