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Post-decision consolidation and distortion of facts

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Abstract

Participants decided whom of two patients to prioritize for surgery in three studies. The factual quantitative information about the patients (e.g., probability of surviving surgery) was given in vignette form with case descriptions on Visual Analogue Scales — VAS's. Differentiation and Consolidation theory predicts that not only the attractiveness of facts but also the mental representations of objective facts themselves will be restructured in post-decision processes in support of a decision (Svenson, 2003). After the decision, participants were asked to reproduce the objective facts about the patients. The results showed that distortions of objective facts were used to consolidate a prior decision. The consolidation process relied on facts initially favoring the non-chosen alternative and on facts rated as less, rather than more important.

Keywords: cognitive psychology, decision making, medical decisions, coherence, differentiation and consolidation.

1 Introduction

Differentiation and Consolidation, Diff Con, theory is a process theory of human decision making. It models decision making as a process involving different kinds of sub processes leading to a final decision (Svenson, 1992, 2003, 2006). According to the theory human decision makers structure and restructure both evaluations and facts about decision alternatives when they make a decision and after the decision. The goal of that process is to reach sufficient support for the chosen alternative. For example, a positively evaluated aspect of the initially preferred alternative can be bolstered to make the alternative seem even better when a decision has been reached. In the post-decision consolidation phase this process continues to strengthen the decision when afterthoughts and outcomes follow. The theory shares a process and attractiveness restructuring approach to decision making with a number of other models of human decision making (Festinger, 1957, 1964; Janis & Mann, 1977, Mather, Shafir & Johnson, 2003; Montgomery, 1983; Payne, Bettman & Johnson, 1993; Russo, Medvec & Meloy, 1996; Simon, Pham, Le & Holyoak, 2001; Simon, Snow & Read, 2004), some of which were reviewed by Brownstein (2003) and by Simon, Snow and Read (2004). Empirical decision research has shown time after time that value/attractiveness evaluation and diagnostic value of facts are restructured before and after a decision, supporting these theories (Brownstein, 2003; Carlson & Klein Pearo, 2004; Glöckner & Engel, 2008; Russo, Medvec & Meloy, 1996; Russo, Carlson & Meloy, 2006; Salo & Svenson, 2001; Simon, Krawczyk & Holyoak, 2004; Simon, Krawczyk, Bleicher & Holyoak, 2007; Svenson, 1996, 2003, 2006; Svenson & Shamoun, 1997). That is, the chosen alternative is upgraded in attractiveness or in diagnostic value of evidence pro that alternative (Simon, Krawczyk & Holyoak, 2004), and/or the non- chosen alternative is downgraded before and after a decision.

However, there is a lack of empirical investigations of consolidation of facts in themselves. If a decision maker is given objective travel time (e.g., 40 min) as a fact of one alternative in a decision between two job offers, she or he may change the *evaluation of this fact* (e.g. from "relaxing" to "boring") in the process of making a decision. This evaluation does not mean that the *quantitative facts representation* must change. The decision maker should be able to communicate the exact travel time (e.g., 40 min within a non-systematic random error) even if there was an evaluative restructuring and no facts restructuring. Facts consolidation appears when the quantitative or

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qualitative facts of a decision problem are communicated or reproduced in a distorted way in support of a decision.[1]

The hindsight paradigm introduced by Fischhoff (1975, 2007) uses a judgment approach that has some similarity with the present decision approach but with a focus on the post-event outcome phase. Fischhoff, and other researchers following him, studied how the memory of a person's prior quantitative probability judgments (a kind of self generated quantitative "fact") was distorted after outcome knowledge. They found that in general the quantitative distortions were in the direction of "we knew it all before" bias. Mather, Shafir and Jonhson (2001, 2003) studied post-decision memory attributions to the chosen and the non-chosen alternative(s) after a decision with alternatives described by qualitative features of varying attractiveness. They found that features with positive attractiveness were attributed comparatively more often to the chosen alternative than to the non-chosen alternative. The opposite was found for negative features. When an alternative was assigned to participants, the memory attributions were less supportive of the assigned option than for an option that was chosen voluntary. This shows that the decision process had a selective effect on memories of evaluative features. Gurkmankin Levy and Hershey (2006) had their participants make treatment choices (yes or no) concerning a medical treatment with side effects and a success rate of 40%. However, "since all patients are different he [the doctor] can't be certain that this is your probability" (Gurkmankin Levy & Hershey 2006 p. 57). This instruction communicated uncertainty about the probability fact that was used in distortions supporting a participant's choice.

Instead of investigating qualitative evaluative features or uncertain probabilities, the present studies will investigate precise quantitative facts on well-defined attributes to find out if the facts are distorted in post-decision memory reproductions. To specify, the present studies were designed to test the Diff Con prediction that facts are restructured in post-decision consolidation.

If the hypothesis is confirmed, the sub-processes of the restructuring process will be investigated. One example is the subprocesses restructuring the mental representations of both the chosen and the non-chosen alternative. Is the chosen alternative restructured to a greater extent than the non-chosen alternative? This is a new problem that has not been focused on in the past, since the attractiveness of facts or the diagnosticity of facts were in focus — not the facts in themselves. Earlier studies of differentiation and consolidation have shown that attractiveness restructuring does not normally appear on the most important decisive attribute to support a choice. Instead, this is a kind of restructuring that focuses on important conflict attributes that favor a non-chosen alternative. In fact, attractiveness consolidation processes in a real-life decision sometimes turn disadvantages of a chosen alternative into advantages after the decision. This was first reported by Svenson and Hill (1997) and later verified by Salo and Svenson (2001) in another real-life context. We do not expect such drastic restructuring of facts, but according to Diff Con we predict no systematic changes on the most important decisive attribute but systematic changes of other attributes and in particular changes of facts supporting the non-chosen alternative.

We also want to introduce the Visual Analogue Scale, VAS, in a way that is new to decision process research. This scale has been used primarily in health care to measure pain and in other contexts as a quantitative response scale. But, in the present context it will be used to give information about facts. According to Diff Con theory, a decision has to be sufficiently involving and important to trigger differentiation and consolidation processes. Therefore, we will use a difficult and engaging medical problem in the following empirical studies.

We predict (1) that facts consolidation will restructure and distort the reproductions of quantitative facts in support of the chosen alternative, (2) that quantitative facts restructuring will follow the same pattern as attractiveness restructuring and concern predominantly other attributes than the most important decisive attribute, and in particular conflict attributes, (3) that facts restructuring can be achieved through changes of both the chosen (increasing facts support) and the non-chosen alternative

[1]Decision processes, like any other processes, are described in relation to a structure where the processes take place and change the structure. To illustrate, in order to describe how one job offer gradually improves over another alternative in a decision process (the process) it is necessary to postulate how the job offers should be described (structure). Decision alternatives can be represented in a holistic way as entities in themselves in a structure. However, usually the structure of a decision problem is described in a more decomposed way using, for example, an alternative x attribute (or dimension) representation matrix. An aspect is the primitive or smallest postulated unit in this representation and it is associated with *physical/objective* (e.g., a color), *subjective cognitive* (perceived color) and *evaluative* (e.g., attractiveness of the color) representations. The evaluative or attractiveness representations of aspects can be mapped on attribute scales. To illustrate, in a job preference decision problem one alternative may be represented by 30 min travel from home to work. This is the *objective* physical factual representation of that aspect (f_1). When traveling or thinking of the travel, the time may be perceived or *subjectively cognitively* represented (c_1) as longer or shorter (depending on what activity is carried out during the travel, how monotonous the travel is etc.). However, if the decision maker is asked about the objective travel time she or he should be able to give the objective time irrespective of whether it is perceived as long or short. Finally, the evaluation *attractiveness* (a_1) of the travel is determined by the perceived travel time mapped onto the decision maker's value system and her or his affective reactions. The attractiveness represents what the decision maker values in life (e.g., using public transport is good, I like a comfortable and short travel) and reactions of an affective emotional kind (e.g., I feel subway tunnels give me claustrophobic feelings). The *importance* of different attributes for a decision can be represented on rank order scales or on more advanced scales. To exemplify, the salary may be more important than the distance to a job (within a certain range) or it may be twice as important.

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(weakening facts support for the non-chosen alternative). We also want (4) to introduce facts presented on VAS scales. The design will be balanced in order to control for response regression effects easily confounded with true restructuring processes depending on a prior decision.

In the first study, economics students serve as participants, and we use the VAS, visual analogue scale, to present a medical vignette case. The second study replicates the first study with a group of participants who are familiar with medical problems and the VAS. Finally, the third study asks whether results from the earlier studies replicate with a new group of participants.

2 Study 1

Study 1 examines post-decision representations to detect post-decision consolidation and possible post-decision consolidation changes.

2.1 Method

2.1.1 Participants

A total of 64 students of economics at the University of Stockholm participated in the study. There were 31 female and 33 male participants aged from 21 to 42 years with a median of 25 years.

2.1.2 Material

Decision Problem. The problem was to prioritize a male or a female patient for surgery. The woman was presented in the left column and the man in the right column on an A4 sheet of paper. The instructions stated that the existing resources allowed only one of the patients to have surgery. The patient who was given priority and surgery would survive with given probabilities and the patient not given priority would die within some time. The vignettes describing the patients were condensed into measures on 5 VAS scales for each of the two patients in order to achieve full experimental control: (1) *Age of the patient* (left endpoint = 0 years, right endpoint = 50 years), (2*) Expected survival time without surgery in months* (left endpoint = 0 months, right endpoint = 5 months), (3) *Probability of surviving surgery* (left endpoint = 0, right endpoint = 100%), (4*) Probability of surviving 5 years if having survived surgery* (left endpoint = 0, right endpoint = 100%), and (5) *Expected quality of life if surviving surgery* (left endpoint = completely handicapped right endpoint = completely healthy). The facts, each given on 56 mm long VAS scales are given in Table 1. Each patient was described by small vertical lines on the VAS. Greater values on scales (3), (4) and (5) speak for priority of surgery, while the opposite is true for scales (1) and (2).

Control of response anchoring effects on the VAS. When analyzing quantitative responses from visual analogue scales (VAS), there are two main response biases that may distort the results. One is response regression towards the middle of a scale and the other is response regression towards one of the end points of the scale (Poulton, 1989). With the aim of controlling for this, the scales with factual information were counter balanced pair-wise. This can be inferred from the numbers describing facts in Table 1. To exemplify, the markings for attributes (1) and (2) were balanced so that the age for the woman was marked at the same place on the scale as the life length of the man without operation.

In a consolidation process a younger age of the woman would speak for prioritizing her and an older age of the man without the operation would also speak for priority of the woman. If the woman is prioritized, Diff Con predicts that the age of the woman should decrease when restructured and the expected life length of the man without surgery should increase in comparison with the factual information given. In that case, the facts from exactly identical positions on the two scales are changed in different directions, and any response bias effects are canceled out. The corresponding relationship holds for the life length of the woman without surgery and the age of the man. If the life length of the woman without surgery is decreased and the age of the man is increased it supports facts restructuring in favor of prioritizing the woman. Attributes (3) and (4) have the same kind of balanced pattern of facts that controls for response bias effects. Attribute (5) with facts at the midpoint of the scales for both patients needs no parallel scale because any response bias would have the same effect on the ratings for both patients. The decision maker's involvement was measured by an involvement scale.[2]

2.1.3 Procedure

Participants were given questionnaires in four consecutive sets. The *first set* consisted of the information about the patients on VAS's followed by the decision sheet on which the participants marked their decision and how much each attribute favored surgery for each of the two

[2]The 8 item involvement scale consists of the following items: (1) *This decision is important to me*, (2) *I am interested in this decision*, (3) *This decision is relevant for me*, (4) *This decision is meaningful to me,* (5) *This is a decision that I think about a lot*, (6) *I do engage myself in this decision*, (7) *In general, when I make decisions, it is very important for me to have made the right decision*, (8) *In general it is important to me that I have chosen the correct alternative.* The positions of the positive and negative ends on the response scales were altered between items in the questionnaire. Chronbach's α for the involvement scale was 0.83.

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Table 1: Facts and reproduced facts about patients in Study 1. Data for participants who prioritized the woman for surgery.

Given facts		Reproduced			
		1^{st} time		2^{nd} time	
Man	Woman	Man	Woman	Man	Woman
(1) Age (years)					
33.6	22.4	33.14 *ns*	21.83 *ns*	33.75 *ns*	20.69 *
		(4.64)	(5.95)	(6.21)	(5.68)
(2) Expected time to live without surgery (months)					
22.4	33.6	26.18 **	29.45 **	26.90 ***	28.44 ***
		(10.00)	(9.45)	(7.95)	(9.42)
(3) Probability of surviving surgery					
14.0	42.0	16.76 **	40.10 *	16.76 **	40.48 *ns*
		(7.07)	(5.32)	(6.52)	(5.95)
(4) Probability of surviving 5 years if surviving surgery					
42.0	14.0	35.08 ***	19.60 ***	35.26 ***	20.57 ***
		(8.65)	(8.02)	(8.68)	(9.62)
(5) Expected quality of life if surviving surgery (0 = complete handicap, 100 = perfect health)					
28.0	28.0	29.54 *	28.80 *ns*	28.83 *ns*	29.50 *ns*
		(5.22)	(5.99)	(4.17)	(6.04)

Note. Data for 55 participants who prioritized the woman for surgery. Standard deviation are in parentheses. Differences between facts given and reproductions are significant at * $p \leq .05$, ** $p \leq .01$, and *** $p \leq .001$, two-tailed.

patients. The participants rated the importance of the attributes, including gender, by rank ordering them from 1 (most important) to 6 (least important). After this the involvement scale was administered. The *second set* of items attached to the first set served as an intermission session during which the participants were given a set of unrelated questions about traffic safety. After having returned set 1 and 2 to the experimenter, the third set was given to the participants. In this set, they were first asked to indicate which patient they had chosen in the previous decision. Then, the man and woman cases were presented again together with the VAS attributes but without the markings giving the facts about each of the patients. The task of the participants was to indicate exactly the same facts as provided earlier when they made their decisions by replicating the markings on the empty VAS scales. When the participants had completed this task they returned the form to the experimenter and received the *fourth set* of questionnaires. They again reproduced the VAS markings and then they filled out the involvement scale once more. The second reproduction was included to find out if consolidation changed over a short period of time. As will be clear in the following this was not the case. The test sessions took place in a lecture hall and the participants needed about 45 min to complete the questionnaires.

2.2 Results

A majority, 55 of the participants decided to prioritize the woman and 9 participants the man. In the following, we will first focus our analyses on the more reliable data from the majority group. Then, the minority group results will be analyzed in comparisons with the majority group results. The involvement scale indicated an above-the-midpoint level of involvement in the problem, with an average of 45.6 on a scale from 0 (no) to 64 (maximum) involvement. Hence, the Diff Con requirement of involvement to trigger differentiation and consolidation was fulfilled.

Table 1 shows the averages of the reproduced facts for the group of participants who prioritized the woman. A comparison of the results of the first and second reproductions in Table 1 did not show any significant overall dif-

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ference. Thus, in general, post-decision consolidation did not build up or weaken significantly from the first to the second reproduction. As will be seen later there was one exception from this general finding. Because of the general trend, session 2 reproductions will be used in the following if nothing else is indicated. We first computed an index of consolidation (described below). This index was used to investigate facts distortion in support of surgery of the woman. The majority of participants who prioritized the woman (selected alternative) were compared with the minority of participants who prioritized the man (and had the woman as a non-selected alternative). Diff Con predicts that the former group should distort more in favor of the woman than the latter group.

2.2.1 Consolidation index and consolidation of the woman alternative

In the first row of Table 1 and the second memory reproduction the woman (chosen alternative) was rated as younger (20.69) than the objectively given age (22.4) and the man slightly older than his factual age. This example represents facts restructuring in support of the chosen alternative, because the difference advantage for the woman is increased from 11.20 (33.60−22.40) to 13.06 (33.75−20.69).

The second attribute in the second memory reproduction shows that the man was judged to live longer and the woman shorter without surgery compared to the facts. This also supports a preference difference in support of surgery of the woman. Note that the advantage to the woman is a difference and that the difference between the woman and the man can increase as an indicator of consolidation even if the support for the man also increases significantly. In such a case, support for the woman has to increase sufficiently more than the support for the man.

Memory reproduction differences from the correct values on the third attribute in session 2 show that the probability of surviving surgery becomes greater than the objective facts for the man and smaller for the woman. These differences seem to speak against the chosen alternative. However, note that these changes may also reflect response biases towards the middle of the response scale (Poulton, 1989). This makes it difficult to evaluate the effect of post-decision consolidation on singular scales.

Fortunately, the present design enables a comparison of the reconstructions from 14.0 to 16.76 on attribute (3) and from 14.0 to 20.57 on attribute (4) (second reproduction Table 1). The comparisons indicate that an increase in support of the chosen alternative is 3.81 units greater when the effects of response regression biases are eliminated. This is because the difference is (20.57 - 16.76) = [(*true reproduced value attribute* (4) + *response regression* + *random error*) -(*true reproduced value attribute* (3) + *response regression* + *random error*)] for the two attributes evaluated jointly with the response regression effect eliminated.

All changes of values for the woman were scaled so that positive numbers indicated increased support for prioritizing the woman. The differences supporting the woman choice concerning the woman alternative are the following. (1) *Objective age of woman – reproduced age*, (2) *objective time to live without surgery – reproduced time*, (3) *reproduced probability of surviving surgery – objective probability of surviving surgery,* (4) *reproduced probability of surviving 5 years – objective probability of surviving 5 years* and (5) *reproduced quality of life – objective quality of life*. The sum of these differences gives the overall advantage difference in consolidation supporting woman priority for surgery. (The numbers in parentheses refer to the attributes in Table 1.)

However, downgrading the non-chosen alternative is also part of decision consolidation. Therefore, the corresponding differences for the man alternative supporting the prioritization of the woman were also computed, (1) *reproduced age of man —objective age of man* etc. Hence, the man's disadvantages serve as advantages supporting a woman choice.

Because the VAS scales were balanced, eliminating response anchoring biases, we summed the advantage differences across attributes for each alternative and for each participant. The average sum of advantages supporting the woman alternative (21.22, second memory reproduction) represents a significant consolidation effect different from the hypothesis of a zero difference between the given facts and the reproduced facts $t(54) = 6.43$, $p \leq 0.001$, two tailed test.

The average sum of advantages in support of the woman in the woman prioritizing group (22.04) was compared with the average sum of advantages in support of the woman in the man prioritizing group (−5.69) (with the woman as a non-chosen alternative) and the difference was significant $t(62)=2.99$ $p \leq 0.01$ (two tailed test, second reproduction). This shows that the participants upgraded the chosen alternative more than they upgraded the non-chosen alternative.

Another research issue was whether the upgrading of the chosen alternative and the downgrading of the non-chosen alternative were equally strong in the woman prioritizing group. In a test of the mean sum of advantages upgrading the woman alternative compared with the mean sum of advantages for the woman by downgrading the man alternative (second memory reproduction) it was clear that the consolidation effect depended significantly more on upgrading the chosen (+13.42, no upgrading at all = 0) than downgrading the non-chosen alternative (−7.79). The difference 13.42 - 7.79 was statistically significant, $t(54) = 2.70$, $p \leq 0.01$ (two tailed test). The

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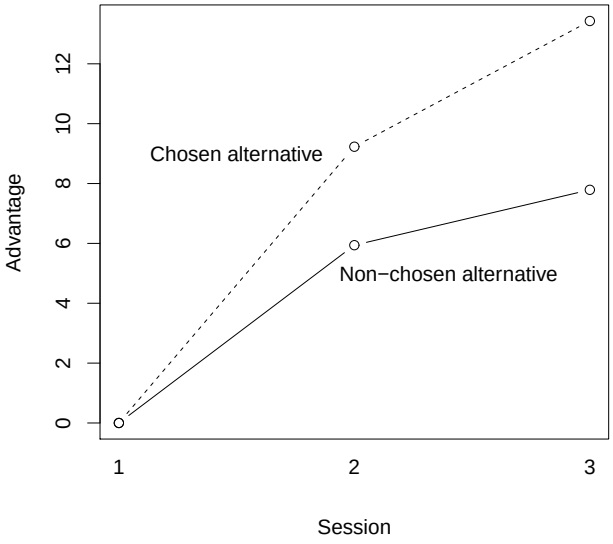

Figure 1: Mean sum advantage supporting chosen alternative (woman patient) deriving from upgrading the chosen alternative (dotted line) and degrading the non-chosen alternative (solid line) across sessions in Study 1.

selective consolidation of the woman and man alternatives developed gradually because the corresponding values at the first memory occasion were +9.22 and −5.94 but the greater upgrading of the woman was not significantly different from the downgrading of the man at that time. Note that the downgrading of the non-chosen alternative is an advantage to the chosen alternative, as shown in Figure 1.

The judged importance of the different attributes on a scale from 0 (= not at all important) to 100 (= maximally important) gave the following result. The most important attribute was *Probability of surviving surgery*, M = 75.8 (*SD* of mean = 3.84), followed by *Age*, M = 58.5 (4.45), *Quality of life* M = 55.8 (4.43), *Probability of surviving 5 years*, M = 51.7 (3.95) and *Life length without surgery*, M = 41.6 (4.12). The sex of the patient was not important, M = 14.2 (3.72). In summary, the decisive attribute was *Probability of surviving surgery* and its importance was significantly greater than its closest competitor *Age,* $t(50) = 3.198$, $p = 0.002$ correlated samples.[3] Note that the conflict attribute speaking against the woman, *Probability of surviving 5 years* is changed more in favor of the woman alternative than the decisive *Probability of surviving surgery* attribute. The *Life length without surgery* attribute is another conflict attribute that was changed more than the important *Age* attribute. In conclusion, the results are in concordance with the hypothesis that consolidation occurs primarily on conflict attributes and not on important decisive attributes supporting the choice that was made.

In summary, we found significant restructuring of facts in the post-decision processes. The chosen alternative was reconstructed more than the non-chosen alternative. The restructuring process left the most important decisive attribute without systematic distortion depending on the prior decision while the facts on other important attributes were distorted in post-decision consolidation.

3 Study 2

This study was designed to test the above findings with participants who were both familiar with VAS scales and health care issues.

3.1 Method

3.1.1 Participants

A total of 35 students participated in the study. They were 11 advanced nursing students of Mälardalen University College and 24 advanced students in a program for psychologists at Stockholm University. The nurses were investigated in conjunction with an exam and the psychologists were given the questionnaires in some free time between lectures. This contrasts with Study 1 in which the data collection was administered by the students' regular teacher. There were 23 female and 12 male participants aged from 23 to 48 years with a median of 29 years.

3.1.2 Material and procedure

The same material as in Study 1 was used except for the material in the intermission session which consisted of a revised and somewhat simpler questionnaire about road traffic to keep the participants busy in the pause before the third session.

[3] We compared the attributes *Probability of surviving surgery* and *Probability of surviving 5 years.* They are interesting because the given facts are numerically exactly the same for both attributes but switched between the man and woman. In Table 1, for example, comparing the judgments of the fact, the woman's *Probability of surviving surgery* (attribute 3 fact = 42) with the man's *Probability of surviving 5 years* (attribute 4 fact = 42), one finds that the difference is positive (40.10−35.08 = 5.02 for the first memory reproduction). This difference represents the true difference due to consolidation because both changes favor the woman and the bias effects are eliminated. The difference is significant $t(54) = 4.92$, $p \leq 0.001$ correlated samples. The same difference for the second memory reproduction is $t(54) = 3.07$, $p \leq 0.003$. The difference between the judgments of the woman's *Probability of surviving 5 years* (19.6) and the man's *Probability of surviving the surgery* (16.76) in the first memory reproduction gives $t(54) = 2.60$, $p \leq 0.012$ and in the second memory reproduction $t(54) = 3.07$, $p \leq 0.003$ (two tailed tests).

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Table 2: Consolidation index for man and woman choices in Study 2. A positive sign indicates a consolidation difference in support of a choice and a negative sign the opposite.

	Choice	
Change of alternative's facts supporting choice	Man N=12	Woman N=23
First reproduction of facts		
Man alternative	*7.71 (3.53)**	4.26 (2.32)
Woman alternative	−3.96 (5.69)	*10.39 (2.87)***
Second reproduction of facts		
Man alternative	*4.00 (3.13)*	3.57 (2.10)
Woman alternative	−4.96 (5.64)	*12.37 (2.29)****

Note Digits in italics denote support of the chosen alternative. *$p \leq 0.005$, ** $p \leq 0.01$ and ***$p \leq 0.001$ in two-tailed t-tests.

4 Results

Twenty-three participants prioritized the woman and 12 the man for surgery. Thus, this study had a greater proportion of man choices (34%) than Study 1 (14%). There was no correlation between the sex of the participant and the preference for surgery on the woman or the man. In addition, there were no differences in the results between the two groups of participants (nurses and psychologists). The involvement scale indicated a rather high level of involvement in the problem with an average of 45.4 on the scale from 0 (no) to 64 (maximum) involvement. Because of the more equal distribution of choices, we present data in Table 2 for choices of both the woman and the man.

The average sum of advantages for the woman in the woman prioritizing group (14.65) was compared with the sum of advantages for the woman in the group giving the man priority (−3.75) (with the woman as a non-chosen alternative) and the difference was significant $t(33)=2.65$, $p \leq 0.01$ (two tailed test, first memory reproduction). This comparison shows that the chosen alternative was upgraded more than the non-chosen alternative.

The consolidation index was computed in the same way as in Study 1 for the woman and man choices separately. Table 2 gives the sums of mean differences between ratings for all attributes that supported the choice in each of the groups giving the man and the woman priority. Thus, a positive sign signifies a change in support of the chosen alternative and a negative sign support for the non-chosen alternative.

For those preferring the man, the chosen alternative indicates significant consolidation of facts restructuring for the man alternative in the first reproduction. However, the consolidation of facts support decreases from 7.71 in the first to 4.00 in the second reproduction. Table 2 shows the net support for the man choice using both differences for the man and the woman alternative becomes weaker and changes from an advantage 3.75 (7.71 — 3.96) in the first reproduction to a disadvantage in the second reproduction −0.96 (4.00 − 4.96). The negative sign indicates that the woman alternative was upgraded. Thus, even when the man was given priority, the woman alternative gained an increased support.

For those prioritizing the woman, the consolidation for the woman choice was strong and increased somewhat over sessions from 14.65 (4.26 + 10.39) to 15.94 (3.57 + 12.37). The positive sign for the man alternative means that it was downgraded. The woman choices were very well consolidated. The man choices were consolidated only right after the decision and the support disappeared at the second memory reproduction indicating regret. When facts restructuring occurred, consolidation was always greater for the chosen alternative (upgrading its facts support) than for its competitor (downgrading its facts support).[4]

In conclusion, the facts consolidation found in Study 1 was replicated for the woman choice. In contrast to the economics students, more nurses and psychologists accepted the man's smaller chance of surviving in the shorter perspective (14% of surviving surgery) to gain a greater chance (42%) of a 5 years survival. However, the consolidation of a man priority was not as successful as for a woman priority. In fact, a man choice was consolidated only right after the decision as shown in Table 2. Later regret seemed to work against that decision. As in Study 1, consolidation distortion of facts was found to be stronger on conflict attributes than on the most important decisive attribute. The difference was not statistically significant due to the small number of participants in each priority group, but it will be tested in the next study.

[4]The rank order of importance of the information differed between participants who prioritized the man and the woman. For those who choose the woman for surgery, the most important fact was *Probability of surviving the surgery* with a mean of rated importance 83.9 on the scale from 0 to 100. This rating was significantly greater than for the next in importance fact *Probability of surviving 5 years if the surgery was successful*, which was 53.0 , $t(11) = 6.30$, $p \leq 0.001$. For those who choose the man for surgery, the most important fact was *Probability of surviving 5 years* (79.2) and this was significantly greater than the rating for the *Probability of surviving the surgery* (57.1) $t(11) = 5.64$ $p \leq 0.001$. *Expected quality of life* was rated as the second most important attribute (63.3) and it was not significantly different from the most important attribute. In conclusion, the man was given priority because of a better prognosis after a successful surgery, while the woman was given priority based on the better chance of surviving the surgery.

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Table 3: Facts and reproduced facts about patients in Study 3.

Given facts		Reproduced	
Man	Woman	Man	Woman
(1) Age (years)			
34.00	20.00	35.03 *ns*	20.15 *ns*
		(4.86)	(7.57) *ns*
(2) Expected life length without surgery			
20.00	34.00	22.93 **	28.07 ***
		(8.55)	(9.43)
(3) Probability of surviving surgery			
14.00	42.00	16.03 *	35.67 ***
		(7.48)	(8.27)
(4) Probability of surviving 5 years if surviving surgery			
42.00	14.00	32.20 ***	18.84 ***
		(6.69)	(8.40)
(5) Expected quality of life if surviving surgery (0 = complete disablement, 100 = perfect health)			
25.00	25.00	25.24 *ns*	26.75 *
		(5.74)	(5.93)

Note. The table shows given facts and reproduction of facts for the 65 participants who chose to prioritize the woman for surgery. Standard deviations are shown in parentheses. Asterisks denote significant *t*-tests of differences between facts given in the first session and reproductions at the second session (*$p \leq .05$, **$p \leq .01$, and ***$p \leq .001$, two-tailed tests).

5 Study 3

This study was designed to test the findings of the earlier studies with a third group of participants and some changes of the procedure.

5.1 Method

5.1.1 Participants

In all 77 students at the Malmö University College in Sweden (41 women and 36 men, 19 to 39 years old with a mean age of 23.0 years) volunteered to participate in the study. They were recruited from two different departments (International Migration and Ethnic Relations, and Technology and Society) at the university.

5.1.2 Material and procedure

The decision material and procedure used in this study were similar to those in Study 1 and 2, but with three differences: (1) the response scales were 50 mm long; (2) the data collection was conducted in two sessions, with reproduction of the facts at the second session; (3) the intermission between the two sessions consisted of one hour of regular class.

5.2 Results

In all, 65 participants prioritized the woman and 12 the man for surgery, and therefore the following illustrative analyses will focus mainly on the data from woman choices.

Table 3 gives the mean judgments for the group of participants giving priority to the woman. The participants in that group rank-ordered the attributes in the following way from the most to the least important for their decisions: (1) *Probability of surviving surgery* (M = 76.53), (2) *Quality of life if surviving surgery* (M = 61.71), (3) *Age* (M = 61.39), (4) *Probability of surviving 5 years* (M = 54.22), and (5) *Life length without surgery* (M = 46.03). The attribute ranked as the most important was significantly more important than the second in rank order attribute, $t(62) = 4.50$, $p \leq 0.001$. The most important attribute was the same as in Study 1. The other differences in importance were insignificant.

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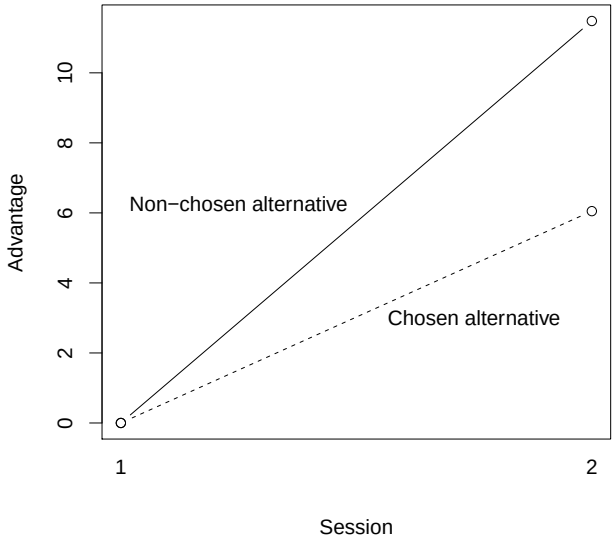

Figure 2: Mean sum advantage supporting chosen alternative (woman patient) deriving from upgrading the chosen alternative (dotted line) and the corresponding advantage as a result of degrading the non-chosen alternative (solid line) in Study 3.

To test the earlier results, the average sum of advantages for the woman in the woman priority group (17.54) was compared with the sum of advantages for the woman in the man priority group (2.25) (with the woman as a non-chosen alternative) and the difference was significant $t(75)$=1.86, $p \leq 0.05$ (one-tailed test, reproduction after intermission). Thus, the chosen alternative was upgraded more in support of a decision than the non-chosen alternative.

Overall consolidation (see Study 1 for computations) supported the woman choice by strengthening the woman +6.04 (no change at all = 0), $t(64) = 2.84$, $p \leq 0.01$; and downgrading the man +11.49, $t(64) = 6.22$, $p \leq 0.001$ (Figure 2). Restructuring in favor of the woman was significantly greater in terms of downgrading of the man alternative than upgrading the woman alternative (11.49 - 6.04), $t(64) = 2.21$, $p \leq 0.05$. Thus, the decision to prioritize the woman for surgery was consolidated more by restructuring the man alternative than restructuring the woman alternative. This contrasts with the result of Study 1, in which the woman alternative was restructured more than the man alternative.

The most important attribute (3) *Probability of surviving surgery* was counterbalanced with attribute (4) *Probability of surviving 5 years if surviving surgery*. A comparison of the means of these attributes in the reproduction indicated a net consolidation for both attributes favoring a choice of the woman (35.67 - 32.20), $t(64) = 3.50$, $p = 0.001$, and (18.84 - 16.03), $t(64) = 2.18$, $p \leq 0.05$.

In summary, the results replicated the findings of study 1 and 2 regarding facts restructuring. Overall, facts restructuring was significant and illustrated consolidation of the chosen alternative. The post-decision consolidation of facts representations occurred on attributes that were in conflict with the decision or neutral, and not by strengthening attributes that gave initial support to the final choice. This finding supported our initial hypothesis. Downgrading of the non-chosen man alternative contributed more to consolidation than upgrading of the selected alternative and this contrasts with the result of Study 1.

6 Discussion

The participants distorted quantitative facts in post-decision restructuring of a decision problem. The quantitative facts distortions followed the same pattern as the attractiveness distortions found in other studies. This result verified the Diff Con prediction of facts restructuring as one of the subprocesses of post-decision consolidation of a decision. Furthermore, the hypothesis that consolidation would not take place on the most important decisive attribute was confirmed. Instead, less important and conflicting attributes speaking against a choice were reconstructed in the consolidation process. However, all reproduced attributes were more or less distorted due to response bias effects. The participants had no problems in using the quantities indicated on the VAS scales as stimuli and the responses could be analyzed so that any response biases were eliminated.

If we give these results a more general interpretation they suggest that, if someone is asked about facts of an earlier decision problem, she or he will give an answer about the information that is not systematically biased on the decisive attribute. Of course, there is a risk of response biases but no systematic effects depending on the earlier decision will appear. However, we can expect systematic distortions and biases in favor of a chosen alternative when facts on less important and conflict attributes are asked for.

The present design and its controls for response bias effects made it possible to compare consolidation in terms of upgrading the chosen alternative and downgrading the non-chosen alternative. Study 1 and 2 showed greater upgrading of the woman than downgrading of the man when the woman was chosen. However, Study 3 showed the opposite effect. We do not know why this difference occurred. In future research, it would be interesting to investigate what determines which alternative is affected most for different problems, in different contexts and with different groups of participants. One factor that may play a role is whether a a decision is interpreted as a choice between positive desired or between negative undesirable

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options. In may be argued that the distortions were not post-decisional and occurred before the decision. But, the decisions were made in front of the facts and there was no possibility of misperception at this stage.

We were able to investigate the minority of participants who gave the man priority in Study 2. Their decisions were consolidated only during a short time after the decision was made. The man choice with its lower chance of surviving at the time of surgery and better chances in the long run in case of survival was not a sustainable choice. This was evident after the second replication of the facts and Simon et al. (2007) reported similar results for attractiveness consolidation in a study with constructed preferences dissipating after a decision. This raises the interesting question of how long decision consolidation and increased coherence can last. From a learning perspective, cumulative consolidation of repeated and suboptimal decisions will be counterproductive, meaning that we do not learn from our mistakes. This is because the next time we encounter a similar decision problem an earlier alternative is already consolidated and we will repeat the same suboptimal decision.

To conclude, we found facts restructuring and distortion after a priority decision. The facts restructuring process used systematic distortion of facts on the conflict attribute or less important attributes.

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