SOCIAL FILTERING OF REASONING PROBLEMS

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Não podia escrever esta página em inglês, porque há coisas que só se conseguem escrever e descrever na nossa língua materna.

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Resumo

Em estudos anteriores verificou-se que pessoas que resolvem problemas de raciocínio de forma intuitiva diferem daquelas que os resolvem de forma deliberativa na sua capacidade de prestar atenção à informação crítica (Mata et al., 2014, 2017). Neste estudo, iremos utilizar recordações livres para compreender melhor este fenómeno. É esperado que as pessoas que raciocinam de forma intuitiva não recordem as partes críticas.

Este estudo tem também como objetivo compreender o impacto social destas representações incorretas. Para tal, utilizou-se um paradigma de reprodução serial. Se os participantes receberem reproduções incorretas, eles acabarão por dar uma resposta incorreta, uma vez que estão a raciocinar com base em premissas erradas. Mesmo que tenham conhecimentos lógicos que lhes permitam chegar à resposta certa, não serão capazes de o fazer se os problemas que lhes são transmitidos não tiverem informação suficiente.

Foi pedido a cada participante que respondesse a três problemas e que escrevesse uma recordação do problema que tinha acabado de ler, o mais exata possível.

Confirmou-se uma correlação significativa positiva entre a precisão da memória e a performance, bem como um efeito ao longo das gerações, já que à medida que mais erros se iam acumulando na reprodução dos problemas, mais erros resultavam daí.

Para resolver problemas de raciocínio, não chega uma boa capacidade de raciocínio é também necessária a capacidade de representar corretamente o problema na mente. O efeito ao longo das gerações é relevante num mundo onde estamos constantemente a receber informações dos outros.

Palavras-chave: reprodução serial; problemas de raciocínio; deteção de conflito; filtragem social; pensamento e raciocínio.

Abstract

Previous studies have found that intuitive problem-solvers differ from deliberative ones in their ability to pay attention to critical information in a problem (Mata et al., 2014, 2017). In this study, we will use free recall to further explore these processes. It is expected that intuitive problem-solvers fail to recall those critical parts.

This study also addresses the social impact of those incorrect representations. To do so, a serial reproduction paradigm was used. If participants receive a misrepresented problem, they are bound to give an incorrect answer, as they are reasoning based on wrong premises. Even if they have logical knowledge that allows them to give a right answer, they will not be able to do it if the problems they read do not have enough information.

Participants were asked to answer three reasoning problem, one at a time and reproduce the problem they just read as accurately as possible.

We found a significant correlation between reasoning performance and accuracy of memory, as well as a downstream effect throughout the generations, as more and more errors accumulated in the reproduction of the problems, and consequently more and more reasoning errors resulted from that.

To solve reasoning problems, not only a good reasoning ability is needed, but also an ability to correctly represent the problem in the mind. The effect found throughout the generations is relevant in a world where we are constantly receiving information from other people.

Key-words: serial reproduction; reasoning problems; conflict detection; social filtering; thinking and reasoning.

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Declaration of Originality

I declare on my word of honour that the work presented is original and all the citations are correctly identified. I am aware that the utilization of non-identified elements of other authors is a severe ethical and disciplinary fault.

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Introduction

Problem

Often, we associate the ability to answer a reasoning problem exclusively to the ability a certain person has to arrive to a right answer. But previous studies (Mata, Schubert, & Ferreira, 2014; Mata, Ferreira, Voss, & Kollei, 2017) have found that when reading reasoning problems, incorrect responders tend to pay less attention to all the premises which are necessary to solve the problem correctly. Will they also misremember the problem? This would mean that they might be basing their answers in the wrong premises, which can be the cause of their incorrect responses.

Moreover, what is the social impact of misremembering the problem? In a society where we seldom go to the source, we hear a lot of stories that are told to us by others. We think we are the generation with the most information ever, but most of us live by the stories that others tell us. This creates a problem: can we rely on information that is told to us by other people? We know from Bartlett's (1932/1972) classic studies that in transmitting information, a lot of details can get lost. In the particular case of reasoning problems, when information is lost by one person's recall how will that impact the answers of the next responders?

Previous studies found that the difference between intuitive and deliberative responders might not be a mere matter of logical knowledge, but also a matter of proper reading and comprehension (Mata et al., 2014). People do not read properly the problems and ignore critical information that allows for a correct resolution of the problem, and that is why they sometimes respond incorrectly. If they were to retell the problem to another person, would they be able to reproduce it properly? Our hypothesis is that if they are unable to spot the conflict when they first encounter it, and afterwards try to reproduce the problem, they will do so in a distorted manner, which does not preserve the conflict. Therefore, other people who receive the misremembered problem will inevitably end up giving the same answer that the one who

reproduced it, since they do not have information to arrive at the correct answer. Not because they did not know how to solve the problem, but because they were not told the right problem.

Detection of conflict in reasoning problems

Cognitive reasoning problems (CRT) have a deliberative or intuitive answer. The most know example is the classic problem of the bat and the ball, where the bat costs 1 dollar more than the ball. And the question is how much does the ball cost? The key component in this problem is the presence of a conflict, an element that creates two possibilities of resolution: one that most often comes to the mind (ten cents) and another that comes after a longer thinking period (five cents). This element is the "more than". Intuitive responders tend to answer ten cents, since they read the problem as if it said: "the bat costs 1 dollar" and miss the "more than the ball". On the other hand, deliberative responders take into consideration all the sentence. They might think about the intuitive answer (Mata, Ferreira, & Sherman, 2013), but end up arriving to the right answer: five cents.

Table 1- Conflict and no-conflict version of a CRT type problem

Problem with conflict	**Problem without conflict**
A TV and a DVD are on sale. Together they cost 110 cents. The TV costs 100 cents <u>more than the DVD.</u> How much does the DVD cost?	A TV and a DVD are on sale. Together they cost 110 cents. The TV costs 100 cents. How much does the DVD cost?

Recent studies found that the ability to solve this kind of problems might not be only a matter of logical knowledge, but also of a process that precedes the reasoning about the problem. When people read the problem, some do not pay attention to all the information in it. In a CRT problem, if people do not pay attention to the conflict (the underlined part of the problem in Table 1), they will not be able to give a correct answer, as they end up answering to the no-conflict version of the problem (see the no-conflict version of the problem in Table

1). This means that attentional processes might as well have an important role in the resolution of this type of problems.

There are various explanations for why some people give an intuitive or a deliberative answer. A theory by De Neys and Bonnefon (2013) focuses on the moment when the bias might occur in the reasoning process. They propose that theories of bias can be situated in three moments:

- a "storage failure" - at an earlier stage, when it is considered that intuitive responders do not have the knowledge to solve this type of problems;
- a "monitoring failure" - proposes that intuitive responders are unable to monitor the conflict in the problem;
- a "inhibition failure" - bias can occur at a later stage takes place, when it is proposed that conflict is monitored, but there is a failure to inhibit the intuitive answer.

A different explanation might be at hand for explaining individual differences in reasoning problems: a representation or comprehension failure, in which subjects "seem to fail to represent or understand the problem accurately" (Mata et al., 2017, p. 6).

The inaccurate representation of information read is already discussed in psycholinguistics. There is evidence that sentences are not exhaustively analysed and that we are happy to store merely good enough-representations (Barton & Sanford, 1993; Erickson & Mattson, 1981; Ferreira, Bailey, & Ferraro, 2002). Ferreira et al. (2002) propose a good-enough representation theory of language processing. According to them "comprehension is more shallow and incomplete than psycholinguists might have suspected" (Ferreira et al., 2002, p. 14). Representations of a sentence are often incomplete and supported by the context or the compreehender schemas. Good enough representations allow people to communicate in a more efficient way. Paradoxically they might cause problems in communication. In the example of

a reasoning problem, a good enough representation such as a version of the problem without the conflict (see Table 1) might be faster to process and to answer, but it will result in an incorrect answer and the loss of important information.

The good-enough representation might result from selective attention, similar to the processes that happen when change blindness occurs, since the inability to detect change might result from a lack of attention towards the critical parts of the text (Sturt, Sanford, Stewart, & Dawydiak, 2004).

Erickson and Mattson (1981), divide sentence comprehension in three processes: an encoding process, a lexical access process and a construction process. On the last process only a global representation of the sentence is stored. This representation might not include all the information read.

Mata et al. (2014) studied if an incorrect representation of the problem could be the cause for intuitive responses. A good-enough, but incomplete, representation of the problem could lead people to give "right answers to the wrong questions" (Mata et al., 2014, p. 462). A good representation of the problem would be one that preserves the conflict, as opposed to a good-enough representation which would not preserve the conflict, but in which the subject would be confident enough – see Table 1. Across a series of studies, a change detection paradigm was used to test whether people who solved a problem deliberatively differed from the ones who solved the problem intuitively in their ability to correctly identify the conflict. After solving each problem, participants were presented with either the same version of the problem or a no-conflict version of the same problem (see Table 1) and asked if they detected any changes from the first to the second problem. In all studies, it was found that performance was positively correlated with conflict detection, providing evidence that a good representation, and not merely a good-enough (e.g., a bat and a ball cost 110 cents, the bat cost 100 cents, how much is the ball?) representation of the problem is needed to answer correctly. Moreover,

detection of irrelevant changes did not predict a better performance on reasoning problems. In this study a two stage pattern of bias emerged, since some incorrect responders were able to implicitly detect conflict, which could be misrepresenting the conflict in the problem (Mata et al., 2014). This provides evidence that conflict monitoring and conflict representation are two different processes and that the occurrence of conflict detection does not imply a correct representation, neither does the absence of a correct representation imply that there was no conflict monitoring.

Another study used eye-tracking, it was found that deliberative problem-solvers spend significantly more time paying attention to the conflict which means that attention might be crucial to the reasoning process (Mata et al., 2017). Even if intuitive responders spend more time reasoning, if they do not focus their attention in the conflict, they would hardly arrive to a right answer. Correct responders distinguish conflict from the no-conflict version of the problems, in that they spend more time looking at the critical part of the problem. Incorrect responders did not pay more attention to any of the sentences of the conflict version than to the sentences of the no-conflict version. Only attention to the critical premise was correlated with performance.

Serial Reproduction

We were not only interested in the intra-individual consequences of misrepresenting the problem, but we were also interested in understanding how the misrepresentation of one person could affect other people responses. Hence, we decided to use a serial reproduction paradigm to understand what would be the social impact of misrepresenting the problem.

The serial reproduction paradigm refers to the reproduction of information throughout a chain of people. The first one receives an original piece of information and should reproduce it to another participant, which in turn receives the information and should reproduce it again

to the next one. The process goes on consecutively, resulting in a distortion of the initial information transmitted (Bartlett, 1932/1972). In serial reproduction, each set of participants in a particular moment is called a generation. A chain is a series of reproductions (e.g., in this study we used three generations of participants, with 30 participants in each generation, meaning we have 30 chains with 3 recalls each).

Initially Bartlett (1932/1972), experimented on serial reproduction of folk-stories, descriptive and argumentative prose passages and pictures. In his studies, participants read the passages twice and after a 15 to 30 minutes interval were asked to reproduce it. He found that the passages tended to become smaller, loose supernatural or non-scientific elements, becoming more rational.

Bartlett (1932/1972) identified some of the processes involved in the distortion of the information such as:

- omissions - when a certain part of the text disappears;
- rationalisation – the need to understand the text as a whole, connecting parts that might not be connected and rational interpretations for the information provided;
- transformation of detail – transforming unfamiliar information to more familiar one, this type of change tends to persist throughout the generations (e.g., transformation of strange names to more familiar names);
- and, order of events – change of the order of events to give more. In the case of the present thesis, we are mainly interested in the omission of the conflict in each problem.

His most notorious finding was that after a few generations, the reproductions "would hardly ever be connected to the original" (Bartlett, 1932/1972, p. 171). Bartlett notes that despite that: "the subjects may be very well satisfied with their efforts, believing themselves to

have passed on all important features with little or no change, and merely, perhaps, to have omitted unessential materials" (Bartlett, 1932/1972, p. 175). This means that not only do participants transform the text in a way that could hardly be connected to the original, but they are also unware of this and confident in their reproduction.

Though many authors focus on the inaccuracy of the memory processes described by Bartlett (Brissey, 1961), Ost and Costall (2002) highlight that Bartlett proposed a schema theory of memory, implying that material which is consistent with a previous schema will be better remembered. Therefore, a reproduction accuracy depends upon conditions of information processing and previous schemas (Ost & Costall, 2002).

Though acknowledged for his findings on serial reproduction, Bartlett (1932/1972) is often considered to have lacked the scientific rigorousness of more modern days. Despite that, the effect was reproduced many times in more controlled conditions (e.g., Allport & Postman, 1947/1965; Bangerter, 2000; Lyons & Kashima, 2006).

Following Bartlett's studies, serial reproduction became a paradigm to study the transmission of information and has been mainly used to study rumours, stereotypes and cultural transmission (e.g., Kashima, 2000). Some studies use images (Allport & Postman, 1947/1965) or stories (Kashima, 2000) that often have incongruent and/or ambiguous information that can lead to distortion.

Kashima (2000) has used serial reproduction to study the recall of stereotype consistent and inconsistent information in five-people chains. He found that individually, people recall more stereotype inconsistent information, but collectively more stereotype consistent information is preserved, which could be due to either a lack of motivation by the last members of the chain or a choice to communicate only what you can make sense of (at the end of the chain, what you can make more sense of is stereotype consistent information)(Kashima, 2000). He also found a tendency to recall more stereotype consistent than inconsistent information

when they had an intention to communicate (Lyons & Kashima, 2006), versus a situation where they were only remembering information. When people perceive their stereotypes to be shared with their listener, they are more likely to pass on more stereotype consistent information (Clark & Kashima, 2007).

The method of serial reproduction has not yet been used to study the transmission of reasoning problems. Bartlett (1932/1972) found a tendency to eliminate information which is not congruent with the representation formed (Allport & Postman, 1947/1965; Bartlett, 1932/1972). In this study, we are expecting that the conflict in the problem (the underlined sentence in Table 1) might be lost if people do not form a correct representation of the reasoning problem.

Approach to the problem

If an incorrect representation of the problem is present, the ability of incorrect responders to reproduce the problem will be affected and that might have an impact on the information that passes on to the next generation. An incorrect representation of the problem might have an impact not only at an individual level, but might result in a collective inability to solve the problem correctly.

Serial reproduction was never used to study the transmission of reasoning problems. Conversely, conflict detection of reasoning problems was never studied with the use of free recall to access representations, neither was the social impact of misrepresenting the problems investigated.

Previous studies have used different methods to access the representation of the problem, namely: a change detection paradigm, where participants are shown a similar or different sentence and asked if they detect any changes (Mata et al., 2014). To detect changes, people have to compare the problem they are reading to the one that they have previously read

and that would be stored in their minds. Another study, used eye-tracking to trace the attention participants pay to certain parts of a problem (Mata et al., 2017). If participants do not pay attention to a certain part of a problem, it is unlikely that they will correctly store it in their memory.

In the present dissertation, we want to merge both literatures and will use a serial reproduction paradigm to study the transmission of reasoning problems. We will analyse results both at an intra-individual level, assessing the relation between performance and accuracy of the memory of each participant, and at a collective level, assessing the impact of misrepresenting the problem throughout generations.

Our first hypothesis is that intuitive problem-solvers will make an incorrect representation of the problem in their minds and as a result they will not be able to reproduce the problem with the conflict. Therefore, throughout the generations there will be fewer and fewer problems with the conflict preserved, since participants will read less and less problems with the conflict preserved.

That leads us to our second hypothesis that by the last generation, since participants do not have access to the information that allows them to deliberate, there will be fewer deliberative answers. We will check if participants would give a deliberative answer to the original problem, by giving them both the (potentially distorted) recall of another participant and the original untransformed problem. This will allow us to know if the expected decrease in deliberative answers is due to participants not being able to arrive at a deliberative answer, or a result of participants in subsequent generations reading less problems with the conflict preserved.

The independent variable is the generation to which participants were assigned. Participants were assigned to the generation by order of participation.

Other than generation, no variables were systematically assigned to participants. We collected the participants answer to the recall, the recall produced by the participant and the answer to the original problem.

All participants will answer each problem twice, the first time they will see a recall (first-generation participants will read the original problem) and the second time all participants will be presented with the original problem. This allowed us to know if they would give an intuitive or deliberative answer to the original problem, when the first problem presented had no conflict (on the first-generation all participants read the original problem twice).

Method

Participants

Questionnaires were collected using Prolific. Prolific is a sample pool where participants are paid to answer questionnaires. We collected a sample of 30 participants per generation, over 3 generations, making a total of 90 participants who will be considered for the data analysis.

Since the experiment was held online in English, a filter was used for participants who were English natives. Three participants indicated another native language in the questionnaire (two referred French and one German, corresponding to 3.3% of participants) – see Table 6 – Appendix 2. Concerning nationalities, 59 were British (65.6%), 20 American (22.2%) 5 Canadian (5.6%), 2 Indians (2.2%) and one Singaporean, one Irish and one German (1.1% each) – see Table 7 – Appendix 2.

Participants were aged, on average, 34.18 years old (DP=11.87) – see Table 8 – Appendix 2. A One-Way ANOVA was performed to check for significant differences in age between generations. Mean age was not significantly different between generations, $F(2,87) = 1.18$, $p = .31$ – see Table 9 – Appendix 2.

Lastly, relative to gender, 60 were men (66.7%) and 30 were women (33.3%) – see Table 10. A chi-square test was performed to examine if there are significant differences of gender between generations. Differences between generations are marginally non-significant, $\chi^2(2, N = 90) = 57$, $p = .06$– see Table 11 – Appendix 2.

Design

This is a between subjects design in which participants are assigned to a generation in participation order (the first 30 are assigned to the first generation, the next 30 to the second

one and the last 30 to the third one). There is an experimental hypothesis and a correlational one.

Materials

The study was programmed in SoSci Survey. We used three CRT type problems that had already been used in a previous study (see Appendix 3).

Since we needed to use the answers produced by the previous generation for the next one, we always needed an intermediary phase where we analysed the content produced by each participant and validated it. Materials for the three generations differ as described below.

Original materials (1st generation)

All the problems had a "bat and ball" structure: "a sum of two things is *x*"; "one is more *y* than the other"; "how much is the other?". Problems had all the same structure and were previously used in a study that used a conflict detection paradigm with reasoning problems (Mata et al., 2014) – see below in *Table 2 – Original problems used*Table 2 all the problems used.

Table 2 – Original problems used

	Original version
Problem 1 – "TV and DVD"	A TV and a DVD are on sale. Together they cost 110 cents. The TV costs 100 cents more than the DVD. How much does the DVD cost?
Problem 2 – "Shells"	Anna and Sophie are collecting shells. Together they found 12 shells. Anna found 10 shells more than Sophie. How many shells did Sophie find?
Problem 3 – "Rope"	A rock climber ties a long rope to a short rope. Together the two ropes measure 88 meters. The long rope is 80 meters longer than the short rope. How much does the short rope measure?

Validation of problems for the other generations

Problems to be presented to the next generation were selected from the ones provided by participants of the first generation. Each problem had three parts that had to be present for a recall to be considered valid – see *Table 3* below for a detailed analysis of each problem.

Table 3 – Structure of the problems used

	"a sum of two things is *x*"	**"one is more *y* than the other"**	**"How much is the other?"**
Problem 1 – "TV and DVD"	Together they cost 110 cents. / A TV and DVD cost 110 cents.	The TV costs 100 cents more than the DVD. /The TV costs 100 cents	How much does the DVD cost?
Problem 2 – "Shells"	Together they found 12 shells. / Anna and Sophie found 12 shells.	Anna found 10 shells more than Sophie./ Anna found 10 shells.	How many shells did Sophie find?
Problem 3 – "Rope"	Together the two ropes measure 88 meters. / The long rope and the short rope measure 88 meters.	The long rope is 80 meters longer than the short rope. / The long rope is 80 meters.	How much does the short rope measure?

This selection had as criteria of elimination:

a) recalls which missed at least one of the critical statements: "a sum of two things is x" or "one is more *y* than the other" (e.g., "Tv cost 100 more, both 110.");

b) if a recall just failed to have a question (i.e., How much is the other?) we introduced the original question from the problem at the end of the recall;

c) recalls which were ambiguous or undefined (e.g., "Anna and Sophie collecting shells, 12 Anna had 10 more");

d) recalls which gave the answer to the problem (e.g., A climber ties two ropes together. The longer one is 80m long, the other is 8 metres long);

e) Spelling, grammatic and inconsistencies were corrected (e.g., "Tv and dvd" was replaced by "TV and DVD"), but we did not correct different names given to the characters or change units (e.g., "pounds" to "cents" or "Michelle" to "Sophie");

f) each recall was adapted in such that any comments on the problem, quality of the story or answers to the problem were excluded (e.g., A climber ties two ropes together. The longer one is 80m long, the other is 8 metres long).

Procedure

Participants were welcomed to the study and asked to give their consent. They were informed that they were free to leave the study at any time.

After giving their consent, they were asked questions about gender, age, nationality and native language. In the first generation, they were then presented three problems.

For each problem, they had to complete three tasks: answer the problem, recall it and answer it again. On the first screen, they were asked to solve the problem, in the next screen they were asked to recall the problem they had just seen and write it down as precisely as possible. And in the third screen they were presented the same (original) problem and told they could see the same or a slightly different problem. If it were to be the same, they should answer the same, if it was different from the previous one, they should answer differently. This would allow to understand if given the correct information (the conflict version of the problem) participants would be able to give a deliberative answer. This process was repeated three times, with three different problems. The order of the problems was randomly assigned.

Only on the first generation they saw the exact same problem twice, this step was present so we could compare data between generations and the procedure would be equal throughout generations. For the other two generations, the procedure was the same, but the first time the problem was presented it was not in its original version but rather the recall from the previous participant of that chain. After answering the problem, the previous participant had written, the participant was asked to recall this problem and lastly shown the original problem

(here again they were told they could see the same problem or a slightly different one and that they should answer differently, if they thought the problem was different).

Lastly, participants were thanked for their participation and redirect to the prolific completion page to prove they have completed the study.

Participants recall was not only used to be presented to the next generation, but we are also interested in evaluating if recalls preserved the conflict.

Participants who had at least a valid story were kept in the study and only their invalid problems were replaced. All the participants who had more than a valid story were placed as the first member of one of the 30 chains. To replace invalid problems, we had to collect more answers and then randomly assign recalls to replace the problems that were missing.

Replacement of invalid recalls

On the first-generation problems, twelve recalls were invalid. Since we could not use invalid problems, and we needed three problems in each chain, we collected more answers to make up for those invalid recalls. On the first generation, problems collected in this second moment were then randomly assigned to each chain.

For the second generation, a total of eleven recalls were invalid. To have complete chains, when a participant had at least one invalid recall, we collected again the same chain where invalid recalls were present, even if just one recall was invalid. Therefore, we re-collected answers for seven chains.

On the third generation only one collection was necessary, since the recalls from those participants would not be used. All the problems used can be found in appendix 3.

Dependent variables

Summing up, we collected a recall and two answers for each problem. The first-time participants could be presented the original problem (only in the first generation) or a recall (on the second and third generation) and the second time they would answer the original problem.

Recalls

Other than validating the problems, we evaluated the presence of conflict on a recall: for each problem, we assessed if conflict was present (see *Table 4* for a conflict and no-conflict version of each problem). This process was conducted by two people. The first one made the first classification, the second one reviewed that classification and lastly the first one rechecked if everything was correctly assessed.

Table 4 – Problems with and without the conflict

	Problem with conflict	**Problem without conflict**
Problem 1 – "TV and DVD"	A TV and a DVD are on sale. Together they cost 110 cents. The TV costs 100 cents more than the DVD. How much does the DVD cost?	A TV and a DVD are on sale. Together they cost 110 cents. The TV costs 100 cents. How much does the DVD cost?
Problem 2 – "Shells"	Anna and Sophie are collecting shells. Together they found 12 shells. Anna found 10 shells more than Sophie. How many shells did Sophie find?	Anna and Sophie are collecting shells. Together they found 12 shells. Anna found 10 shells. How many shells did Sophie find?
Problem 3 – "Rope"	A rock climber ties a long rope to a short rope. Together the two ropes measure 88 meters. The long rope is 80 meters longer than the short rope. How much does the short rope measure?	A rock climber ties a long rope to a short rope. Together the two ropes measure 88 meters. The long rope is 80 meters. How much does the short rope measure?

We will use two measures: the mean of recalls where conflict was preserved and the mean of problems read with conflict. The first measure reports to the recalls that preserved the

conflict, produced by the participant. The second measure reports to the problems that were presented to a certain participant with conflict.

Answers to the problem

We evaluated participants answer to the first time the problem was presented, as either intuitive or deliberative – you can see in *Table 5* what was considered a deliberative answer, answers different from this one were considered intuitive.

We also evaluated if the answer was right or wrong considering the absence or presence of conflict on the recall of the problem presented. If the recall preserved the conflict, a correct answer would be the same as a deliberative answer. If the recall failed to preserve the conflict, then the right answer would be different – you can see in *Table 5* what were the correct and incorrect answers for each type of recall. For the first generation those measures are equal, since all problems were presented in its original form, with conflict.

Table 5 – deliberative answer, right answer for a recall with conflict and right answer for a recall without conflict for each problem

	Deliberative answer	**Right answer for a recall with conflict**	**Right answer for a recall without conflict**
Problem 1 – "TV and DVD"	5	5	10
Problem 2 – "Shells"	1	1	2
Problem 3 – "Rope"	4	4	8

The second time the problem was always presented in its original form, therefore we only evaluated if the answer was intuitive or deliberative. This last measure allows us to understand if participants who were presented a problem without the conflict the first time, would give a different answer when presented the problem with conflict.

Therefore, we have three variables from the answers given to the problem: the mean of deliberative answers; and the mean of correct answers the first time and the second time the problem was presented.

Results

Participants considered for the data analysis

We needed 30 participants for each generation. We started by collecting 30 answers per generation, when recalls were invalid we had to collect more answers. In total we collected 110 answers, from which 3 participants were completely invalid (i.e., all the recalls from this participants were invalid) . Since in the third generation we did not need to use the recalls, no extra answers were collected. On the final data set we will use the first 30 answers collected in each generation. Only participants with all the recalls invalid were replaced in the database (3 participants met this criteria).

Computation of dependent variables

We found a significant correlation between recalls with conflict for problem 1, 2 and 3 (1 and 2 , $r(87)=0.34$, $p<.01$. 1 and 3, $r(88)=0.43$, $p<.01$. 2 and 3, $r(87)=0.27$, $p=0.01$) and the number of problems 1, 2 and 3 read with conflict (1 and 2 , $r(88)=0.43$, $p<.01$. 1 and 3, $r(88)=0.47$, $p<0.01$. 2 and 3, $r(88)=0.26$, $p<.01$) we will use the mean of recalls with conflict and the mean of problems read with conflict (see

Table 12 and Table 13).

Since the number of deliberative answers to problem 1, 2 and 3 (1 and 2, $r(88)=0.76$; $p<.01$. 1 and 3, $r(87)=.78$; $p<.01$. 2 and 3, $r(87)=0.72$, $p<.01$) and the number of right answers to problem 1, 2 and 3 also correlate significantly (1 and 2 , $r(88)=0.59$, $p<.01$. 1 and 3,

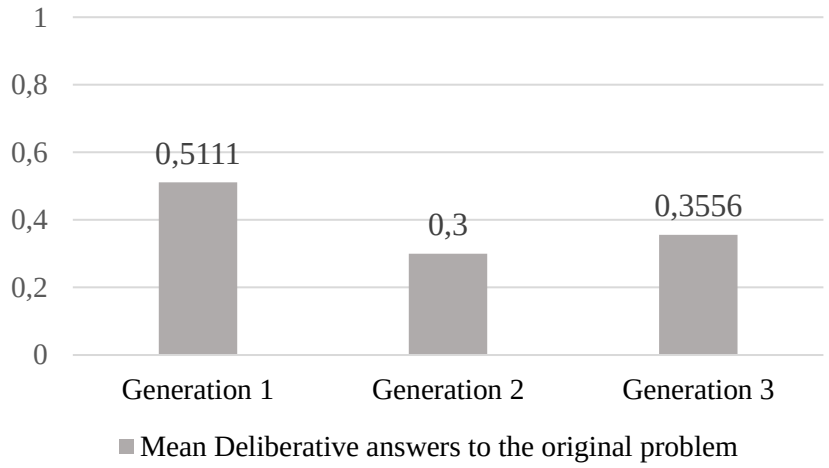
r(87)=0.66, *p*<.01. 2 and 3, *r*(87)=0,64, *p*<.01), we will use the mean of deliberative answers and the mean of right answers (see Table 14 and Table 15).

Likewise, the number of correct answers to the second time problem 1, 2 and 3 were presented were significantly correlated (1 and 2, *r*(88)=0.86, *p*<.01. 1 and 3, *r*(87)=0.84, *p*<.01. 2 and 3, *r*(87)=0.27, *p*<.01), we will also use the mean of correct answers for the original problem (see Table 16).

Control variable – deliberatives across generations

We started by checking for differences of correct answers across generations. Correct answers to the original problem should not be significantly different across generations. To test this, we ran a one-way ANOVA. Means were not significantly different across generations, F(2,87)=1.78, *p*=0.17 (see Table 17– Appendix 2 and Figure 1, below). Neither a posteriori multiple comparisons nor planed contrasts between generation 1 and 2 or generation 1 and the other two generations held significant results. Which means there were no differences in a priori capacity to give deliberative answers.

Figure 1 – Mean Deliberative answers to the original problem



Hypotheses testing

Our first hypothesis was that people who give an intuitive answer will reproduce the problem without the conflict. To test this, we performed a *Pearson* correlation[1] between the mean of deliberative answers and the mean of recalls with conflict. We found a significant positive correlation between the mean of deliberative answers and the mean of recalled problems which preserve the conflict, $r(88)=0.44$, $p<.01$ (see Table 19– Appendix 3).

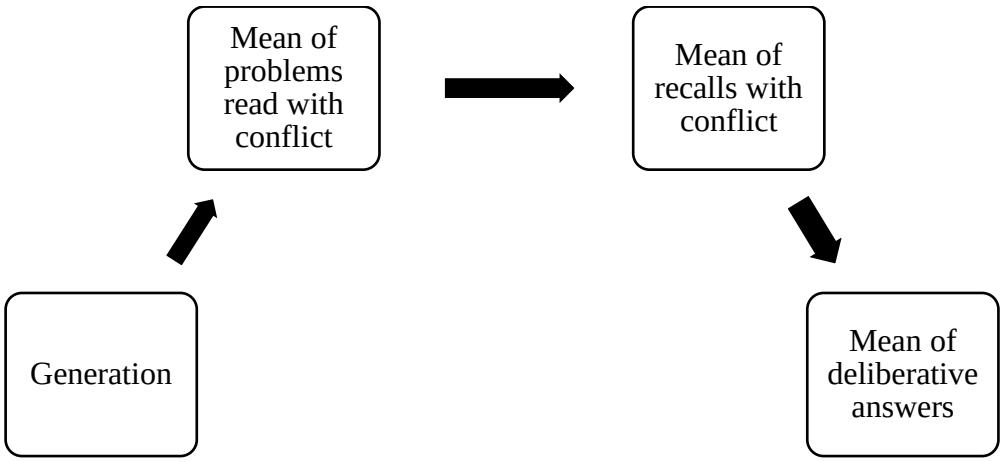
This also means that there will be fewer reproduced problems with the conflict in generation 3 than in generation 1. To test this hypothesis, we conducted a *Pearson* correlation between the mean of recalls with conflict and the generation to which participants were assigned. We found a significant cognitive correlation between the mean of problems recalled with conflict and the generation, $r(88)=-0.26$, $p=0.01$ (see Table 20– Appendix 3). Meaning that throughout the generations fewer problems were recalled with conflict.

Our second hypothesis was that by the third generation there will be fewer deliberative answers. To test this, we will also do a *Pearson* correlation[2]. It is expected that as the generations go by there will be less participants with deliberative answers. We found a marginally significant negative correlation between the mean of deliberative answers and the generation, $r(88)=-0.20$, $p=0.06$ (see Table 21– Appendix 3) which suggests that throughout the generation there are less deliberative answers.

Lastly, we decided to test a double mediation hypothesis whereby the effect of the generation on deliberative answers is mediated by the mean of recalls with conflict, which in turn is mediated by the mean of problems read with conflict (see a graphic representation of the model below, Figure 2).

[1] Assumption of normality was checked, output can be checked on Table 18 – Appendix 2.

Figure 2 – Double mediation model



We decided to test this hypothesis by testing the indirect effect with bootstrap analysis (Hayes, 2013). This analysis produces a confidence interval for the statistic, which if different from zero is significant. To test the double mediation, we used the ad-on *PROCESS* for *SPSS*. We used the model 6, defining mean deliberative answers as the outcome variable, mean problems read with conflict and mean recall with conflict as the mediator variables, generation as the independent variable and used 5000 bootstraps. The model is significant, CI = [-0,09; -0,02] – see full output for Bootstrap analysis in Table 23 – Appendix 2.

Discussion

This study analysed processes of memory of reasoning problems both at an individual and collective level. We analysed performance and free recalls for individuals, and the social impact of misrepresenting the problems throughout the generations of serial reproduction.

Hypothesis confirmation

The first hypothesis was that people who give an intuitive answer will reproduce the problem without the conflict. This hypothesis was confirmed both at an individual level – participants who gave an intuitive answer were more likely to have a recall which did not preserve the conflict; and at a collective level – because of what happened at an individual level throughout the generations there were less and less problems which preserved the conflict.

Though our hypothesis was confirmed, we found some recalls that were almost exact. Even though the problems are small and there was no distraction task, this could indicate one of two things: a) that participants are memorizing the problem or, b) since the data was collected online, participants might be copying the problems from the first screen and pasting it to the next one (obviously they could only do this for the second and third problems). To address this, in future studies, we suggest the use of an extra space between two words of the problem, if this is present and the text is the same it is unlikely that the participant spotted and reproduced the two spaces, but more likely he copied the text and did not notice the presence of an extra space.

It is also important to mention that if this is correct, this will increment the effect, not decrease it. Since the exact recall has the conflict, people who copy the problem, can be either deliberative or intuitive problem-solvers, so it is likely that the number of problems without the conflict would increase.

Our second hypothesis was that by the last generation there would be fewer deliberative answers and this hypothesis was confirmed as well. We found a negative correlation between the number of deliberative answers and the number of the generation participants were at. This result was marginally significant and this might be a result of the situation described before of possible copying of the original problems, which increased the maintenance of problems that preserved the conflict.

Participants did not differ significantly across generation in their ability to give a deliberative answer, as we found no significant differences between their answers to the original problems throughout the generations, only answers to the recalls of previous participants suffered this effect throughout the generation.

With the confirmation of both the first and the second hypotheses, we decided to test a sequential double-mediation model. We previewed that the effect of the generation on deliberative answers would be mediated by the number of problems recalled with conflict, which in turn would be mediated by the number of problems read with conflict. This indirect effect was significant.

If they are unable to spot the conflict, or if the conflict is no longer in the problem, they will also be unable to reproduce it. The result is that, no matter how deliberative you are, you end up giving an intuitive answer. This is especially relevant in a world where we rely so much on what other people tell us, namely through social media.

Implications

At an individual level, we normally associate deliberative problem-solving to be a result of sound reasoning as opposed to intuitive responders who are normally thought of as not having the ability to reason correctly. This study is one more in a series of studies that (Mata et al., 2014, 2017) are considering a previous step that is the basis for sound reasoning. For

sound reasoning to occur, a correct representation of the problem must be formed in the mind. Previous studies (Mata et al., 2014, 2017) could only account for attention processes, as they used eye-tracking and conflict detection paradigms. In this study, we wanted to go one step further and test if performance was also correlated to memory. Though you should infer that if attention is not paid to a certain part of the problem, this part will probably not be remembered and therefore it is probably not represented in the mind.

With reasoning abilities being so important in our days, it would be important to train people to recognize the critical parts of information in a problem, to facilitate the formation of a good representation of the problem. Which in turn could have a positive impact in the ability to solve this type of problems.

But probably the most stunning result is the impact that these individual misrepresentations have in the group. This study is promising since serial reproduction was never applied to the recall of reasoning problems.

On a chain only made exclusively by deliberative responders, no information would be lost. But in the moment an intuitive responder enters the chain there is a chance that information will be lost. It is important to note that not all intuitive responders have a recall which does not preserve the conflict, and so not everyone who gives an intuitive answer compromises the chain in the same way. If a participant who gives an intuitive answer, in a certain moment of a chain, does not preserve the conflict in his recall, the information is lost and can no longer be restored throughout that chain. From the moment the conflict is not preserved in a particular chain, participants can no longer arrive to a deliberative answer. Since they will be basing their answers on the wrong premises. Therefore, we can also consider that the number of deliberative answers in a certain chain is a consequence of the moment of the chain when a no-conflict recall appears.

Today we have more information than ever before. Although the original information is often available, we tend to rely on what other people tell us. Participants in this study were shown the original problems afterwards and able to give a deliberative answer, in case they wanted so. They were given all the information they needed, to decide correctly. In the real world are we given all the information? Often, we rely on information that another person gives us. Frequently we have no information on the person ability and willingness to pass on a correct representation of the information.

People at the end of a chain are subject to the information it is passed on to them, and no matter how deliberative they are, they are not going to be able to make correct judgments if they are given incomplete information.

It should be tested whether this hypothesis holds true in daily life settings such as when sharing a post through Facebook or when talking with other people. In those cases, transmission might not occur only on a one to one basis but one sharing moment might impact a bigger number of people (e.g., a post on Facebook can reach thousands of people in minutes).

Limitations and Future studies

In this study, we only used CRT type problems, other studies should cover other type of problems, such as syllogisms, base rates or semantic illusions. E.g., "A computer virus is spreading through the system of a computer. Every minute, the number of infected files doubles. If it takes 100 minutes for the virus to infect all of the system, how long would it take for the virus to infect half of the system?" (Mata & Almeida, 2014, p. 359) and the right answer would be "99". When recalling the problem if people fail to remember that "the number of infected files doubles every minute", the next responder will be unable to arrive at the original deliberative answer. For the study to be replicated, these problems should have a critical part

that if it is not remembered or if it is misrepresented will result in the inability to give a deliberative answer.

We only used three generations of participants. Even though results were quite similar from the second to the third generation, which makes us believe that they would hold stable throughout the generations, it would be interesting to replicate the study with more generations.

In this study, a participant from a subsequent generation would receive a complete set of recalls from a previous participant (except for the case where replacements had to be made). In our daily lives, we receive information from many sources. This might have a different impact on how we perceive information and therefore how we represent that information, and ultimately the world.

This study does not account either for the great amount of information that we receive, often at the same time. With such a high cognitive load, it would be easier even for a deliberative to pay attention to the critical parts of the problem and to pass it on without preserving the conflict to the next generation. A next study could have participants doing this same task but with another task at the same time, which could simulate the way we are processing different sets of information at the same time (e.g., when we are watching TV, checking the telephone and writing a thesis at the same time).

Conclusion

We found a correlation between performance and free recalls and we found a social impact of this effect throughout the generations. These two findings are relevant at individual and social level.

If you would only remember two things from this thesis, please remember that reasoning problems do not require only logical knowledge, but also attention to the critical part and a correct representation formed in the mind. Without it, people could have great reasoning skills, and still be unable to arrive to the right answer, in sum, they would be giving "right answers to the wrong problem" (Mata et al., 2017).

The other takeaway message is the social impact of misremembering the problem. The impact of misrepresenting the problem goes beyond the individual level. In a world where we are constantly receiving and passing information to others this is something to consider, how much of the information we receive daily can be misrepresented or misremembered, without the individual even being conscious of their lack of precision.

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Appendices

Appendix 1 - Literature Review

Index

Introduction

This thesis studies serial reproduction of reasoning problems, to date no studies have been made combining those two topics, therefore this literature review will cover previous research in serial reproduction and conflict detection in cognitive reasoning problems (CRT).

The first topic covered will be the serial reproduction. From Bartlett, through Allport until more recent studies.

Next, the concept of conflict detection of CRT problems will be presented. In this topic, some studies on attentional processes involved in the CRT literature will be covered with more depth, including some studies on language processing.

Lastly, some topics of attention and memory, relevant for this thesis will be addressed.

This is a longer review about the topic of this thesis that complements the introduction/literature review done in the first part of this dissertation.

Serial Reproduction

We will start this literature review by focusing on the method of serial reproduction. Serial reproduction was first introduced, in 1932, by Bartlett on his famous book *Remembering*.

The serial reproduction paradigm refers to the reproduction of information throughout a chain of people. The first person in that chain receives an original piece of information and should reproduce it to another participant, which in turn receives the information and should reproduce it again to the next one. The process goes on consecutively, resulting in a distortion of the initial information transmitted (Bartlett, 1972). In serial reproduction, each set of participants in a particular moment is called a generation. A chain is a series of reproductions (e. g., in this study we used three generations of participants, with 30 participants in each generation, meaning we have 30 chains with 3 recalls each).

Initially Bartlett (1932/1972), experimented on serial reproduction of folk-stories, descriptive and argumentative prose passages and pictures. In his studies, participants read the

passages twice and after a 15 to 30 minutes interval, they were asked to reproduce it. He found that the passages tended to become smaller, in the case of the folk story more supernatural parts were left behind throughout the generations.

Bartlett (1932/1972) identified some of the processes involved in the distortion of the information such as:

- omissions (when a certain part of the text disappears);
- rationalisation – the need to understand the text as a whole;
- transformation of detail – transforming unfamiliar information to more familiar one, this type of change tends to persist through out the generations (e.g. transformation of strange names to more familiar names);
- and, order of events – change of the order of events to give more. In the case of the present thesis, we are mainly interested in the omission of the conflict in each problem.

After a few generations, the reproductions "would hardly ever be connected to the original" (Bartlett, 1932/1972, p. 171). Bartlett (1932/1972) also found common trends of change among all the recalls:

- the most unstable elements were proper names and story titles;
- a general bias towards the concrete - opinions, arguments, pieces of reasoning and deductions tend to be omitted;
- loss of individual characteristics or peculiarities, and there is a tendency for arguments and opinions to go towards social conventions;
- abbreviations – though a reproduction could be longer, the reproductions tended to be abbreviated throughout generations.
- Rationalisation – in the folk-tale it would mean a reconstruction of the text to give it a meaning as a whole. In the case of the argumentative and descriptive

> texts, this was traduced in a tendency to generate a text that was apparently less coherent. This happened because in the last case, because the setting was familiar and the cohesion between the text needed not to be created. "So long as material can be reduced to any form which an ordinary member of a given social group will accept with a minimum of questioning all is well." (Bartlett, 1932/1972, p. 175).

Bartlett makes an interesting note on the serial reproduction process, though it "normally brings about startling and radical alterations (…) the subjects may be very well satisfied with their efforts, believing themselves to have passed on all important features with little or no change, and merely, perhaps, to have omitted unessential materials" (Bartlett, 1932/1972, p. 175). This means that not only do participants transform the text in a way that could hardly be connected to the original, but they are also unware of this and confident in their reproduction.

He also refers that changes in real life would be easier and more prominent. This happens frequently in the popular game "broken phone" where a person creates a sentence and passes on in a low voice to another person, this goes on in a circle and we all know that most of the times the end sentence is nothing like its original version. For Bartlett, this meant that the reproductions were more like constructions formed based on the impression that was made when people read the material.

Though accounted for his findings in the serial reproduction, Bartlett is often considered to have lacked the scientific rigorousness of more modern days. Despite that, the effect was reproduced many times in more controlled conditions (Bangerter, 2000; Lyons & Kashima, 2006).

Though many authors focus on the inaccuracy of the memory processes described by Bartlett (Brissey, 1961), using Bartlett to justify the memory inaccuracies, Ost and Costall

(2002), highlight that Bartlett proposed a schema theory of memory, implying that material which is consistent with a previous schema will be better remembered. A reproduction accuracy can, therefore, depend upon conditions and previous schemas (Ost, & Costall, 2002). Though normally, in an incongruent world, we will miss on same details to improve the congruency of the story. If the details are congruent with previous schemas we will remember it better.

Allport and Postman (1947/1965) used the serial reproduction to study rumours, in the aftermath of Pearl-Harbour. They used pictures with details and a central action that could generate distortion. They presented a picture to the first subject and asked him to reproduce it as exactly as possible to a second participant that would enter the room later, but could not see the original picture. Then a third participant would enter the room and the second participant would recall the information the first participant had just told him. They found, similarly to Bartlett, that recalls tended to become shorter, more congruent with previous schemas and some details would become more salient. They propose a three-part pattern of distortion in which three processes are involved in the transformation and deterioration of the problems:

- *Leveling* - associated with Bartlett's omissions, is the process by which many important details are omitted. This happens not just by the inaccuracy of memory, but as a result of misinterpretation caused mainly by biases and preconceptions;
- Sharpening – a process by which the details which are preserved become more salient and are accentuated as a result of the previous interpretation. Overall, the story gains more coherence, losing its complexity;
- Assimilation – the process that underlies *leveling* and sharpening. The rumour goes in a direction that conforms with a person previous experience and attitudes, preconceptions and bias.

Following Bartlett's studies, serial reproduction became a paradigm to study the transmission of information and has been mainly used to study rumours, stereotypes and cultural transmission (e.g., Kashima, 2000). Some studies use images (Allport, & Postman, 1968) or stories (Kashima, 2000) that have stereotype consistent or inconsistent information to understand if there is a tendency for people to distort the story in a more stereotypical consistent way. Consistent with Bartlett's schema theory, people tend to memorize more information that is congruent with their previous stereotypes and adapt the story accordingly.

Kashima has used serial reproduction to study the recall of stereotype consistent and inconsistent information. He found that individually, people recall more stereotype inconsistent information, but collectively more stereotype consistent information is preserved, which could be due to either a lack of motivation by the last members of the chain or a choice to communicate only what you can make sense of (which at the end of the chain, when so many information has been lost, is stereotype consistent information) (Kashima, 2000).

This has been confirmed by another series of studies that found that shared stereotypes contribute for a chain to recall more stereotype consistent information. Though when people believe the receiver of the recall will not endorse their stereotype there is a tendency for less stereotype consistent information to pass on (Lyons & Kashima, 2003).

Yet another study where participants were asked either to reproduce the information to another participant or just asked to recall information with no intent to communicate it. A tendency to recall more stereotype consistent than inconsistent information when they had an intention to communicate (Lyons & Kashima, 2006). When people perceive their stereotypes to be shared, they are more likely to pass on more stereotype consistent information (Clark & Kashima, 2007).

The method of serial reproduction has not yet been used to study the transmission of reasoning problems. Bartlett (1932/1972) and Bangerter (2000) found a tendency to rationalize

information (Bangerter, 2000; Bartlett, 1972). As well as tendency to eliminate information which is not congruent with the representation formed (Allport & Postman, 1947/1965; Bartlett, 1932/1972). In this study, we are expecting that relevant information might be lost if people do not keep a correct representation of the reasoning problem.

Conflict detection in reasoning problems

Cognitive Reasoning problems

Cognitive reasoning problems divide the world between intuitive and deliberative responders. The most know example is the classic problem of the bat and the ball, where the bat costs 1 $ more than the ball. And the question is how much does the ball cost? The key component in this problem is the presence of a conflict, an element that creates two possibilities of resolution one that most often comes to the mind (ten cents) and another that comes, for most people, after a longer thinking period and it is normal (five cents). This element is the "more than". Intuitive responders tend to answer ten cents, since they read the problem as if it said: "the bat costs 1$" and miss the "more than the ball". On the other hand, deliberatives take into consideration all the sentence, they might think about the intuitive answer (Mata et al., 2013), but end up arriving to the right answer: five cents.

Recent studies found that the ability to solve this kind of problems might not be only a matter of reasoning ability, but of a process that precedes the reasoning about the problem. This means that attentional and memory processes might as well have an important role in the resolution of this type of problems.

The idea of the experience of conflict between the two types of reasoning comes earlier in literature. Epstein (1994) differentiated experiented and rational reasoning and argued that subjects preferred the first. Sloman (1996) wrote about simultaneous contradictory belief, experienced when a problem can be promptly solved with one type of reasoning but after a contradictory answer arises that is more correct.

There are various explanations for why some people give an intuitive or a deliberative answer. A theory by De Neys and Bonnefon (2013) focus on the moment when the bias might occur in the reasoning process. They propose that theories of bias can be situated in three moments:

- a "storage failure" - at an earlier stage, when it is considered that intuitive responders do not have the knowledge to solve this type of problems;
- a "monitoring failure"- proposes that intuitive responders are unable to monitor the conflict in the problem; and lastly;
- a "inhibition failure" - bias can occur at a later stage takes place, when it is proposed that conflict is monitored, but there is a failure to inhibit the intuitive answer (in Mevel et al., 2015).

De Neys and Glumicic (2008), recovered this idea and studied the experience of conflict when people were presented with base-rates problems which had conflict or not. His goal was to compare if when problems were incongruent (with conflict) mental conflict was experienced more than when problems were congruent (without conflict). He found that when people had to reason out loud, conflict monitoring did not seem to be present, conversely when implicit measures were used (namely time spent reasoning, time revising the problem and quality of recall), even people who did not answer correctly, seemed to be monitoring conflict (De Neys & Glumicic, 2008). This would indicate that both intuitive and deliberative problem-solvers implicitly spot the presence of conflict, as we will see later this is not entirely true.

In another study, researchers asked participants to rate their confidence level after they answered conflict or no-conflict problems. They found that most of participants (56%) reported less confidence when they gave an incorrect answer to a conflict problem than when they gave a correct answer to a no-conflict problem. They also identified two subgroups: one made by

participants who reported greater confidence in their incorrect response and another one made of participants who reported the same level of confidence (Mevel et al., 2015).

If the difference in answering was all justified by the lack of logical knowledge, then biased reasoners would not show implicit conflict monitoring (De Neys, 2014). It is also important to notice that not all biased reasoner detect conflict (Mevel et al., 2015).

A different explanation might be at hand for explaining individual differences in reasoning problems: a representation or comprehension failure, in which subjects "seem to fail to represent or understand the problem accurately" (Mata et al., 2017).

Mata et al. (2014) studied if an incorrect representation of the problem could be the cause for intuitive responses. In other words, if a good-enough, but incomplete, representation of the problem could lead people to give "right answers to the wrong questions" (Mata et al., 2014, p. 462).

Across a series of studies, a change detection paradigm was used to test whether intuitive responders differed from deliberative responders in their ability to correctly identify the conflict. In all studies, it was found that performance was positively correlated with conflict detection, providing evidence that a good representation, and not merely a good-enough, representation of the problem is needed to answer correctly. Moreover, detection of irrelevant changes did not predict a better performance on reasoning problems. Another factor that could have an impact in detecting changes would be working memory (since you need to remember the previous problem, and compare it to a second problem you are being presented), but working memory was not a predictor of better reasoning ability. In this study a two stage pattern of bias emerged, since some incorrect responders were able to implicitly detect conflict, which could be explained by a problem in representing the problem (Mata et al., 2014). This provides evidence that conflict monitoring and conflict representation are two different processes and

that the occurrence of conflict detection does not imply a correct representation, neither does the absence of a correct representation imply that there was not conflict monitoring.

Another study used eye-tracking and found that deliberatives spend significantly more time paying attention to the conflict which means that attention might be detrimental to the reasoning process (Mata et al., 2017). Even if intuitive problem-solvers spend more time reasoning if they do not focus their attention in the conflict they would hardly arrive to a right answer. Correct responders distinguish conflict from no-conflict version of the problems, in that they spend more time looking at the critical part of the problem. Incorrect responder did not paid more attention to any of the sentences of the conflict version than to the sentences of the no-conflict version. Only attention to the critical premise was correlated with performance.

If an incorrect representation of the problem is present the ability of incorrect responders to reproduce the problem will be affected and that might have an impact on the information that passes on to the next generation. An incorrect representation of the problem, might have an impact not only at an individual level, but might result in a collective inability to solve the problem correctly.

Cognitive processes involved

Psycholinguistics

It is discussed in linguistics weather or not people make accurate representations of what they read. There is evidence that sentences are not exhaustively analysed and that we are happy to store merely good enough-representations.

Ferreira et al. (2002) propose a good-enough representation theory of language processing. According to them “comprehension is more shallow and incomplete than psycholinguists might have suspected” (Ferreira et al., 2002, p. 14) representations of a sentence are often incomplete and supported by the context or the compreehender schemas.

Good enough representations allow people to communicate in a more efficient way. Paradoxically they might cause problems in communication.

The good-enough representation might result from selective attention, similar to the processes that happen when change blindness occurs, since the inability to detect change might result to a lack of attention towards the critical parts of the text (Sturt et al., 2004).

One of the most studied semantic illusions it is the Moses illusion, "How many animals of each kind did Moses take on the Ark?". In answer to this problem, people fail to notice that it was Noah, not Moses, who built the Ark. This provides evidence that people do not encode all the information and rather encode a representation of the problem. Subjects are even able to reproduce problem with a semantic illusion without understanding there is something wrong with it (Erickson & Mattson, 1981). This type of illusion occur even without time pressure and when participants are asked to look for mistakes in the questions (Erickson & Mattson, 1981).

Erickson and Mattson (1981), divide sentence comprehension in three processes: an encoding process, a lexical access process and a construction process. On the last process only a global representation of the sentence is stored.

The way a text is initially perceived may shape the way in which it is assimilated. Information is integrated with our previous information and knowledge of the world (Fillenbaum, 1974).

In this study, memory processes involve only working memory, since participants are asked to reproduce the problem immediately after they have seen it.

It is also important, in a broader term, how information is stored and represented in our mind.

Conclusion

Using serial reproduction and recalls of information, the present thesis will bring a better understanding of the impact of no conflict detection on representations of the reasoning problems.

We expect that the inability to correctly represent problems of the first generation participants will amplify throughout generations, resulting in less correct responses in the third generation, comparing with the first generation. This could happen because, even when participants are themselves deliberatives, if they do not get the critical information, they will be giving a tight answer to the wrong problem.

No previous studies have used a serial reproduction paradigm with reasoning problems, nor have the social amplification of intuitiveness been explored. Since participants are asked to recall a problem, we can have a better access to the representation they have stored from the problem.

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Appendix 2 – Tables

Method

Table 6

native_language

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	english	87	96,7	96,7	96,7
	French	2	2,2	2,2	98,9
	German	1	1,1	1,1	100,0
	Total	90	100,0	100,0	

Table 7

nationality_01

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	1,1	1,1	1,1
	american	20	22,2	22,2	23,3
	british	59	65,6	65,6	88,9
	canadian	5	5,6	5,6	94,4
	German	1	1,1	1,1	95,6
	Indian	2	2,2	2,2	97,8
	Irish	1	1,1	1,1	98,9
	Singaporean	1	1,1	1,1	100,0
	Total	90	100,0	100,0	

Table 8

Age: What is your age?

generation	Mean	N	Standard Deviation
1	33,1000	30	11,92028
2	32,5667	30	11,29444
3	36,8667	30	12,29167
Total	34,1778	90	11,86590

Table 9

ANOVA

Age: What is your age?

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	329,622	2	164,811	1,175	,314
Within Groups	12201,533	87	140,248		
Total	12531,156	89			

Table 10

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	60	66,7	66,7	66,7
	Female	30	33,3	33,3	100,0
	Total	90	100,0	100,0	

Table 11

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5,700[a]	2	,058
Likelihood Ratio	6,104	2	,047
Linear-by-Linear Association	4,747	1	,029
N of Valid Cases	90		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 10,00.

Table 12

Correlations between recalls with conflict for problems 1, 2 and 3

		conflict_01	conflict_02	conflict_03
conflict_01	Pearson Correlation	1	,341**	,429**
	Sig. (2-tailed)		,001	,000
	N	90	89	90
conflict_02	Pearson Correlation	,341**	1	,267*
	Sig. (2-tailed)	,001		,011
	N	89	89	89
conflict_03	Pearson Correlation	,429**	,267*	1
	Sig. (2-tailed)	,000	,011	
	N	90	89	90

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 13

Correlations between problems 1, 2 and 3 read with conflict

		read_01	read_02	read_03
read_01	Pearson Correlation	1	,427**	,470**
	Sig. (2-tailed)		,000	,000
	N	90	90	90
read_02	Pearson Correlation	,427**	1	,263*
	Sig. (2-tailed)	,000		,012
	N	90	90	90
read_03	Pearson Correlation	,470**	,263*	1
	Sig. (2-tailed)	,000	,012	
	N	90	90	90

**. Correlation is significant at the 0.01 level (2-tailed).

Table 14

Correlations between deliberative answers given the first-time problem 1,2 and 3 were presented

		deliberativo_01	deliberativo_02	deliberativo_03
deliberativo_01	Pearson Correlation	1	,759**	,782**
	Sig. (2-tailed)		,000	,000
	N	90	90	89
deliberativo_02	Pearson Correlation	,759**	1	,724**
	Sig. (2-tailed)	,000		,000
	N	90	90	89
deliberativo_03	Pearson Correlation	,782**	,724**	1
	Sig. (2-tailed)	,000	,000	
	N	89	89	89

**. Correlation is significant at the 0.01 level (2-tailed).

Table 15

Correlations between right answers given the first time to problem 1, 2 and 3 were presented (right or wrong depending on what subjects read)

		ans01_01	ans02_01	ans03_01
ans01_01	Pearson Correlation	1	,586**	,665**
	Sig. (2-tailed)		,000	,000
	N	90	90	89
ans02_01	Pearson Correlation	,586**	1	,642**
	Sig. (2-tailed)	,000		,000
	N	90	90	89
ans03_01	Pearson Correlation	,665**	,642**	1
	Sig. (2-tailed)	,000	,000	
	N	89	89	89

**. Correlation is significant at the 0.01 level (2-tailed).

Table 16

Correlations between answers given the second time the problem 1, 2 and 3 were presented (original problem, with conflict)

		ans01_02	ans02_02	ans03_02
ans01_02	Pearson Correlation	1	,861**	,837**
	Sig. (2-tailed)		,000	,000
	N	90	90	89
ans02_02	Pearson Correlation	,861**	1	,837**
	Sig. (2-tailed)	,000		,000
	N	90	90	89
ans03_02	Pearson Correlation	,837**	,837**	1
	Sig. (2-tailed)	,000	,000	
	N	89	89	89

**. Correlation is significant at the 0.01 level (2-tailed).

Results

Table 17

ANOVA

Mean correct answers to the original problem

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	,743	2	,372	1,784	,174
Within Groups	18,126	87	,208		
Total	18,869	89			

Table 18

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
generation	90	1	3	2,00	,821	,000	,254	-1,517	,503
MeanRead	90	,00	1,00	,8667	,25868	-2,113	,254	3,947	,503
Mean recalls with conflict	90	,00	1,00	,7556	,31917	-1,112	,254	,147	,503
Mean deliberative answers	90	,00	1,00	,3407	,43555	,638	,254	-1,436	,503
Valid N (listwise)	90								

Table 19

Correlations between mean recalls with conflict and generation

		Mean deliberative answers	Mean problems recalled with conflict
Mean deliberative answers	Pearson Correlation	1	,435**
	Sig. (2-tailed)		,000
	N	90	90
Mean recalls with conflict	Pearson Correlation	,435**	1
	Sig. (2-tailed)	,000	
	N	90	90

**. Correlation is significant at the 0.01 level (2-tailed).

Table 20

Correlations between mean recalls with conflict and generation

		Mean problems recalled with conflict	generation
Mean recalls with conflict	Pearson Correlation	1	-,257*
	Sig. (2-tailed)		,014
	N	90	90
Generation	Pearson Correlation	-,257*	1
	Sig. (2-tailed)	,014	
	N	90	90

*. Correlation is significant at the 0.05 level (2-tailed).

Table 21

Correlations between generation and mean of deliberative answers

		generation	Mean deliberative answers
Generation	Pearson Correlation	1	-,199
	Sig. (2-tailed)		,060
	N	90	90
Mean deliberative answers	Pearson Correlation	-,199	1
	Sig. (2-tailed)	,060	
	N	90	90

Table 22

Partial Correlations

Control Variables			Mean problems read with conflict	Mean recalls with conflict	generation
-none-[a]	Mean problems read with conflict	Correlation	1,000	,591	-,380
		Significance (2-tailed)	.	,000	,000
		df	0	88	88
	Mean recalls with conflict	Correlation	,591	1,000	-,257
		Significance (2-tailed)	,000	.	,014
		df	88	0	88
	generation	Correlation	-,380	-,257	1,000
		Significance (2-tailed)	,000	,014	.
		df	88	88	0
generation	Mean problems read with conflict	Correlation	1,000	,552	
		Significance (2-tailed)	.	,000	
		df	0	87	
	Mean recalls with conflict	Correlation	,552	1,000	
		Significance (2-tailed)	,000	.	
		df	87	0	

a. Cells contain zero-order (Pearson) correlations.

Table 23

Run MATRIX procedure:

********** PROCESS Procedure for SPSS Release 2.16.3 **********

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2013). www.guilford.com/p/hayes3

****
Model = 6
Y = MeanDeli
X = generati
M1 = read_m
M2 = Mean_con

Sample size

90

****
Outcome: read_m

Model Summary

R	R-sq	MSE	F	df1	df2	p
,3803	,1446	,0603	14,8750	1,0000	88,0000	,0002

Model

	coeff	se	t	p	LLCI	ULCI
constant	1,1074	,0685	16,1764	,0000	,9714	1,2435
generati	-,1222	,0317	-3,8568	,0002	-,1852	-,0592

****
Outcome: Mean_con

Model Summary

R	R-sq	MSE	F	df1	df2	p
,5919	,3504	,0677	23,4608	2,0000	87,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	,1836	,1446	1,2692	,2077	-,1039	,4711
read_m	,6971	,1130	6,1692	,0000	,4725	,9217
generati	-,0148	,0363	-,4075	,6846	-,0870	,0574

****
Outcome: MeanDeli

Model Summary

R	R-sq	MSE	F	df1	df2	p
,4467	,1996	,1571	7,1471	3,0000	86,0000	,0002

Model

	coeff	se	t	p	LLCI	ULCI
constant	-,0507	,2224	-,2278	,8203	-,4928	,3915
read_m	,0959	,2064	,4648	,6433	-,3144	,5062
Mean_con	,5194	,1633	3,1796	,0021	,1947	,8441
generati	-,0419	,0554	-,7564	,4515	-,1520	,0682

********** DIRECT AND INDIRECT EFFECTS **********

Direct effect of X on Y

Effect	SE	t	p	LLCI	ULCI
-,0419	,0554	-,7564	,4515	-,1520	,0682

Indirect effect(s) of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
Total:	-,0637	,0258	-,1205	-,0193
Ind1 :	-,0117	,0187	-,0536	,0227
Ind2 :	-,0442	,0181	-,0920	-,0195
Ind3 :	-,0077	,0201	-,0501	,0311

Partially standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
Total:	-,1462	,0577	-,2700	-,0425
Ind1 :	-,0269	,0432	-,1218	,0535
Ind2 :	-,1016	,0405	-,2052	-,0453
Ind3 :	-,0176	,0461	-,1128	,0717

Completely standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
Total:	-,1200	,0473	-,2225	-,0356
Ind1 :	-,0221	,0353	-,1012	,0427
Ind2 :	-,0834	,0331	-,1705	-,0382
Ind3 :	-,0145	,0375	-,0925	,0585

Ratio of indirect to total effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
Total:	,6031	12,9666	,0370	4,8465
Ind1 :	,1111	8,5186	-,2858	2,3135
Ind2 :	,4192	11,7610	-,2289	3,1524
Ind3 :	,0728	7,7854	-,8921	,7117

Ratio of indirect to direct effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
Total:	1,5196	70,2122	,1225	409,3567
Ind1 :	,2799	31,1405	-,2834	85,1630
Ind2 :	1,0562	49,9223	,0652	221,5656
Ind3 :	,1835	17,3022	-,8596	15,7194

Indirect effect key

Ind1 :	generati ->	read_m ->	MeanDeli	
Ind2 :	generati ->	read_m ->	Mean_con ->	MeanDeli
Ind3 :	generati ->	Mean_con ->	MeanDeli	

********** ANALYSIS NOTES AND WARNINGS **********

Number of bootstrap samples for bias corrected bootstrap confidence intervals:
5000

Level of confidence for all confidence intervals in output:
95,00

------ END MATRIX -----

Appendix 3 – Generation 1 questionnaire (with original problems) [2]

INFORMED CONSENT STATEMENT

Dear participant,

with this questionnaire we want to know how people reason about problems. With your participation you can contribute to the growing body of knowledge in Science.

Any information obtained from you in this study will be strictly anonymous. There are no known risks for you to participate in this study. Participation is completely voluntary. You have the right to decline to participate and withdraw from the research now or at any time after the study has begun. You may do this by closing your web browser. At that time, all records of your participation will be destroyed.

Please only answer the questionnaire once.

For this study it is very important that you follow a few general instructions very thoroughly. The survey will take you under 5 minutes. Please **do not rush. Take some time to read the initial instructions carefully.** During the study please pay attention to the instructions on the screen and take your time while completing the tasks. **We also ask you not to switch tabs** while you participate in the study.

Thank you!

☐ In consideration of all of the above, I give my consent to participate in this research study.

Please enter your Prolific Participant ID in the box below:

Please start by answering the questions below:

What is your gender?

Male

Female

Other

What is your age?

What is your nationality?

What is your native language?

---

[2] Order of the problems was randomized.

Please answer the following problem:

A TV and a DVD are on sale.
Together they cost 110 cents.
The TV costs 100 cents more than the DVD.
How much does the DVD cost?

Now we ask you to recall the problem that you have just read, and write it down in the space below.
Try to be as accurate and detailed as possible.
Your description of the problem will be presented to the next participant, so that he/she can read and answer the problem as you recall it.
Therefore, it is very important that you are as accurate and detailed as possible.

Now you will see the same problem again or a slightly different version of this problem.
We ask you to answer the problem.
You may give the same answer as before, if you think that the problem is the same as before.
Or you may give a different answer, if you think that the problem is different.

A TV and a DVD are on sale.
Together they cost 110 cents.
The TV costs 100 cents more than the DVD.
How much does the DVD cost?

Please answer the following problem:

Anna and Sophie are collecting shells.
Together they found 12 shells.
Anna found 10 shells more than Sophie.
How many shells did Sophie find?

Now we ask you to recall the problem that you have just read, and write it down in the space below.
Try to be as accurate and detailed as possible.
Your description of the problem will be presented to the next participant, so that he/she can read and answer the problem as you recall it.
Therefore, it is very important that you are as accurate and detailed as possible.

Now you will see the same problem again or a slightly different version of this problem.
We ask you to answer the problem.
You may give the same answer as before, if you think that the problem is the same as before.
Or you may give a different answer, if you think that the problem is different.

Anna and Sophie are collecting shells.
Together they found 12 shells.
Anna found 10 shells more than Sophie.
How many shells did Sophie find?

Please answer the following problem:

A rock climber ties a long rope to a short rope.
Together the two ropes measure 88 meters.
The long rope is 80 meters longer than the short rope.
How much does the short rope measure?

Now we ask you to recall the problem that you have just read, and write it down in the space below.
Try to be as accurate and detailed as possible.
Your description of the problem will be presented to the next participant, so that he/she can read and answer the problem as you recall it.
Therefore, it is very important that you are as accurate and detailed as possible.

Now you will see the same problem again or a slightly different version of this problem.
We ask you to answer the problem.
You may give the same answer as before, if you think that the problem is the same as before.
Or you may give a different answer, if you think that the problem is different.

A rock climber ties a long rope to a short rope.
Together the two ropes measure 88 meters.
The long rope is 80 meters longer than the short rope.
How much does the short rope measure?

Thank you for completing this questionnaire!
We would like to thank you very much for helping us. Please advance to the next page to return to Prolific and complete your participation.

Appendix 4 – recalls from the participants, organized by generation

Recalls from the first generation (with replacements)

Problem 1_1

A TV and DVD is for sale for **110 cents**. The TV costs **100 cents**, how much does the DVD cost?

Problem 2_35_c1

Anna and Sophie are out collecting shells. Between them they collect 12 shells. **Of these 12 shells, Anna collected 10.** How many shells did Sophie collect?

Problem 3_35_c1

A rock climber ties two ropes together that measures to a length of **88 meters. The longer of the ropes is 80 meters in length.** What is the length of the shorter of the two ropes?

Problem 1_32_c2

TV and DVD are on sale. **Together they are 110. The TV costs 100**. How much does the DVD cost?

Problem 2_32_c2

Anna and **Sophie collected 12 shells. Anna collected 10 more shells tha**n Sophie. How many shells did Sophie collect?

Problem 3_2

One rope was **80 longer than the shorter one and both of them was 88.** How much does the short rope measure?

Problem 1_3

A TV and DVD are on sale. **Together they cost 110 cents. The TV costs 100 cents** more than the DVD. How much does the DVD cost?

Problem 2_3

Anna and Sophie look for shells. They find **12 shells. Anna found 10 more shells** than Sophie. How many shells did Sophie find?

Problem 3_3

A rock climber ties two ropes together and **they combine to be 88 metres in length**. The longer rope **is 80 metres longer than the** short rope. How long is the short rope?

Problem 1_4

A TV and a DVD are on sale. **together they cost $1.10. A TV costs $1 more than a DVD**. how much does a DVD cost?

Problem 2_4

Anna and Sophie are collecting shells. **Anna found 10 shells more than Sophie. Together they found 12 shells**. how many shells did Sophie find?

Problem 3_31_c4

A rock climber ties a long rope and a short rope. They total **88 meters. The long rope is 80 meters**, how long is the short rope?

Problem 1_5

A TV and a DVD are on sale. Together, they cost **110 cents**. The TV costs **100 cents** more than the DVD. How much does the DVD cost?

Problem 2_5

Anna and Sophie are collecting shells. Together, they found **12 shells. Anna found 10 more shell**s than Sophie. How many shells did Sophie find?

Problem 3_5

A rock climber ties a long rope and a short rope together. Altogether, the length of the two ropes is **88 metres**. The long rope is **80 metres longer** than the short rope. What is the length of the short rope?

Problem 1_6

A TV and DVD are on sale. In total, they cost **110 cents. The TV costs 100 cents more** than the DVD. How much does the DVD cost?

Problem 2_6

Anna and Sophie are collecting shells. They find a total of **12 shells. Anna found 10 shells** more than Sophie. How many shells did Sophie find?

Problem 3_6

A long rope, and a short rope are tied together. Together, they total **88 meters**. The long rope is **80 meters longer** than the short one. How long is the short rope?

Problem 1_7

A TV and DVD are on sale. **Together they cost 110 cents. The TV costs 100 cents more than the DVD.** How much does the DVD cost?

Problem 2_7

Anna and Sophie spent time looking for shells. **Together, they found 12 shells**. Anna **found 10 more shells than Sophie** did. How many shells did Sophie find?

Problem 3_7

A climber ties a long rope to a short rope. Together, the ropes combine to become **88 meters long**. The long rope is **80 meters longer than the short rope**. How long is the short rope?

Problem 1_8

A TV and a DVD are for sale. Their combined price is **110 cents. The TV costs 100 cents** more than the DVD. What does the DVD cost?

Problem 2_8

Anna and Sophie are collecting shells. **Together they found 12 shells. Anna found 10 shells more than Sophie.** How many shells did Sophie find?

Problem 3_8

A rock climber ties a long rope to a short rope. Their length together is **88m.** The long rope is **80m longer than the short rope**. How long is the short rope?

Problem 1_9

A TV and a DVD player are on sale **together for 110 cents**. The TV costs **100 cents more** than the DVD player. How much does the DVD player cost?

Problem 2_9

Annie and Michelle are collecting shells. **Together they have collected 12 shells**. If **Annie collected 10 more shells than Michelle**, how many shells did Michelle collect?

Problem 3_9

A rock climber ties a long rope to a short rope. Together the two ropes measure **88 metres in length. If the long rope is 80 metres longer t**han the short rope, how long is the short rope?

Problem 1_34_c10

TV and DVD are on sale. They both cost **110 cents. The TV costs 100 cents more** than the DVD. How much does the DVD cost?

Problem 2_34_c10

Anna and Sophie are collecting shells. Together they have collected **12 shells. Anna has collected 10.** So how many shells did Sophie collect?

Problem 3_34_c10

Long rope and short rope are there. **Together they are 88 meters long. The long rope is 80 meters longer than the shorter rope**. How much does the short rope cost?

Problem 1_11

A TV and a DVD are on sale. Together they **cost 110 cent**s. **The TV cost 100 cents more** than the DVD. How much does the DVD cost?

Problem 2_11

Anna and Sophie go to collect some shells. **Together they collect 12 shells**. **Anna collected 10 more shells than Sophie**. How many shells did Sophie collect?

Problem 3_11

A rocker climber ties a long rope to a short rope. **The two ropes together total 88 metres. The long rope is 80 metres longer than the shorter rope**. How long is the shorter rope?

Problem 1_12

You are buying a TV and a DVD. **Together they cost 1.10. The TV cost 1.00 more cents then the DVD.** How much does the DVD cost?

Problem 2_12

Annie and Sophia collected **12 seashells. Annie collected 10 more than Sophia**. How many did Sophia collect?

Problem 3_12

Two ropes measure **88 meters. Long rope is 80 meters longer than the short rope**. How long is the short rope?

Problem 1_13

A TV and a DVD are on sale. **Together they cost 110. The TV cost 100 more t**han the DVD. How much did the DVD cost?

Problem 2_36_c13

Anna and Sophie are collecting shells. They found **12 shells. Anna found 10 shells more** than Sophie. So how many shells did Sophie collect?

Problem 3_13

A long rope is tied to a short rope. **Together the two ropes measure 88 meters. The long rope is 80 meters longer** than the short rope. How long is the short rope?

Problem 1_14

A TV and DVD set costs **110 cents**. The TV costs **100 cents more** than the DVD. How much does the DVD cost?

Problem 2_14

Anna and Sophie are searching for Shells. Together they find **12 shells**. Anna finds **10 more** shells than Sophie. How many shells did Sophie find?

Problem 3_14

A climber ties a long rope and a short rope together. The two ropes measure **88 meters** tied together. The long rope **is 80 meters longer** than the shorter rope. How long is the shorter rope?

Problem 1_15

A TV and a DVD are on sale. In total, they both cost **110 cents. The TV costs 100 cents** more than the DVD. How much does the DVD cost?

Problem 2_15

Anna and Sophie are both collecting shells, **12 have been collected in total. Anna has 10 more shells** than Sophie. How many shells does Sophie have?

Problem 3_15

There are two ropes, one short and one long. Together, they equal **88cm. The long rope is 80cm**, so how long would the short rope be?

Problem 1_16

TV and DVD cost **110 cents. The TV costs 100 more.** How much does the DVD cost?

Problem 2_16

Annie and Sophie find **12 shells. Ana finds 10 more shells than S**ophie. How many shells does Sophie find?

Problem 3_16

Ties two ropes together. The two ropes are **88 meters together. The long rope is 80 meters longer than the short rope**. How short does the short rope measure?

Problem 1_17

A TV and DVD are for sale. Together they cost **110 Cents. The TV costs 100 cents more** than the DVD. How much does the DVD Cost?

Problem 2_17

A and B are collecting shells. A and B collect **12 shells total. A collects 10 more** shells than B. How many shells did B collect?

Problem 3_17

A rock Climber joins two ropes. Together the ropes are **88 meters long. Rope A is 80 meters longer** than rope B. How long is rope B?

Problem 1_18

A DVD and player **together cost 110 cents. The player is 100 cents more** than the DVD, how much does the DVD cost?

Problem 2_18

Anna and Sophie found **12 shells between them. Anna found 10 more** than Sophie, how many shells did Sophie find?

Problem 3_18

A climber has two pieces of rope, together they measure **88metres. One piece is 80 metres** longer that the other what does the other one measure?

Problem 1_19

A TV and DVD **cost 110 cents. The TV cost 100 cents more**. How much was the DVD?

Problem 2_19

There are **12 shells. Annie found 10 more than Sophie**. How many did Sophie find?

Problem 3_19

There are two ropes that total **88 feet. One is 80 feet longer.** How long is the shorter one?

Problem 1_20

A TV and DVD are on sale. Collectively they cost **110 cents. The TV costs 100 cents.** How many cents does the DVD cost?

Problem 2_20

Sophie and Anna were collecting shells. Collectively they collected **12 shells. Anna collected 10 more shells than Sophie.** How many shells did Sophie collect?

Problem 3_20

A rock climber ties a long rope to a short rope. Together the two ropes **measure 88 meters. The long rope is 80 meters longer** than the short rope. How much does the short rope measure?

Problem 1_21

A TV and DVD are sold together. **Together they cost 110 cents. The TV costs 100 cents** more than the DVD. How much does the DVD cost?

Problem 2_21

Anna and Sophie are collecting shells. Together they found **12 shells. Anna found 10 shells more than Sophie**. How many shells did Sophie find?

Problem 3_21

A rock climber ties a long rope to a shorter rope. Together the two ropes **measure 88 meters. The long rope is 80 meters longer** than the shorter rope. How much does the shorter rope measure?

Problem 1_36_c22

A TV and A DVD are on sale. The total price of the two products is **110 cents. The TV's price is 100 cents higher than the DVD'**s price. So how much does the DVD cost?

Problem 2_22

Two people together **collected twelve shells. The first girl caught ten of them.** How many did the second girl get?

Problem 3_22

Two ropes combined at **88 feet. The longer one is 80 feet longer** than the shorter one. How long is the shorter one?

Problem 1_23

A DVD and a DVD player cost **110 cents together. If the DVD player is 100 cents** more than the DVD. How much does the DVD cost?

Problem 2_23

The girls found **12 shells together. If one girl found 10 more shells** then the other, how many sells this the one who found the fewest find?

Problem 3_23

The problem that was presented wanted to know if you tied 2 pieces of rope together one measuring **80 feet longer than the other, what would be the length of the short rope if the total is 88 feet?**

Problem 1_24

The sum of a TV and DVD cost **110 cents in total. If the TV costs 100 cents**, how expensive is the DVD?

Problem 2_24

Anna and Sophie have collected **12 shells. Anna collected 10 more shells than Sophie**. How many shells did Sophie collect?

Problem 3_24

2 pieces of rope are tied together. One of the pieces is significantly longer than the other. The combined rope length is **88m and the longer rope is 80m.** What is the length of the shorter rope?

Problem 1_25

A TV and DVD are on sale. Together **they cost 110 cents. The TV costs 100 cents** more than the DVD. How much does the DVD cost?

Problem 2_25

Anna and Sophie are collecting shells. **Together they have found 12 shells. Anna found 10 shells more than Sophie.** How many shells did Sophie find?

Problem 3_25

A rock climber ties a long rope and a short rope together. Together the ropes are **88 meters long. The long rope is 80 meters longer** than the short rope. How long is the short rope?

Problem 1_26

There is a TV and DVD on sale. **They cost 110 cents together. The TV costs 100 cents more**. How much does the DVD cost?

Problem 2_26

Anna & Sophie are collecting shells. **All together they find 12. Anna found 10 more** than Sophie. How many shells did Sophie find?

Problem 3_26

A rock climber joins a long rope and a short rope. **Together they are 88 meters. The long rope is 80 meters longer** than the shorter rope. How long is the shorter rope measure?

Problem 1_27

A TV and a **DVD cost 110 cents. The DVD by itself costs 100**. How much more does the TV cost?

Problem 2_27

Anna and Sophie are collecting shells. They collected **12 shells total. Sophie collected 10 shells.** How many did Anna collect?

Problem 3_27

A rock climber attached a short rope to a long rope. Together they measure **88 feet. The long rope is 80 feet.** How long is the short rope?

Problem 1_35_c28

A TV and DVD are on sale and together they cost **110 cents. The TV costs 100 cents more** than the DVD. How much does the DVD cost?

Problem 2_28

If Anne and Sophie **collected 12 total shells and Anne had 10 more than Sophie**, how many did Sophie collect?

Problem 3_28

You have two ropes to tie together. **Total length needs to be 88 meters. The long rope is 80 meters longer than the short rope.** How long does the short rope need to be?

Problem 1_29

A TV and a DVD **together cost 110 cents. The TV costs 100 cents more than the DVD**. How much does the DVD cost?

Problem 2_29

Anna and Sophie are collecting shells. Together they find **12 shells. Anna found 10 shells more than Sophie**. How many shells did Sophie find?

Problem 3_29

A climber ties a long rope to a short rope. **Together the two ropes measure 88 metres. The long rope is 80 metres longer** than the short rope. How long is the short rope?

Problem 1_33_c30

A TV and DVD together cost **110 cents. The TV costs 100 cents more than the DVD** so how much does the DVD cost?

Problem 2_30

Annie and Sophie collected **12 shells, Annie collected 10 more** shells than Sophie. How many shells did Sophie collect?

Problem 3_30

A rock climber ties an **80-metre-long rope to a short rope. Together the rope is 88 metres** long. How long is the short rope?

Recalls from the second generation (with replacements)

Problem 1_01

A TV and a DVD cost **110 cents**. If the TV **costs 100 cents**, how much does the DVD cost?

Problem 1_02

Anna and Sophie have 12 shells. **Of those 12 shells, Anna collected 10 of them**. How many did Sophie collect?

Problem 1_03

A rock climber ties two ropes to each other, resulting in a length of **88 metre**s. The longer rope is **80 metres long**. How long is the shorter rope?

Problem 1_02

TV and DVD are on sale**. Together they cost 110. The TV cost 100**. How much does the DVD cost?

Problem 2_02

Sophie and Julie **collected 12 shells. If Sophie collected 10 shells more than Jul**ie, how many shells did Julie collect?

Problem 3_02

One rope was **80 longer than the shorter one and together they were 88**. How long was the short rope?

Problem 1_03

There is a TV and DVD on sale. **Their cost together is 110 cents. If the TV costs 100 cents more** than the DVD, what will be the cost of the DVD?

Problem 2_03

Anna and Sophie both are looking for shells and **find 12 shells. If Anna found 10 more shells than Sophie,** how many shells did Sophie find?

Problem 3_03

If a rock climber ties two ropes together and **they are 88 meters in length in total**. What is the length of the short rope if the longer rope is **80 meters longer** than the short rope?

Problem 1_04

A TV and a DVD are on **sale for £1.10. The TV costs $1 more than the DVD**. How much does the DVD cost?

Problem 2_04

Anna and Sophie are collecting shells. **Anna found 10 shells more than Sophie but in total they found 12 shells.** How many shells did Sophie find?

Problem 3_04

A climber ties a long rope and a short rope. **They both equal 88 metres with the long rope equalling 80 metres**. How long is the short rope?

Problem 1_05

A TV and DVD are **on sale for 110 cents together. The TV costs 100 cents more** than the DVD. How much does the DVD cost?

Problem 2_05

Annie and Sophie are collecting shells together. **They have found 12 shells. Anna found 10 shells more than Sophie.** How many Shells did Sophie find?

Problem 3_05

A rock climber ties a long rope and a short rope together**. Altogether, the length of the two ropes is 88 metres. The long rope is 80 metres longer than the short rope**. What is the length of the short rope?

Problem 1_31_c6

A TV and DVD player cost **in total 110 cents**. The TV costs **100 cents more** than the DVD player. How much does the DVD player cost?

Problem 2_31_c6

Together Anna and Sophie collect **a total of 12 shells. Anna found 10 more** shells then Sophie. How many shells did Sophie find?

Problem 3_31_c6

A long and short rope are tied together, **in total measuring 88m long**. The long rope is **80m longer** than the short rope. What is the length of the short rope?

Problem 1_07

A TV and DVD **together cost 110 cents. The TV costs 100 cents more** than the DVD. How much does the DVD cost?

Problem 2_07

Anna and Sophie **found 12 shells. Anna found 10 more than Sophie** found. How many shells did Sophie find?

Problem 3_07

There are two ropes. together they are **88 meters long. One longer rope is 80 meters longer** than the shorter rope. How long is the shorter rope?

Problem 1_08

A TV and DVD are for sale**. Their combined price is 110 cents. The TV costs 100 cents more than the DVD**. How much does the DVD cost?

Problem 2_08

Anna and Sophie are collecting shells. **Together they found 12 shells. Anna found 10 shells more** than Sophie. How many shells did Sophie find?

Problem 3_08

A rock climber ties a short rope and a long rope together. **Together their length is 88m. The long rope is 80m longer than the short rope**. How long is the short rope?

Problem 1_09

A TV and a DVD player are on sale for **110 cents together. The TV is 100 cents more than the DVD player.** How much is the DVD player?

Problem 2_09

Annie and Michelle have collected **12 shells. Annie has collected 10 more** shells than Michelle. How many shells has Michelle collected?

Problem 3_09

A long piece of rope is joined to a short piece of rope. **Together it measures 88 metres. The longer piece is 80 metres longer** than the short piece. How long is the short piece?

Problem 1_10

TV and DVD are on sale. **Together they cost 110 dollars. The tv costs 100 dollars more** than the DVD. How much did the DVD cost?

Problem 2_10

Anna and Sophie are collecting shells. **Together they have collected 12 shells. Anna has collected 10 shells,** how many did Sophie collect?

Problem 3_10

Long and short rope are there. **Together they measure 88 meters. The long rope is 80 meters longer than the short rope**. How long is the short rope.

Problem 1_11

A TV and DVD player bought together have a price of **110 cents. By itself, the TV is 100 cents more** expensive than the DVD player. How much does the DVD player cost?

Problem 2_11

Sophie and Anne collected shells on the beach. In total **they found 12 shells. Sophie found 10 more shells than Anne**. How many shells did Anne find?

Problem 3_11

A rock climber has two ropes that he's tying together. **Combined, they are 88m long. The longer rope is 80m longer** than the shorter one. How long is the shorter rope?

Problem 1_32_chain12

A DVD and TV **cost 1.10. The TV cost 1.00 more** cents than the DVD. How much does the DVD cost?

Problem 2_12

Annie and Sophia collected 12 seashells between them. Annie collected 10 more than Sophia, so how many did Sophia collect?

Problem 3_12

The total length of two ropes is **88 meters. The long rope is 80 meters longer than the short rope.** how long is the short rope?

Problem 1_13

A TV and DVD together **cost 110. If the TV cost 100 more** than the DVD how much did the TV cost?

Problem 2_13

Sophie and Anna together **found 12 shells. If Anna found 10 more s**hells than Sophie how many did Sophie find?

Problem 3_13

Two ropes tied together **add up to 88. If the long rope is 80** how long is the short one?

Problem 1_14

A DVD and TV costs 110 cents. The TV costs 100 cents more than the DVD. How much does the DVD cost?

Problem 2_14

Anna and Sophie together **collect 12 shells. Anna collects 10 more** shells than Sophie. How many shells did Sophie find?

Problem 3_14

A man ties two ropes together. **Together they measure 88 meters. The long rope is 80 meters longer** than the short rope. How long is the short rope?

Problem 1_15

A TV and DVD are on sale. **In total they cost 110cents. The TV costs 100cents more** than the DVD. How much does the DVD cost?

Problem 2_15

12 shells have been collected, Anna has 10 more shells than Sophie, how got many shells has Sophie got?

Problem 3_15

There are two ropes, one long, one short. **Together they equal 88cm. The long rope is 80cm.** How long is the short rope?

Problem 1_16

A TV and a DVD cost **110 cents together. The TV is 100 cents more** than the DVD. How much does the DVD cost?

Problem 2_16

Annie and Sophie find **12 shells. Annie finds 10 more** shells than Sophie. How many shells does Sophie find?

Problem 3_16

Two ropes tied together are **88 metres long. The first rope is 80 metres longer** than the second rope. How long is the second rope in metres?

Problem 1_17

A DVD and another thing cost 110 cents. That thing costs 100 cents more than the DVD. How much is the DVD?

Problem 2_17

A and B collect **12 shells. A collected 10 more shells** than B. How many shells did B collect?

Problem 3_17

Two ropes are 88 meters. Rope A is 80 meters longer than B. How long is rope B?

Problem 1_18

A **TV and DVD cost 110 cents. If the TV cost 100 cents**, how much did the DVD cost?

Problem 2_18

Annie and Sophie **collected 12 shells. If Annie collected 10 more** shells than Sophie, how many shells did Sophie collect?

Problem 3_18

A climber ties an **80 metre rope to another rope. Together, they are 88 metres long**. How long is the smaller rope?

Problem 1_19c

There is a TV and DVD **that cost 110 cents, the TV costed 100 cents more** so how much does the DVD cost?

Problem 2_19

There are **12 shells in total. Sophie found 10 more** than the other person. How much did the other person find?

Problem 3_33_c19

Two ropes are a **total of 88 feet long. One rope is 80 feet long**, how long is the other rope?

Problem 1_20

A TV and video are for sale collectively **costing 110 cents, the TV is 100 cents** how much is the video?

Problem 2_20

Anna and Sophie collected **12 shells all together, Anna collected 10 more shells** than Sophie, how many shells did Sophie collect?

Problem 3_34_c20

A rock climber ties two pieces of rope (a long piece and a short piece) together totalling **88 meters.** The long **piece measures 80 meters** longer than the short piece. How long is the short piece of rope?

Problem 1_35_c21

A TV and DVD are being sold together **for 110 cents. The TV costs 100 cents more** than the DVD. How much does the DVD cost?

Problem 2_35_c21

Anna and Sophie are collecting shells**. Together they found 12 shells. Anna found 10 more shells than Sophie.** How many shells did Sophie find?

Problem 3_35_c21

A rock climber has a long rope and a shorter rope. **Together they measure 88 meters. The longer rope is 80 meters longer** than the shorter rope. How long is the shorter rope?

Problem 1_22

A TV and DVD are for sale **together they cost 110 cents, the TV costs 100 cents more** than the DVD, how much is the DVD?

Problem 2_22

Two girls collected all **together 12 shells, one girl collected 10 more** shells than the other girl? how many shells did the other girl collect?

Problem 3_22

2 ropes combined are a total of **88 feet the long rope is 80 feet longer** than the smaller rope how long is the smaller of the ropes?

Problem 1_23

A DVD player and a DVD together **cost 110 cents. If the DVD player costs 100 cents,** how much does the DVD cost?

Problem 2_36_c23

Two girls found **12 shells together. One found 10**. How much did the other girl find?

Problem 3_23

The problem presented is that there are **2 pieces of rope. One is 80 feet longer** than the other. How long is the short rope if the total is 88 feet.

Problem 1_24

A TV and DV **player cost 110 cents. If the TV costs 100 cents**, how much does the DVD cost?

Problem 2_24

Sophie and Anna **have collected 12 shells. Anna has collected 10 more shell**s than Sophie. How many shells has Sophie collected?

Problem 3_24

2 pieces of rope are tied together. **The ropes have a combined length of 88m. If the long rope is 80m.** How long is the short rope?

Problem 1_25

The **TV and DVD together costs 110 cents. The TV costs 100 cents more** than the DVD, how much does the DVD costs?

Problem 2_25

Anna and Sophie collected **12 shells together. Anna collected 10 shells more than Sophie**, how many shells did Sophie collect?

Problem 3_25

A rock climber tied together a long and a short rope which together is **88metres long. The long rope is 80metres long**, what is the length of the short rope?

Problem 1_26

There is a TV and DVD player on sale. **Together they cost 110 cents. If the TV costs 100 cents more** than the DVD player, how much does the DVD player cost?

Problem 2_26

Anna and Sofie are collecting shells, they have **12 in total. Anna has 10 more** than Sofie. How many shells did Sofie collect?

Problem 3_26

A climber ties a short rope and a long rope together. In total, the **new rope measures 88 meters. One of the ropes measures 80 meters longer** than the other. How long is the short rope?

Problem 1_27

A **DVD player and TV cost 110 cents. The DVD cost 100**. How much did the TV cost?

Problem 2_27

Anna and Sophie **have 12 shells altogether, Sophie has 10 shells.** How many shells does Anna have?

Problem 3_27

A rock climber attached a long rope to a short rope. **The ropes measured a total of 88 feet. The long rope was 80 feet,** how long was the short rope?

Problem 1_28

A TV and a DVD cost **110 cents, the TV costs 100 cents more** than the DVD. How much did the DVD cost?

Problem 2_28

Annie and Sophie had **12 shells combined. If Sophie has 10 more shells** than Annie, how many shells does Annie have?

Problem 3_28

You have 2 pieces of rope, you have to tie them together with the **total length being 88 meters. The longer rope is 80 meters**, how long does the shorter rope need to be?

Problem 1_29

A TV and a DVD together cost **110 cents**. **The TV costs 100 cents more than the DVD**. How much does the DVD cost?

Problem 2_29

Anna and Sophie are collecting shells. Together **they find 12 shells. Anna finds 10 more** shells than Sophie. How many shells did Sophie find?

Problem 3_29

A climber ties a long rope to a short rope. **Together, they measure 88 meters. The long rope is 80 meters longer** than the short rope. How long is the short rope?

Problem 1_30

A TV and DVD **together cost 110 cents. The TV costs 100 cents more** than the DVD so how much does the DVD cost?

Problem 2_30

Annie and Sophie collected **12 shells, Annie collected 10 more** shells than Sophie. How many shells did Sophie collect?

Problem 3_37_c30

A climber ties a long rope to a short rope. **Together the two ropes measure 88 metres. The long rope is 80 metres longer** than the short rope. How long is the short rope?

Recalls from the third generation

Problem 1_01

A TV and a DVD cost 110 cents. The TV **costs 100 cents**, how much is the DVD.

Problem 2_01

Anna and Sophie have 12 shells, **Anna collected 10 of them**. How many collected Sophie?

Problem 3_01

A climber ties two ropes together and they are equal to 77 meters. **The length of the longer rope is 70 meters**, how much is the second rope!

Problem 1_02

TV and DVD are on sale, together they cost £110. If the **TV cost £100** how much did the DVD cost?

Problem 2_02

Sophie and Julie collected 12 shells. If Sophie collected **10 more** shells than Julie, how many shells did Julie collect?

Problem 3_02

two ropes together are 88 long, one rope was **80 longer**. How long was the shorter rope?

Problem 1_03

A TV and DVD cost 110 cents. The TV costs **100 cents more** than the DVD. How much is the DVD?

Problem 2_03

Anna and Sophie found 12 shells between them. Anna found **10 more** than Sophie. How many did Sophie find?

Problem 3_03

Two ropes have a total length of 88 m when tied together. The **longer rope is 80 m longer** than the sorter rope. How long is the shorter rope?

Problem 1_04

A TV and a DVD are on sale for £1.10. The TV costs **£1 more** than the DVD. How much does the DVD cost?

Problem 2_04

Anna and Sophie are collecting shells. **Anna collected 10 shells**. Sophie collected less shells than Anna. In total 12 shells were collected. How many shells did Sophie collect?

Problem 3_04

A climber ties a long rope and a short rope. They both equal 88 metres. The long rope measures **80 metres**. How long is the short rope?

Problem 1_05

A TV and DVD are on sale for 110 cents together. The TV costs **100 cents more** than the DVD. How much does the DVD cost?

Problem 2_05

Annie and Sophie are collecting shells together. They have found 12 shells. Anna found **10 shells more** than Sophie. How many Shells did Sophie find?

Problem 3_05

A rock climber has tied together a long rope and a short rope. The total length of the two ropes is 88 feet. If the long rope is **80 feet longer** than the short rope, what is the length of the short rope?

Problem 1_06

A TV and DVD player together cost 110 cents. The TV costs **100 cents more** than the DVD player. How much does the DVD player cost?

Problem 2_06

Anna and Sophie collect a total of 12 shells. Anna collected **10 more shells** than Sophie. How many shells did Sophie collect?

Problem 3_06

A long and a short rope are tied together for a total length of 88m. The long rope is **80m longer** than the short rope. How long is the short rope?

Problem 1_07

A TV and a DVD cost 110cents. The TV costs **100 cents more** than the DVD. How much does the DVD cost?

Problem 2_07

Anna and Sophie found 12 shells. Anna found **ten more** shells than Sophie. How many shells did Sophie find?

Problem 3_07

There are two ropes of differing lengths. The total length is 88m. **One rope is 80m longer** than the other. How long is the other rope?

Problem 1_08

TV and DVD combined cost 110 cents. **The TV costs 100 cents more** than DVD how much is the DVD?

Problem 2_08

Anna and Sophie found a total of 12 shells. Anna found **10 more** than Sophie. How many did Sophie find?

Problem 3_08

Rock climber ties a short and long rope together with a total length of 80m. The longer rope is **80m longer** than the short rope. How long is the shorter rope?

Problem 1_09

A TV and a DVD are on sale for 110 cents the TV costs **100 cents more** than the DVD how much does the DVD cost?

Problem 2_09

A rock climber ties a long rope to a short rope together they measure 88 metres the long rope is **80 metres longer** than the short rope, how long is the short rope?

Problem 3_09

Two pieces of rope are joined together they measure 88cm together **the longest rope is 80 cm,** how long is the shortest rope?

Problem 1_10

A television and DVD are on sale. Together they cost 110. The television costs **100 more** than the DVD. How much is the DVD?

Problem 2_10

Anna and Sophie are collecting shells. Together they collected 12 shells. **Anna collected 10.** How many did Sophie collect?

Problem 3_10

There is a long rope and a short rope. In total they are 88 meters. **The long rope is 80 meters longer** than the short rope. How long is the short rope?

Problem 1_11

A TV & DVD player purchased as a single package costs 110 cents. By itself, **the TV is 100 cents more** expensive than the DVD player. What does the DVD player cost?

Problem 2_11

Sophie and Annie were looking for shells. In total they collected 12 shells. **Annie found 10 more shells** than Sophie. How many did Sophie find?

Problem 3_11

A rock climber is connecting two ropes, one long and one short. Combined, the ropes are 88m long. **The long rope is 80m longer**. How long is the short rope?

Problem 1_12

A TV and a DVD costs $1.10 together, and the **TV costs $1.00 more** than the DVD. How much was the DVD?

Problem 2_12

Annie and Sophia collected 12 seashells altogether. **Annie collected 10 more** than Sophia. How many did Sophia collect?

Problem 3_12

Two ropes together are 88 metres long. The long rope is **80 metres long**. How long is the short rope?

Problem 1_13

A DVD and a TV together cost 110. **If the DVD cost 100 more** than the TV, how much did the TV cost?

Problem 2_13

Sophie and Anna collect 12 shells. If Anna collected **10 more shells** than Sophie, how many shells did Sophie collect?

Problem 3_13

Two ropes tied together add up to 88. If **the long rope is 80**, how long is the short one?

Problem 1_14

A TV and a DVD cost 110 cents in total. The TV costs **100 cents more** than the DVD. How much does the DVD cost?

Problem 2_14

Anne and Sophie collect 12 shells together. Anne **collects 10 more** than Sophie. How many shells did Sophie collect?

Problem 3_14

Two pieces of rope are tied together and measure 88 meters in total. If the long rope **measures 80 metres**, how much does the short rope measure?

Problem 1_15

A TV and a DVD are on offer. The total cost is $110. The TV costs **$100 more** than the DVD. How much is the DVD on sale for?

Problem 2_15

There are 12 shells. Anna has **10 more shells** than Sophie. How many shells does Sophie have?

Problem 3_15

There are two ropes, one long and one short. The length of the ropes in total is 88cm. **The long rope is 80cm.** How long is the shorter rope?

Problem 1_16

A DVD player and DVD together cost £110. The DVD player is **£100 more** expensive than the DVD. How much did the DVD player cost?

Problem 2_16

There are 12 shells, Sophie has **10 more shells** than her friend, but how many does she have in total?

Problem 3_16

There are two pieces of rope together which measure out to 88cm. The first part is **80cm longer** than the second. Therefore, what is the length of the second piece?

Problem 1_17

A DVD and another thing cost 110 cents. that other thing costs **100 cents**. how much does the DVD cost?

Problem 2_17

A and B collected 12 shells. A collected **10 more shells than** B. How many shells did B collect?

Problem 3_17

Rope a and b measure 88 meters together. rope a is **80 meters longer** than rope b. how long is rope b?

Problem 1_18

A TV and DVD costs 110 cents. If the **TV costs 100 cents**, how much does the DVD cost?

Problem 2_18

Annie and Sophie together collected 12 shells. If Annie collected 10 more shells than Sophie, how many shells did Sophie collect?

Problem 3_18

A climber ties an 80 metre rope to another rope. Together they are 88 metres in length. How long is the smaller rope?

Problem 1_19

The TV and DVD cost 110 and DVD cost 10 the DVD is to cheap ~~thats all i say~~

Problem 2_19

sophi found 10 that left 2

Problem 3_19

the rope is only 8 feet long

Problem 1_20

A TV and a video are for sale collectively for 110 cents. If the TV costs 100 cents, how much is the video?

Problem 2_20

Anna and Sophie collected 12 shells altogether. Anna collected 10 more shells than Sophie. How many shells did Sophie collect?

Problem 3_20

A rock climber ties two pieces of rope together, a long piece and a short piece. Together they measure 88metres. The longer piece measures 80 metres, how long is the short piece?

Problem 1_21

A TV and DVD are being sold together for 110 cents. The TV costs 100 cents more than the DVD. How much does the DVD cost?

Problem 2_21

Anna and Sophie were collecting shells, in total they found 12 shells. Anna found 10 more shells than Sophie. How many shells did Sophie find?

Problem 3_21

A rock climber has a long rope and a short rope. Together the ropes are 88m in length. The longer rope is 80m longer than the shorter rope. How long is the short rope?

Problem 1_22

The TV and DVD together cost 110 cents. The TV cost 100 cents more than the DVD. How much did the DVD cost?

Problem 2_22

Anna and Sophie collected 12 shells together. Anna collected 10 more shells than Sophie. How many shells did Sophie collect?

Problem 3_22

A rock climber tied together a long and a short rope. The combined length is 88 metres. The long rope is 80 metres. How long is the short rope?

Problem 1_23

A DVD player and a DVD together cost 110 cents. How much does the DVD cost if the player costs 100 cents?

Problem 2_23

2 girls found 12 shells together. One found ten. How many did the other girl find?

Problem 3_23

There are two pieces of rope. In total, they are eighty eight feet long. One is eighty feet longer than the other. How long is the second rope if the first one is eighty eight feet?

Problem 1_24

A TV and a DVD are for sale for the cost of 110 cents. The TV costs 100 cents more than the DVD. How did the DVD cost?

Problem 2_24

Two girls collect 12 shells. One collects 10 more than the other - how many shells did the other girl collect?

Problem 3_24

Two ropes have a combined length of 88 feet. The longer rope is 80 feet longer than the shorter rope. How long is the shorter rope?

Problem 1_25

A TV and DVD cost 110 cents. The TV costs 100 cents. how much does the DVD cost?

Problem 2_25

Sophie and Anna collected 10 shells. Sophie collected 8 how many did Anna collect?

Problem 3_25

2 ropes ties together are 88mm. one rope is 80mm. how long is the other rope?

Problem 1_26

A TV and DVD player is for sale and together costs 110 cents. The TV costs 100 cents more than the DVD player. How much did the DVD player cost?

Problem 2_26

Anna and Sofie are collecting shells. Anna has 10 more than Sofie. How many shells did Sofie collect?

Problem 3_26

A climber ties a short and long rope together. In total, the new rope measures 88 metres. One rope measures 80 metres longer than the other. How long is the shorter rope?

Problem 1_27

A DVD player and TV cost 110 cents. The DVD player is 100. How much is the TV?

Problem 2_27

Anna and Sophie have 12 shells but Sophie has 10. How many does Anna have?

Problem 3_27

A rock climber joined a long rope to a short one. The ropes measured 88 feet. The long one was 80 feet so how long was the short one?

Problem 1_28

A TV and DVD cost 110 cents combined. The TV costed 100 cents more then the DVD. How much did the DVD cost?

Problem 2_28

Annie and Sophie had 12 shells combined. Sophie has 10 more shells than Annie. How many shells does Annie have?

Problem 3_28

You have 2 pieces of rope and you have to tie them together with the total length being 88 meters. The longer rope is 80 meter. How long does the shorter rope need to be?

Problem 1_29

The TV costs 100 cents more than the DVD. How much does the DVD cost?

Problem 2_29

Anna and Sophie are collecting shells. Together Anna and Sophie collect 12 shells. Anna collected 10 more shells than Sophie. How many shells did Sophie collect?

Problem 3_29

A climber ties a short rope to a long rope. The length of the two ropes ties together is 88 meters. The long rope is 80 meters longer than the short rope. How long is the short rope?

Problem 1_30

The TV cost 100 cents more than the DVD player. How much did the DVD player cost?

Problem 2_30

Annie and Sophie collected 12 shells together, Annie collected 10 more than Sophie, how many did Sophie collect?

Problem 3_30

A climber ties a long rope together with a short rope for a total length of 88 meters. The long rope is 80 meters longer than the short rope, how long is the short rope ?