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What is a Specialist? Effects of the Male Concept of a Successful Academic Person on Performance in a Thinking Task[1]

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Abstract

For many persons the prototypical successful academic person is male. In three studies, the effects of this belief on types of solutions to a thinking task will be shown. In Study 1 (*N*=144), it is demonstrated that people have major difficulties finding a solution that refutes this belief. In Study 2 (*N*=21), which uses an equivalent formulation of the thinking problem whose solution corresponds to the male-associated successful academic person, the level of difficulty sinks dramatically. Participants from Study 3 (*N*=200), who were primed with a story of either an academically successful woman or man before receiving the thinking task were female and male university students from Germany and Israel in a counterbalanced design. The results show that a successful solution requires a restructuring of the thinking task that is based on the availability and accessibility of alternatives. In the discussion, the effects of the male-dominant interpretation of an academically successful person on Israeli and German women and men will be dealt with and starting points for change will be discussed.

Key words: thinking task – gender stereotypes – priming – cross-cultural study

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Introduction

Suppose that a friend tells you the following story:

A father and his son driving together in their car have a terrible car accident. The father dies upon impact. The son is rushed to the hospital in an ambulance and is immediately brought to the operating table. The doctor takes a quick look at him and says that a specialist is needed. The specialist comes, looks at the young man on the operating table and proclaims, I cannot operate on him, he is my son.

Many listeners would think that this friend is a bad storyteller because the story obviously doesn't make any sense. However, there is a simple solution: the specialist is female and is the young man's mother. The difficulty many people have in interpreting this story is, from many perspectives, interesting. From the psycholinguistic point of view there is a clear indication that the reception of language is very strongly male-associated (cf. Rackow & Wackwitz, 1998): even without explicit gender-marking, most people quietly assume that the doctor and the specialist are male. From a cognitive-psychological viewpoint attention is drawn to the difficulty many people have in re-interpreting the story (cf. Duncker, 1935/1963), even after the original assumption that the specialist is a man has led to an absurd contradiction. Finally, the story is a further example of the fact, often pointed out in feminism, that positive roles are frequently represented by masculine prototypes, which supposedly put women at a clear disadvantage in reaching these positions (Bartholomew & Schnorr, 1994; McConnell & Fazio, 1996). This could, for example, be demonstrated by the fact that it is less likely for women to strive for the aforementioned roles or that men who fulfill the role stereotype more completely are preferred in role assignment (Anderson, 1995; Basow & Howe, 1980; Forsyth, Heiney, & Wright, 1997).

In the following section, we will first deal with the question of why many people stick to the male interpretation of the "specialist problem" and why, even after seeing the striking contradiction at the end of the problem, they still have difficulty in altering their interpretation. Subsequently, the central cognitive mechanisms that lie behind a successful solution to the "specialist problem" will be examined from the viewpoint of problem-solving.

Male Language and Partial Matching

A quick glance into the research literature on gender stereotypes shows that the prototype of a person who either demonstrates leadership qualities or is professionally successful or has special intellectual abilities is normally male. This is valid for such various prototypes such as that of an intelligent person (Raty & Snellman, 1997), a successful business manager (Forsyth et al., 1997; Lord & Maher, 1991), and even for the culturally accepted and personal concepts of God (Foster & Keating, 1992). Furthermore, in addition to these specific prototypes, there is a tendency to usually assign the male gender to unspecified groups of people. Merritt and Kok (1997) argue, on the basis of their empirical findings, that a *people=male bias* leads people to attribute the male gender to gender-unspecified persons. For example, the typical pedestrian is categorized as male (Kowal, O'Connell, & Posner, 1995) or the gender-neutral pronoun "they" provokes the notion of masculinity to a stronger degree (Hyde, 1984; Switzer, 1990). These research results clearly confirm the presumption that the specialist is assigned the masculine gender first. Nevertheless, these findings do not explain why

people have such great difficulties in correcting gender attribution once it has been established. In this context, research findings regarding the so-called *Moses illusion* provide us with some first hints.

A typical thinking task of this research paradigm, to which it owes its name, is to answer the question of how many of each type of animal Moses took with him on the Ark. Typically, most participants give the same (incorrect) answer two, whereby they overlook the fact that it was not Moses, but rather Noah, who took the animals onto the Ark. As in the "specialist problem", most participants working on the Moses illusion tasks form a believable initial representation of the problem for themselves, which actually makes the task solution more difficult. In both problems there are immense difficulties in critically questioning and modifying the original representation of the problem.

In a series of tricky studies, some explanations for the Moses illusion could be disproved (cf. Bredart & Modolo, 1988; Erickson & Mattson, 1981; Kamas, Reder, & Ayers, 1996; Reder & Kusbit, 1991; Van Oostendorp & de Mul, 1990). The recipient of the question: (1) does not, according to the cooperation principle, carry out a correction of the question because he/she presumes to know what the questioner meant, (2) he/she does not miss or ignore the wrong term or, in other words, make a mistake in encoding, and (3) it is not the case that he/she is not equipped with the relevant information about whether it was Moses or Noah who took the animals on the Ark.

In fact, it seems to be that a *partial-matching process* is responsible for the original acceptance of the question's contents as well as the participant's sticking to the established interpretation. According to this explanation, people understand and encode the question linguistically correct, they have, in principle, the necessary information for the re-interpretation in their memory, however they overlook an important discrepancy between the question posed and the information activated in their memory. Thus, the characteristic that both Moses and Noah were "patriarchs of the old testament" could be enough to verify the correctness of the first interpretation. It is then decisive in this case that relevant characteristics that would be important for the detection of the contradiction are not activated, and a partial matching is accepted.

Assuming this explanation can be transferred to the specialist problem, then the difficulty cannot be due to the facts that: (1) people understand the question wrongly, (2) they overlook important information when the question is posed or (3) they do not possess the fundamental knowledge that a specialist can be female. Rather, the information "specialist" triggers a certain prototype, wherein a characteristic that is important for the solution to the problem, namely the gender of the specialist, is already considered to be verified, although the specialist is only introduced in her gender-neutral professional role.

The Specialist Problem from the Perspective of Problem-Solving Psychology

The actual trick in the solution of the specialist problem seems to be what is often referred to as a *Gestaltwechsel*, or a radical restructuring and reinterpretation of the problem (Fitzek & Salber, 1996). Similar to how when observing a three-dimensional sketch of a cube the front side depends on which surface one focuses on, the solution of the specialist problem requires a reinterpretation of the specialist's gender.

From the perspective of problem-solving psychology, three points can be named which can positively influence a reinterpretation of the specialist problem: (1) Research has shown that under certain conditions a problem whose content is familiar can be easier to solve (Holding, 1985; Ziegler, 1994). This facilitation effect is mainly based on the fact that since a more economical cognitive representation of the problem's starting condition is in effect, mental resources are freed that can be used to search the problem space (Ziegler, 2000). (2) Research in the area of problem-solving shows that in finding solutions, their availability and accessibility can play an important role. The basic idea of this distinction is very old (Holzman, Glaser, & Pellegrino, 1976; Tulving & Thomson, 1971), and can be found in many research fields. A good illustration is, for example, the tip-of-the-tongue-phenomenon (Brown & McNeill, 1966), whereby a piece of knowledge is in principle available, but cannot be accessed. In the case of the specialist problem, the availability of a woman who is exceptionally skilled in medicine *and* the ability to have access to this knowledge is of central importance. Primarily from information gathered in the areas of research on the effect of beliefs derived from logical reasoning and stereotype research, it is known that expectations facilitate the access to knowledge-congruent information stored in the knowledge base and block the access to knowledge-incongruent information (e.g., Lepore & Brown, 1999; Wyer, 1998; Ziegler, 2000). Therefore, persons with a less pronounced male-associated specialist conception should find it easier to access the example of an exceptionally skilled woman in medicine in their knowledge base. One must here realize that availability and accessibility do not necessarily imply that such knowledge units have already been stored in the memory. For example, availability can also indicate that a specific piece of knowledge can be construed through inductive or abductive inferences and the result will be accessible for further inferences (Ziegler, 2000). (3) Should the explanation of a partial matching also apply to the specialist problem, the availability as well as the accessibility of the concept of a female specialist would also depend on which attributes are encoded under the concept "specialist". Suppose that a person knows academically successful women, but no successful women in medicine. Should the partial matching rest on the combination of attributes "academically successful" instead of "successful in medicine", the reinterpretation of the specialist as a woman would probably be carried out more easily.

Overview of the Current Research

In this contribution the results of three studies will be described. In Study 1, women worked on the specialist problem, providing us with an initial baseline measurement of the solution rate. Since it is plausible to assume that personality traits of the subjects can have an influence on the solution, especially when they mediate the effect of pre-existing knowledge, we considered the *personal need for structure* as a potential mediator (Neuberg, Judice, & West, 1997; Thompson, Naccarato, & Parker, 1989). Study 2, which was carried out with men and women, dealt with the fact that the male interpretation of the specialist problem causes difficulties in finding a solution. Therefore, the text was reformulated so that the roles of the mother and the father were exchanged in the problem scenario; the specialist, consequently, was male. Study 3 was carried out with female and male participants as a cross-cultural study. The countries Germany and Israel differ insofar as the Israeli family concept is more strongly influenced by patriarchy. While the availability of a female specialist is sup-

posedly the same in both countries, the accessibility of a professionally successful woman is expected to be more strongly blocked by the patriarchal family concept, which allows for differentiated predictions with regards to solution rates. At the same time, the explanatory power of partial matching was tested through priming. Finally, an investigation was made to determine whether a further personal trait, the implicit personality theory according to Dweck (1999), mediates the solution rate.

Study 1

The specialist problem was worked on for the first time in Study 1. Based on the aforementioned factors, it is expected that many subjects will not find the solution. Therefore, the results will give the first clues concerning the difficulty of the problem. The determination of whether a specialist is indeed assigned the attribute "male" most of the time was of further interest. Since in the literature there are many different indications regarding differential thinking performances or thinking styles of university students majoring in various subjects (cf. the classical studies by Cox & Griggs, 1982, and Jackson & Griggs, 1988), this variable was also taken into account. For example, it could easily be the case that language students, on the grounds of their intense experiences with text analysis would take different paths in solving the problem than students with qualifications in logic or students of life sciences, which concentrate on the higher importance of gender variables. Furthermore, a personal trait of the participants in this study was recorded, which could possibly influence the effect of the masculine interpretation of the specialist and thus influence the subjects' finding the solution. In the past few years a series of stable, dispositional motives which influence people's thinking have been identified (Gollwitzer & Bargh, 1996; Sorrentino & Higgins, 1996). The personal need for structure describes a temporally stable preference for cognitive simplicity and structure (Neuberg et al., 1997; Thompson et al., 1989). People with a high personal need for structure show, among other things, a stronger tendency to integrate information into existing knowledge structures (Thompson, Roman, Moskowitz, & Chaiken, 1994), they stereotype more strongly (Schaller, Boyd, Yohannes, & O'Brien, 1995) and they form simplifying trait inferences more quickly (Moskowitz, 1993). From this, one could infer that this dispositional construct of the personal need for structure does indeed influence the ability to find the solution, in that people with a high need would be expected to show relatively poorer solution rates because they have more problems freeing themselves from their knowledge and assessing information from another perspective.

Study 1

Method

Participants. Participants in Study 1[5] were 144 female students of various subjects at the University of Munich: 51 studied psychology, 21 natural sciences, 26 business, 19 philoso-

[5] For each of the studies subjects who were already familiar with specialist problem needed to be disqualified. This figure ranged between 7-18% for these studies.

phy (which includes two obligatory courses in logic) and 26 German language. They were randomly approached in their departmental libraries and did not receive any payment for their participation in the study.

Material. All participants completed a uniform questionnaire in the German language. In addition to information concerning their age and major, the questionnaire contained a German version of the specialist problem printed in its English version above. This problem is based on a well known logic question[6]. As a result of a pilot study, the solution was sought in the following manner: "Can the problem be solved and explained in one sentence? If you are of this opinion, state your solution in a single sentence. Otherwise, write 'no'." Answers which stated that the specialist is the mother or a woman were considered to be correct. The solution was coded as incorrect when, in addition to the statement that the problem is unsolvable, answers were given such as the specialist is the boy's stepfather, a priest or another member of the clergy, or any sort of supernatural explanations such as reincarnation.

By means of a semantic differential, the participants were examined to determine whether they imagined a more masculine or feminine person under the concept "specialist". Moreover, four further word pairs were given which were either mentioned in a free-answer description of a specialist in a pilot study, or were added for our own considerations as in the case of the age variable. Ratings along a 6-point bipolar scale were made for the following five pairs: cold-hearted vs. warm-hearted, under 50 years old vs. older than 50 years, male vs. female, honest vs. dishonest, and a well-rounded scholar vs. a limited expert. The following statement was printed above the rating scales: "What, in your opinion, is a specialist? Is a specialist more: ..."

The Personal Need for Structure Scale (Thompson et al., 1989) comprises 12 items along a 6-point Likert-type scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The scale satisfies reliability and validity criteria (Thompson et al., 1989; Neuberg et al., 1997) and the Cronbach's alpha determined in our sample was .85. Sample items are: "I enjoy having a clear and structured mode of life", and "I hate to be with people who are unpredictable."

Firstly, personal information was asked for in each questionnaire. Then, the semantic differential and the specialist problem and, finally, the Personal Need for Structure Scale was given. It was accepted here that the mention of the possibility that the specialist could be a woman in the semantic differential might facilitate finding the solution. This effect, in fact, would be rather conservative, i.e. the expectation that the specialist problem could not be solved by most of the participants, would therefore be more difficult to confirm.

Results

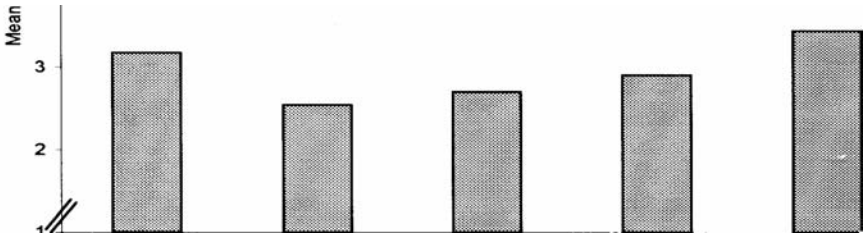
The average age of the participants was M=23.43 (S=2.89) years. Age had no systematic relationship to any other variable in this or in either of the subsequent studies, and is therefore not further addressed. The results of the semantic differential are shown in Figure 1. It is of particular interest that a specialist is indeed expected to be male (M=2.76, S= 1.16). Only 22 participants assume that the specialist is more likely to be a woman than a man (scale

[6] Here it is important to mention that the term specialist was not translated by the German word Spezialist which is masculine, but rather by the German word Koryphäe, which is feminine in the German language.

value > 3). A binomial test shows that except for the well-rounded vs. limited knowledge ($p < 1$), all distributions are significantly skewed.

A factor analysis with varimax rotation and an *eigenwert* > 1 proves two factors, the first of which explains 31.2% of the variance and the second a further 22.7%. For the first factor, the tendency is towards cold-hearted (-.64), male gender (-.52), honest (.61) and well-rounded scholar (.69). For the second factor, there is a tendency towards "older than 50 years" (.81) and male gender (.64), which loaded on both factors. In these results at least a hint can be found that two different pictures of a specialist exist: a masculine person over 50 years old as well as a female specialist, who is characterized by warm-heartedness, honesty and well-rounded educational interests. Still, keeping the picture drawn by the means in mind, one sees that the vision of the male specialist is clearly dominant.

Table 1 shows the solution rate of the specialist problem according to the major subject of study of the participants. A chi^2-test shows no significant differences in their solutions, $chi^2(4)=2.79$, $p < 1$. The average solution rate of 32.2% indeed makes clear that the specialist problem is a difficult task, which could only be solved by one out of three participants.



Coldness Over 50 Male Honesty Broadness of Education

Figure 1:
Mean ratings of attributes of a specialist
(Min: 1, Max: 6; small values indicate high agreement)

Table 1:
Study 1: Frequency and percent of correct and incorrect answers, classified according to major subject of study

	Major Subject of Study					
Answer	*Psychology*	*Natural Sciences*	*Business*	*Philosophy*	*German Language*	*Total*
Correct	19	5	7	8	7	46
	37,5%	23,8%	26,9%	42,1%	26,9%	32,2%
Wrong	32	16	19	11	19	97
	62,7%	76,2%	73,1%	57,9%	73,1%	67,8%

In the next step, an attempt was made to predict solution behavior with a logistic regression. The dependent variable was the dichotomous variable solution vs. non-solution of the specialist problem. Predictors were the personal need for structure as well as the individual factor scores from the factor analysis of the semantic differential items. None of the predictors proved to be significant and the means for the solvers vs. non-solvers were almost identical. A further logistic regression in which the gender assigned to the specialist was used as a predictor led to the same result.

Discussion

The main result of Study 1 is that the specialist problem is indeed a difficult task, which could only be solved by one third of the participants. The solvability of the task appeared not to be influenced by a series of variables, namely: major subject of study, whether one of the two pictures of a specialist that were discovered in the factor analysis was represented, if the specialist was rated as masculine, and personal need for structure. On the whole, these results seem more likely to show that the reasons for the low solution rate must be sought from the aforementioned perspective of problem-solving psychology.

Study 2

The purpose of Study 2 was to show that, above all, it is the Gestaltwechsel which is the cause for the low solution rate in the specialist problem. It was already argued that, primarily, the low accessibility of a female specialist is responsible for this. However, according to the converse conclusion, the degree of difficulty of the specialist problem should sink if accessibility can be ensured. A simple demonstration for this presumption can be reached by means of a reformulation of the question so that the correct solution can be found through the accessibility of a male specialist, i.e. that the father is the specialist.

Method

Participants. Nine female and 12 male psychology majors in the first semesters of their studies at the University of Munich took part in this study. The experiment was carried out during a regular seminar meeting.

Material. All participants worked on a uniform, modified form of the specialist problem, in which instead of the father, a mother and her son were involved in the car accident. The gender of the doctor and the specialist remained unspecified in this version.

Results

Of the 21 participants, 17 (7 female, 10 male) solved the modified specialist problem. A binomial test with the solution rate of 32.2% found in Experiment 1 generates a probability of $p < 0.001$ for this result to appear. Equally interesting were the reasons for the wrong solu-

tions, which all signaled that these subjects did not even realize the existence of a problem! It was so self-explanatory for them that the specialist was the father, that they did not see a contradiction.

Discussion

The results of Study 2 prove that the specialist problem no longer presents any difficulty or even loses its problem nature when it is not a female, but rather a male specialist that has to be inferred. This finding is a strong indication that in the available knowledge base, the explanation for the low solution rate in the specialist problem must be sought in its original format. In order to check this supposition participants with presumably different knowledge bases and different accessibility to their knowledge bases (women and men, Israeli and German university students) were examined in Study 3. Furthermore, a priming was given before the actual task, which was expected to influence the accessibility of knowledge (as far as it exists) relevant to the solution.

Study 3

The three factors varied in Study 3 (gender, nationality and priming) should be observed according to three aspects: (1) How economical is the representation of the problem, i.e. how much mental capacity is available to the participants for the completion of the problem-solving operation. (2) Do they have the picture of a woman who is academically successful in their knowledge base, i.e. availability. (3) Can they get to this knowledge, i.e. is it possible to access to this knowledge. Through this, specific hypotheses concerning the interplay of these factors in the solution of the specialist problem will be formed.

It can be assumed that the concept of a male specialist is equally shared by men and women (Amancio, 1993). However, the participants in Study 3 are university students, which should lead to an interesting difference in the knowledge bases of the female and male participants: Women give more thought to the successful academic careers of women (namely, their own) and men to the successful academic careers of men (also namely their own). Since male students are more familiar with successful male scholars, they should be able to represent male specialists more economically. It follows from this that if women and men represent a specialist according to the male concept, the latter have more mental resources available to them for the solution to the problem.

However, women have - as mentioned above - more items of knowledge about successful female careers in their knowledge bases, due to their concerns with their own careers. On the other hand, due to the predominant male concept of successful scholars, they probably have difficulties in activating this knowledge, although it is in principle available, accessing it is presumably more difficult. A further difficulty is added for Israeli women. On the one hand, equal access to a career for both sexes formally exists in both countries, even when this equality of possibilities is, in fact, in no way realized in either country (Bundesministerium für Familie, Senioren, Frauen und Jugend, 2002; Ma'or, 2002). On the other hand, the family role concept is still more strongly patriarchal in Israel, i.e. a woman is pushed much more into the mother/family role than in Germany (Israeli, 1992; Jerby, 1996; Scholz, 1997).

Therefore, and to a presumably higher degree in Israel than in Germany, there are two diverging tendencies open to women in universities, one is that of a woman striving for her own academic career, the other encompasses a traditional family position. Since the traditional family role partially rules out that of a successful academic for women, it can be expected that the accessibility of this knowledge is more difficult for Israeli women.

This argumentation should be quickly summarized and the presumable effects should be weighed against one another. Men have an advantage in the male-coined representation of the specialist problem, which provides them with more mental resources for completing problem-solving operations. As the results of Study 2 have shown, this advantage should be rather small as the actual difficulty of the specialist problem lies in the Gestaltwechsel. Here, women should show an advantage due to their concerns with their own career chances, because more knowledge is available to them. However, because Israeli women belong to a more strongly patriarchal society, a lower accessibility to their knowledge is expected from them than from German women. Specifically, an interaction between culture and gender regarding solution rate is expected.

With the priming used in Study 3, two goals were pursued: Indications for (1) a partial matching and (2) the necessity to distinguish between availability and accessibility of knowledge. The story used to prime the participants in Study 3 does not mention the attributes *successful/female doctor,* but rather the attributes *academically successful/female*, which only allows for a partial matching. However, it is important to emphasize here that priming can generally only be successful when the corresponding knowledge is available. Priming can therefore only have an effect on the accessibility of knowledge. However, since mainly women have items of knowledge concerning successful female scholars, an interaction between priming and gender with regard to the solution rate is expected. Israeli women, in particular, should also profit from the priming, as their difficulty in solving the problem exists in the access to their available knowledge.

In addition to the variables discussed above, a further personality scale was used in Study 3. According to Dweck (1999), people can be differentiated as to whether they rate personality as an unchangeable and rigid characteristic (*entity theory*) or as an alterable one (*incremental theory*). She was able to show in various studies that entity theorists have a stronger tendency to form a belief (Chiu, Hong, & Dweck, 1997). When they have already formed an opinion, they are additionally less sensitive to new (Erdley & Dweck, 1993; Plaks & Dweck, 1997) and contradictory information and even strive to actively avoid it (Plaks & Dweck, 1997). They are also more likely to retain stereotypes (Dweck, 1999; Levy, Stroessner, & Dweck, 1998). Should personality factors, in addition to the aforementioned cognitive variables, play a role in solving the specialist problem, an incremental theory could be a good candidate for explaining why persons succeed in freeing themselves from existing knowledge.

Method

Participants. Fifty male and fifty female psychology majors in the first semesters of their studies at the University of Tel Aviv and the University of Munich took part in this study. They were approached randomly in a computer room (Israel) or in departmental libraries and received no reimbursement for their participation in the study.

Material. Study 3 was part of a larger study that was not connected to the questions pursued here, but rather researched the psychological causes of illnesses. In Germany the material was made available in a German language format, for Israeli subjects the material was translated into Hebrew. In order to guarantee that the German and Hebrew questionnaires contained parallel statements, the German material was translated into Hebrew by one person and then translated back into German by another person. Besides the specialist problem[7] described in Study 1, the questionnaire contained a priming as well as a scale to measure the implicit theory of personality.

The priming took place by means of a supposed newspaper report about the award of a scientific prize to a successful female chemist, which is handed over by a female professor who is also the dean of the recipient's chemistry department. In the control condition, the chemist and dean of the chemistry department are two male scientists. Because both, the Israeli and the German languages mark gender, the exact English translation cannot sufficiently convey the gender markings inherent in everyday spoken language. Therefore, in the following translation of the female priming, the symbol "*" denotes the presence of a female gender-marking. The wording of the priming was the following: "Yesterday afternoon, Prof. Dr. Blaschke, director* and chemist* at the Wöhlerinstitut in Munich [Tel Aviv], was presented the scientist's award of the city of Munich at a small awards ceremony given by Prof. Dr. Vilser, dean* of the chemistry department. Prof. Dr. Blaschke achieved distinction through publications in international scientific journals. In the past year, she achieved international reputation by means of her discovery of a new method of extraction that greatly simplified gas chromatography. The findings, attained through her new method of extraction, have helped her to make ground-breaking discoveries, particularly in aroma research. In her award speech, Dean* Vilser stressed that *Prof. Dr. Blaschke now is counted among the 10 most frequently quoted persons in German [Israeli] chemical research. The cash prize of $ 20,000 which accompanied the award will be, according to the scientist*, used for the acquisition of desperately needed research materials."

The participants were asked to evaluate the newspaper report with regard to several dimensions concerning journalistic quality. The subjects in the two testing conditions didn´t differ in the evaluation of these dimensions. Between the priming and the specialist problem, and in addition to 5 questions belonging to the other study, the implicit theory of personality was measured by three items in a 6-point Likert-type format ranging from 1 (*strongly agree*) to 6 (*strongly disagree*). Detailed information concerning reliability and validity of the scale can be found in Dweck (1999). A sample item is "The kind of person someone is, is something very basic about them and it can't be changed very much." The Cronbach's alpha for the Israeli sub sample was .84, and for the German subsample it was .81.

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[7] In Hebrew there are two possible translations of the word specialist (possible translation 1: male form: mumche, female form: mumchit, possible translation 2: male form: memune, female form: memuna). In order to avoid an influence by the male/female forms on the investigative participants, the term specialist was replaced by the word memune/a.

Results

The data were first analyzed to see if the solution was influenced by age or major subject of study, which was not the case. Table 2 contains the numbers of correct solutions structured according to priming, gender and nationality of the participants. The solution rate of the entire sample was 40%, and was similar to that of Study 1. However, a 2 (priming with a successful female vs. successful male scientist) X 2 (gender) X 2 (nationality) X 2 (solution vs. non-solution of the specialist problem) log-linear analysis showed three significant interactions between the solution to the problem and further variables. The 2-way-interaction of priming and problem solution, $chi^2(1)=3.24$, $p < 0.05$, was modified by means of the predicted 3-way-interaction of priming, gender and problem solution, $chi^2(1)=3.17$, $p < 0.05$, for this reason only the latter should be interpreted. An inspection of Table 2 shows that in fact, the priming was only effective with the female participants. Additionally, the predicted 3-way-interaction of gender, nationality and problem solution could be confirmed, $chi^2(1)=9.07$, $p < 0.01$. Table 2 illustrates the manifestation of this interaction: In the non priming condition German women and Israeli men solve the specialist problem somewhat better. In light of the priming effects on Israeli women, this result allows us to assume that the Israeli women's low solution rate is not caused by the lacking availability of knowledge, but rather by their restricted access to this knowledge. This effect was apparently so strong that they even performed somewhat worse than Israeli men who, by comparison, have a representation advantage. In contrast, the German women in our study apparently not only had a higher availability but also a better access to this knowledge than the German men had.

In the last step of the analysis a series of logistic regressions were calculated, wherein the implicit theory of personality functioned as a predictor, and the solution of the specialist problem functioned as a dependent variable. Although no alpha-adjustment took place, statistically verifiable possibilities for prediction could not be verified for the whole group nor for any of the subsamples made up by possible combinations of priming condition, gender and nationality (each $p < 1$).

Table 2:
Study 3: Frequency of correct answers, classified according to priming, gender of the participants and country

			Country		
Priming	**Gender**	**Answer**	*Germany*	*Israel*	*Total*
Female Scientist	Female	Correct	17	9	26
		Wrong	8	16	24
	Male	Correct	6	9	15
		Wrong	19	16	35
Male Scientist	Female	Correct	10	4	14
		Wrong	15	21	36
	Male	Correct	6	9	15
		Wrong	19	16	35

Discussion

As in Study 1, no proof for an influence of major subject of study or of a personality trait - in this case, the implicit theory of personality (Dweck, 1999) - could be found. On the other hand, the assumptions based on problemsolving psychology could be proven. Even a partial matching between the specialist problem story of a successful female chemist, which was placed before the specialist problem, and the successful female doctor was enough to raise, in women, the accessibility of their knowledge. Furthermore, both of the expected interactions between priming and gender and between gender and nationality could be statistically confirmed. However, the latter interaction deserves more attention because the appearance of the interaction was somewhat surprising. In fact, Israeli women's low solution rate in comparison to German women and their somewhat poorer performance in comparison to Israeli men give evidence for a strong effect of the traditional family concept which obviously inhibits their access to knowledge of a successful female scholar. It is shown, through the fact that priming was effective in Israeli women, that at least some of them have this knowledge at their disposal. All in all, the results refer to the importance of an interplay between women's availability and access to knowledge about the careers of successful academic women, which is influenced by societal male-dominated concepts. In the following, this will be discussed on the basis of all three studies.

General Discussion

The specialist problem used in this investigation had an academically successful woman as its solution, however, this was not discovered by the majority of the participants in our studies (Studies 1 and 3). In contrast, the participants in Study 2 either had no difficulty in coming to the equivalent solution of an academically successful man, or did not even perceive a problem in the reformulated version. This result mirrors a reality in which the picture of an academically successful man is still dominant (David, 2003). At the same time, the postulated psychological mechanisms offer not only possible explanations for the effects of the male-coined concept of academically successful people, but can also be understood as hints as to where a change must be implemented.

The discussion of the results should be opened up by addressing the two potential starting points for the fight against the effects of a gender-role concept based on a successful male scholar which found no support in our studies: an improvement in problem solving style and a change in personality characteristics that cause an orientation on male concepts. The major subject of study pursued by participants in Studies 1 and 3 had no influence on their ability to find the solution, which shows that the ways of approaching problems associated with the different majors cannot clear up the main difficulty in the specialist problem. Included in our studies were, among others: persons with a training in logic; students of languages, whose education is supposed to especially sensitize them concerning the use of language; and students of life sciences, who supposedly should have been made aware of gender problems through their studies. The two personality traits that we studied which influence gender-biased thinking were the personal need for structure (Study 1; cf. Thompson et al., 1989) and the implicit theory of personality (Study 3; cf. Dweck, 1999). Neither personality traits had any connection to the solution of the problem. Of course, the negative findings can, neither in

the case of major subject of study nor in the examination of only two personality traits, give a final insight into whether influences of problem-solving strategies or personality characteristics actually could be proven. However, the results of our studies suggest that the reasons for the effect of male-dominated concepts should be sought in other areas.

From the results of Study 3 it can cautiously be concluded that men have a small advantage in the representation of the problem, which is why Israeli men could solve the specialist problem somewhat better than Israeli women could. The resulting measure to promote the male-coined gender-role concept of the successful scholar is, however, due to its socio-political undesirability and moral questionability, unacceptable.

Theoretical analyses, which were carried out under the perspective of problem-solving research, and the results of Study 3 point to the necessity of differentiating between the availability and accessibility (Holzman et al., 1976; Tulving & Thomson, 1971; Ziegler, 2000) of the concept of an academically successful woman. Consistent with the assumption of a partial matching, it was shown that even priming of an academically successful woman is enough to make it possible for many women to come to the assumption of a female medical specialist. It can plausibly be supposed that a complete matching, i.e. the priming of a female medical specialist, would have resulted in an even better solution rate. A follow-up of this question could provide important insights into the effectiveness of role models in career settings.

The necessity of a differentiation between availability and accessibility could be proven by means of the effect of priming. This not only made improved performances by German women possible, but also by Israeli women who, due to the competing concept of their family roles, had more difficulty in accessing their knowledge of an academically successful female. In fact, without priming, Israeli women solved the specialist problem less successfully than Israeli men did (16% vs. 36 %), with priming however they did just as well (36 % vs. 36 %). Yet, German women were especially successful after a priming with a solution rate of 68%. The corresponding knowledge is not only available, but additionally, their access to it is much less hindered by a patriarchal familial concept.

The results of Study 3 allow for differentiated conclusions concerning the presence and effect of the male concept of academically successful people. The lack of a priming effect on men suggests that men possess hardly any or at least only insufficient information regarding academically successful women. However, also women - as it was assumed - have knowledge about this mainly due to their involvement with their own personal professional careers. Still, there is a lack of corresponding role models, for which the number of female Nobel Prize winners is provided as a simple indicator. As shown in a study by Cixous (1993), among 510 winners of the Nobel Prize, only 24 were women. Nevertheless, it seems that the mere availability of role models is not sufficient. In addition, access to these role models must also be ensured so that they can exert an effect. In this case, Israeli women are apparently hampered by the still strongly visible contradiction between professional and family roles. An effective improvement in the situation of women must, therefore, consider at least two points: (1) The knowledge of the possibility of academically successful women must be conveyed (Zorman & David, 2000) for which, apart from the presentation of appropriate role models, intensive individual involvement with this topic is suitable as a first step. This involvement should, however, not be restricted to women, but should also be demanded from men. For example, empirical studies show that employment decisions can be influenced by gender-bound expectations that employers have concerning the applicants (Frable, 1989;

Perry, 1994). (2) Knowledge remains predominantly inert or ineffective when access to this knowledge cannot be achieved. The results of our studies give evidence that not only the male concept of an academically successful person but also concepts that are in conflict with the notion of an academically successful woman are obstructive. Therefore, the desired goal should not only be to anchor women's and men's knowledge about academically successful women, but at the same time, to restrict the effectiveness of concepts which conflict with this goal.

References

1. Amancio, L. (1993). Stereotypes as ideologies: The case of gender categories. Revista de Psicologia Social, 8, 163-170.
2. Anderson, V. (1995). Identifying special advising needs of women engineering students. Journal of College Student Development, 36, 322-329.
3. Bartholomew, C.G. & Schnorr, D.L. (1994). Gender equity: Suggestions for broadening career options of female students. School Counsellor, 41, 245-255.
4. Basow, S.A. & Howe, K.G. (1980). Role-model influence: Effects of sex and sex-role attitude in college students. Psychology of Women Quarterly, 4, 558-572.
5. Bredart, S. & Modolo, K. (1988). Moses strikes again: Focalisation effect on a semantic illusion. Acta Psychologica, 67, 135-144.
6. Brown, R. & McNeill, D. (1966). The “tip of the tongue” phenomenon. Journal of Verbal Learning and Verbal Behaviour, 5, 325-237.
7. Bundesministerium für Familie, Senioren und Frauen (2002). Frauen in der Bundesrepublik Deutschland. [Women in the Federal Republic of Germany]. Bonn, Germany.
8. Chiu, C., Hong, Y., & Dweck, C. S. (1997). Lay dispositionism and implicit theories of personality. Journal of Personality and Social Psychology, 73, 19-30.
9. Cixous, H. (1993). We who are free. Are we free? In B. Johnson (Ed.), Freedom and interpretation. The Oxford Amnesty Lectures 1992 (pp. 17-44). New York, NY: Basic Books.
10. Cox, J. & Griggs, R.A. (1982). The effects of experience on performance in Wason's selection task. Memory and Cognition 10, 496-502.
11. David, H. (2003).The influence of gender, religion, grade, class-type, and religiosity on mathematical learning in the Israeli junior high school. Dissertation, LMU München: Fakultät für Psychologie und Pädagogik.
12. Duncker, K. (1935/1963). Psychologie des produktiven Denkens [The psychology of productive thinking]. Berlin, Germany: Springer.
13. Dweck, C.S. (1999). Self theories: Their role in motivation, personality, and development. Philadelphia, PA: Psychology Press.
14. Erdley, C.S. & Dweck, C.S. (1993). Children's implicit theories as predictors of their social judgements. Child Development, 64, 863-878.
15. Erickson, T.D. & Mattson, M. E. (1981). From words to meaning: A semantic illusion. Journal of Verbal Learning and Verbal Behavior, 20, 540-551.
16. Fitzek, H. & Salber, W. (1996). Gestaltpsychologie. Geschichte und Praxis [Gestaltpsychology. History and practice]. Darmstadt, Germany: Wissenschaftliche Buchgesellschaft.
17. Forsyth, D.R., Heiney, M.M., & Wright, S. S. (1997). Biases in appraisals of women leaders. Group Dynamics, 98-103.

18. Foster, R.A. & Keating, J.P. (1992). Measuring androcentrism in the Western god concept. Journal for the Scientific Study of Religion, 31, 366-375.
19. Frable, D.E. (1989). Sex typing and gender ideology: Two facets of the individual's gender psychology that go together. Journal of Personality and Social Psychology, 56, 95-108.
20. Gollwitzer, P. & Bargh J.A. (Eds.) (1996). The psychology of action: Linking cognition and motivation to behavior. New York, NY: The Guilford Press.
21. Holding. D.H. (1985). The psychology of chess skill. Hillsdale, NJ: Erlbaum.
22. Holzman, T.G., Glaser, R., & Pellegrino, J. (1976). Process training derived from a computer simulation theory. Memory and Cognition, 4, 349-356.
23. Hyde, J.S. (1984). Children's understanding of sexist language. Developmental Psychology, 20, 697-706.
24. Izraeli, D. (1992). Women trapped: The situation of the woman in Israel. Tel-Aviv, Israel: Hakibbutz Hame'uchad (in Hebrew).
25. Jackson, S. & Griggs, R.A. (1988). Education and the selection task. Bulletin of the Psychonomic Society, 26, 327-330.
26. Jerby, I. (1996). The double price: Women's status in Israeli society, and female military service at the IDF. Tel Aviv, Israel: Ramot Publishing House.
27. Kamas, E.N., Reder, L.M., & Ayers, M.S. (1996). Partial matching in the Moses illusion: Response bias not sensitivity. Memory and Cognition, 24, 687-699.
28. Kowal, S., O'Connell D.C., & Posner, R. (1995). Der prototypische Fußgänger: Zum Menschenbild der amtlichen Verkehrszeichen [The prototypical pedestrian: The picture of humans in official traffic signs]. Zeitschrift für Semiotik, 17, 151-163.
29. Lepore, L. & Brow, R. (1999). Exploring automatic stereotype activation: A challenge to the inevitability of prejudice. In D. Abrams & M. A. Hogg (Eds.), Social identity and social cognition (pp. 141-163). Malden, MA: Blackwell.
30. Levy, S., Stroessner, S., & Dweck, C.S. (1998). Stereotype formation and endorsement: The role of implicit theories. Journal of Personality and Social Psychology, 74, 1421-1436.
31. Lord, R.G. & Maher, K.J. (1991). Leadership and information processing: Linking perceptions and performance. London, UK: Unwin Hyman.
32. Ma'or, A. (Ed.) (2002). Women: The rising power. Advancing women at the workplace: Smashing the "glass ceiling". Tel Aviv, Israel: Sifriyat Po'alim (in Hebrew).
33. McConnell, A.R. & Fazio, R.H. (1996). Women as men and people: Effects of gender-marked language. Personality and Social Psychology Bulletin, 22, 1004-1013.
34. Merritt, R.D. & Kok, C.J. (1997). Implications of the People=Male Theory for the interpretation of the Draw-A-Person Test. Journal of Personality Assessment, 68, 211-214.
35. Moskowitz, G.B. (1993). Individual differences in social categorization: The influence of personal need for structure on spontaneous trait inferences. Journal of Personality and Social Psychology, 65, 132-142
36. Neuberg, S.L., Judice, T.N., & West, S.G. (1997). What the Need for Closure Scale measures and what it does not: Toward differentiating among related epistemic motives. Journal of Personality and Social Psychology, 72, 1396-1410.
37. Perry, E. (1994). A prototype matching approach to understanding the role of applicant gender and age in the evaluation of job applicants. Journal of Applied Social Psychology, 24, 1433-1473.
38. Plaks, J. & Dweck, C.S. (1997). Implicit person theories and attention to counter-expectant social information. Paper presented at the Annual Convention of the American Psychological Society, Washington, DC.

39. Rakow, L.F. & Wackwitz, L.A. (1998). Communication of sexism. In M.L. Hecht (Ed.), Communicating prejudice (pp. 99-111). Thousand Oaks, CA: Sage Publications.
40. Raty, H. & Snellman, L. (1997). Children's images of an intelligent person. Journal of Social Behavior and Personality, 12, 773-784.
41. Reder, L.M. & Kusbit, G.W. (1991). Locus of the Moses Illusion: Imperfect encoding, retrieval, or match? Journal of Memory and Language, 30, 385-406.
42. Schaller, M., Boyd, C., Yohannes, J., & O'Brien, M. (1995). The prejudiced personality revisited: Personal need for structure and formation of erroneous group stereotypes. Journal of Personality and Social Psychology, 68, 544-555.
43. Scholz, R. (1997) Die Verwilderung des Patriarchats in der Postmoderne [The decline of patriarchy in post modernity]. Psychologie & Gesellschaftskritik, 21, 31-51.
44. Sorrentino, R.M. & Higgings, E.T. (1996). Handbook of motivation and cognition: Foundation of social behavior (Vol. 3). New York, NY: Guilford Press.
45. Switzer, J.Y. (1990). The impact of generic word choices: An empirical investigation of age- and sex-related differences. Sex Roles, 22, 69-82.
46. Thompson, M.M., Naccarato, M.E., Parker, K.E. (1989, June). Assessing cognitive need: The development of the Personal Need for Structure and the Personal Fear of Invalidity Scales. Paper presented at the annual meeting of the Canadian Psychological Association, Halifax, Nova Scotia, Canada.
47. Thompson, E.P., Roman, R.J., Moskowitz, G.B., & Chaiken, S. (1994). Accuracy motivation attenuates covert priming: The systematic reprocessing of social information. Journal of Personality and Social Psychology, 66, 474-489.
48. Tulving, E. & Thomson, D.M. (1971). Retrieval processes in recognition memory: Effects of associative context. Journal of Experimental Psychology, 87, 116-124.
49. Van Oostendorp, H. & de Mul, S. (1990). Moses beats Adam: A semantic relatedness effect on a semantic illusion. Acta Psychologica, 74, 35-46.
50. Wyer, R. S. (ED.) (1998). Stereotype activation and inhibition. Advances in social cognition (Vol. 11). Mahwah, NJ: Erlbaum.
51. Ziegler, A. (1994). Die Entwicklung schlussfolgernden Denkens [The development of deductive reasoning]. Frankfurt, Germany: Lang.
52. Ziegler, A. (2000). Der Überzeugungseffekt im logischen Denken Jugendlicher [The belief bias in the logical reasoning of adolescents]. Regensburg: Roderer.
53. Zorman, R. & David, H. (2000). Female achievement and challenges toward the third millennium. Jerusalem, Israel: Henrietta Szold Institute and the Ministry of education.