Novices´ Reasoning Processes in a Psychological Modeling Task

Bachelor thesis

Psychology

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Abstract

This study investigates the reasoning activities during a psychological modeling task. Under examination were 16 participants with different experience in the field of psychology. The task was to create a model of the psychological phenomenon called “visual search“. Gathered data were from think-aloud protocols, the created models and a post test. Participants were grouped in “novices“ and “advanced learners“. The only difference in reasoning activities between the groups was found in time spent on experimenting. A correlation analyses revealed a strong indication for the importance of orientation. Also a difference in experimenting behavior was found, which is suggested for further research.

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1. Introduction

In order to investigate the modeling strategies of psychology students the questions have to be answered what models are and what they are good for in science education.

1.1 Models

Stachowiak (1973) explains in his "General Model theory" that a model has to show at least three characteristics: first is "Representation", which means that a model is always representing a natural or artificial original, which might be a model at his own. Second is "Shortening" implying that a model doesn't cover all attributes of the original, but only those seeming relevant to the designer of the model. The third characteristic mentioned by Stachowiak is "Pragmatism". That means that a model is used for a certain purpose and for certain duration of time instead of the original. That implicates that the model gets interpreted. A fourth characteristic was added by Dörner in 1998: "Validity". This seems indispensable, because an invalid model delivers a wrong representation and leads to conclusions which are contrary to the pragmatic goal. In this sense of the term, models are representations that abstract and simplify a system to make its central features explicit (Gobert & Buckley, 2000). They consist of elements, relationships, operations, and rules that govern the interactions (Lesh & Doerr, 2003).
Models can be differentiated in various types depending on the place of representation, the way they are represented, and the function of the model.
Mental models for example are used to explain how humans know, perceive, make decisions, and construct behavior in different environments (Davidson et al., 1999). They were first described by Craik (1943) as a storage tool for the content of thoughts. In 1983 Johnson-Laird specified mental models as a way of describing the process which humans go through to solve deductive reasoning problems (Davidson et al., 1999). Thus he saw mental models not only as a storage tool for thoughts, but also as an instrument of thinking, which helps to understand something (Johnson-Laird, 1983). As mental models are conceptual models, they don't need an external representation (Webb, 1993). Models, which always need such an external representation, are called physical models. They are physical representations of a phenomenon which might be larger, like a plastic model of a cell, or smaller, like a globe, as the phenomenon they are representing. (Lehrer & Schauble, 2000)
Another distinction can be made between expedient and explanatory models. Whereas an expedient model only shares behavior and features of the represented system, an explanatory model also gives insight in the underlying processes. Thus, the first only shows *what* the system is and the second also shows *how* it works (Clement, 1989).
As described earlier models can appear in many different forms and functions. In the following section the value of models for science education is outlined.

1.2 Models in science education

In science education models can broadly be used, because they "offer students the means to externalize and to test their own mental representations of particular scientific phenomena " (Sins et al., 2009). One approach to use modeling in science education is scientific inquiry. „A modeling-centered inquiry approach is an instructional approach in which learners engage in scientific inquiry whose focus is on the creation, evaluation, and revision of scientific models that can be applied to understand and predict the natural world" (Schwarz, 2008). In other words, the practice may begin with a question and an initial model that is being tested. An example for such an inquiry learning task was shown by Löhner et al. (2004) who used an inquiry learning environment with the simulation of the temperature of a house to test students' reasoning during a modeling task. A normative description of the inquiry process was given by White and Shimoda (1999). They assumed that a so-called inquiry cycle should include the following steps: question, hypothesize, investigate, analyze, model, and evaluate. Löhner et al. (2004) concluded that if such an inquiry cycle resembles the way scientists work, the process of building a model should be similar to such a cycle. So they deduced from inquiry cycles of different authors a normative description of the modeling process to test its validity. That description is used in this study as a coding scheme to analyze the modeling strategies of the participants.

1.3 The study

The value of models for science education has been described and was content of many studies in different domains. Earlier studies in the field of psychology (Stellmacher, 2009, Kopitzki, 2010) and in other fields (Löhner, 2004) concentrated foremost on the reasoning activities during a modeling task, its influence on the model product and the inquiry cycle. To add something to this series of studies, the current thesis also wants to discuss the impact of reasoning strategies on acquired knowledge. Further a clear distinction between novices and advanced learners should be made. Therefore this study addresses the following question:
1. What are novices reasoning activities during a psychological modeling task in comparison with advanced learners?
2. How do reasoning activities influence the model product?
3. How do reasoning activities influences acquired knowledge?

2. Method

2.1 Participants

In this study 16 people studying or working in the field of psychology at the University of Twente (UT) participated. Participants were 3 first year, 4 second year and 4 third year bachelor-students. In addition, 3 master-students participated, one master graduate and one PhD graduate, too. Out of 16 participants 6 were women and 10 were men.

2.2 Materials

Core of the experiment was a modeling task derived from the psychological phenomenon of "visual search". This phenomenon was described by Anne Treisman in her feature integration theory of attention (FIT) in 1980. To get familiar with the theory participants had access to an experimental task about "visual search" offered in an interactive learning environment from the UT, called ZAP (Hulshof, Eysink, & de Jong, 2006).
All textual parts of the experiment were also offered on a paper to give participants the chance to reread all information provided in the task. Further that paper included background information, important variables and instructions for the modeling task and two training tasks. First training task was a puzzle to practice the think aloud technique, second was a small modeling task to get prepared for the main task. Paper and tasks were adopted from Kopitzki (2010) and can be found in Appendix A. The modeling tasks were performed with a tablet and the main task was recorded with a microphone. Further material was a post-test composed of 6 textual items and 3 visual items to get evidence of the knowledge about visual search participants achieved in this experiment (Appendix B).

2.3 Procedure

At the beginning of the experiment the participant was given a short verbal instruction about the tasks and the tablet. Then the participant had to read the instruction about the first task, which was

the puzzle, and then accomplish it while thinking aloud. Then the modeling training task followed, which was performed on the tablet while thinking aloud. Thereafter the main task started, beginning with the ZAP experiment having the aim to make the participant familiar with the FIT and the variables important for a visual search. The ZAP was consisted of pictures which had to be scanned by the participants to find a green dot. Depending on number and characteristics of distractors, the search task included different degrees of difficulty. The results gave participants insight in the different search methods, which should be used according to the theory.
On completion of the experimental task the participant read the instruction for the modeling task which had the aim to explain the search time during a visual search. This model was drawn on a tablet and the think aloud protocol was recorded via a microphone. Participants were instructed to use the text about the theory, the results from the experiment, and own ideas in order to construct the model. The experiment ended as soon as the participant revealed not to be able to add any improvements to the model. Afterwards a short debriefing followed to explain the aim of the study and the methods of analysis. Within 12-15 days after the experiment participants filled in the post-test.

2.4 Data collection and analysis

In order to examine the research question critically analysis took place in a threefold way. First, the strategies of the participants during the modeling process were coded. Therefore the records of the think aloud protocols were split into text segments and coded via a coding scheme from Loehner et al. (2004). In this scheme modeling strategies are divided into two categories. First, scientific reasoning with its 5 subcategories: orientation, hypothesizing, experimenting, model implementation and model evaluation. Second, other activities with its 4 subcategories: actions, regulation, off tasks and experimenter. To obtain the inter-rater reliability a second rater coded a random participant (participant 9). The inter-rater reliability was good for the two main categories (Cohen's kappa = 0,823) and usable for the subcategories (Cohen's kappa = 0,687).
Second part of analysis was the rating of the models. Therefore a coding scheme was created on basis of an ideal model from Kopitzki (2010). The scheme contained as criteria the variables of the ideal models as well as the relationships between the variables. So a model was scored with a point for each used variable as "attention" or "conjunctive search". Further, a point was added for each important relationship between the variables. An example therefore is that during a search task "distractors" have more influence on "conjunctive search" than on "feature search". If that relation was observable in a model product, a point was scored. Points could also be subtracted if the influence (positive or negative) from one variable on another was not labeled or wrong labeled. The product of the points resulted in the final model score. The ideal model, the best rated model, and the worst rated model can be found in Appendix C.
Third part of analysis was the quantitation of the post-test. The 6 textual items, which were answered via a 5 point Likert-scale, were rated with 1 point each for the right answer or a half point if the answer went in the right direction. For example, if on the question "which influence has the pop out effect on the search time?" a "strong negative influence (--)" was marked, the participant got 1 point to his test score. If a "negative influence (-)" was marked, the participant got a half point. If "no influence (0)", "positive influence (+)" or "strong positive influence (++)" were marked, no point was added to the test score.
The 3 visual items were composed of 4 pictures each, which showed one of the items from the visual search experiment. These pictures had to be ranked accordingly to the search time it should need to finish a search task. Each picture was rated with 1 point if it was ranked on the right place and with a half point if it was ranked next to the right place.
For example, a participant might rank the pictures of an item "abcd" whereas "a" represents the search which should need fewest time and "d" the search which should need longest time. If the correct order (according to the theory) is "dbac" the participant would achieve 1 point for "b" being

on the right place and a half point for “c“ being next to the right place. Pictures “a“ and “d“ would not be scored. So for the whole item a score of 1.5 would be achieved.
On all visual items together 12 points could be scored and on the whole test a score of 18 points was possible.
Assuming that students with less experience in the field of psychology differ in strength of their models and obtained knowledge from that of more experienced people, participants were post-hoc divided into two groups: The “novices” group contained the 7 first and second year students, the “advanced learners” group the more experienced participants including the expert with PhD. Usually the novices should have had included all Bachelor students, but after recognizing very strong models and post-tests from the third year students, those were added to the advanced learners. After building the groups on basis of model strength and post-test score the strategies of the two groups got compared.

3. Results

3.1 Reasoning activities

Table 1 shows the percentages of time each group spent on reasoning activities. High standard deviations indicate large differences within the individual groups. The amount of experimenter talk has a high variation and amounts in some cases up to 40% of the total time. Even so is in both groups most time spent in reasoning activities (about 70%).
Regarding main group differences, the only significant one was time spent on experimenting. Novices (5.6%, SD= 3.0) use significantly more time for comments about the experiment (VIP module) while modeling than the advanced learners (1.9%, SD= 2.6, p= 0.02).
Analysis of real time (not percentages) spent on reasoning activities shows similar results.

Table 1
Percentage of time spent on reasoning activities for novices and advanced learners (standard deviation in parentheses)

	Novices	Advanced learners	*p*
Orientation	17.4 (6.5)	19.1 (4.0)	0.524
Hypothesizing	17.9 (5.1)	18.8 (6.5)	0.873
Experimenting	5.6 (3.0)	1.9 (2.6)	0.02*
Model implementation	19.9 (6.4)	18.4 (10.1)	0.525
Model evaluation	8.1 (10.6)	8.6 (4.3)	0.242
Actions	5.0 (5.6)	7.1 (5.9)	0.335
Regulation	7.0 (2.8)	8.7 (5.1)	0.365
Off task	1.6 (2.5)	3.7 (3.4)	0.177
Experimenter	17.7 (14.7)	14.6 (12.6)	0.71

P scores were obtained with a non-parametric Mann-Whitney *U*- test.
* $p<0.05$

3.2 Reasoning activities related to model product

Comparison of model strength with a non-parametric Mann-Whitney U-test shows a slight, but not significant, difference between novices (M= 6.4) and advanced learners (M= 8, p= 0.22).
To get a relation between model strength and used reasoning activities, correlations between percentages of time spent on particular reasoning activity and the highest achieved model score were computed (Table 2). For all participants a significant positive correlation (r= 0.52) between the

amount of time spent on off tasks and the highest model is shown. Also a significant negative correlation (-0.54) is found between the time spent on model implementation and the highest model score. When looking at the different groups, for advanced learners the highest model score correlates significantly positive with time spent on model evaluation (r= 0.87) and significantly negative with experimenter talking time (r= -0.82). Novices only show a marginal significant negative correlation between time spent on model implementation and the highest model score.

Table 2
Spearman rank correlations between percentage of time spent on particular reasoning activity and the highest achieved model score for all participants and separately for novices and advanced learners

	Highest model score		
	Novices	Advanced learners	All participants
Orientation	0.22	0.28	0.22
Hypothesizing	0.07	0.40	0.23
Experimenting	-0.74	-0.03	-0.28
Model implementation	-0.71**	-0.47	-0.54*
Model evaluation	-0.62	0.87*	0.11
Actions	0.30	0.16	0.35
Regulation	-0.21	0.31	0.16
Off task	0.41	0.44	0.52*
Experimenter	0.36	-0.82*	-0.34

* p<0.05 (2-tailed)
** p<0.1 (2-tailed)

3.3 Reasoning activities related to post-test

Comparison of post-test scores with a non-parametric Mann-Whitney U-test shows a significant difference between novices (M= 10.5) and advanced learners (M= 13, p= 0.007). Correlations between time spent on reasoning-activities and the highest post-test score were also evaluated. Table 3 shows a significant positive correlation (r= 0.73) between time spent on orientation and the highest post-test score for all participants. Also a marginal negative correlation (r= -0.49) is shown for time spent on model implementation, and a marginal positive correlation (r= 0.46) for time spent on actions, compared with the highest post-test score. Novices showed significant positive correlations between highest post-test score and time spent on orientation (r= 0.96), hypothesizing (r= 0.85) and experimenting (r= 0.79). Further novices showed a marginal negative correlation (r= -0.74) between test score and time spent on evaluation. For advanced learners table 3 shows a significant positive correlation (r= 0.89) between test score and time spent on orientation and a significant negative correlation (r= -0.73) between test score and time spent on model implementation.

Table 3
Spearman rank correlations between percentages of time spent on particular reasoning activity and the highest achieved post-test score for all participants and separately for novices and advanced learners

	Highest post-test score		
	Novices	Advanced learners	All participants
Orientation	0.96*	0.89*	0.73*
Hypothesizing	0.85*	0.23	0.37
Experimenting	0.79*	0.03	0.23
Model implementation	-0.05	-0.73*	-0.49**

Model evaluation	-0.74**	0.23	0.06
Actions	0.30	0.43	0.46**
Regulation	-0.44	0.32	0.27
Off task	-0.66	0.09	0.11
Experimenter	-0.43	-0.25	-0.28

* *p*<0.05 (2-tailed)
** *p*<0.1 (2-tailed)

Model score and post-test score show a marginal significant correlation (r= 0.45, p= 0.08)

4. Discussion

The research question of this paper is: what are novices reasoning activities during a psychological modeling task in comparison *to* advanced learners?
Data shows that participants spent most time during modeling on orientation, hypothesizing and model implementing activities. The only significant difference between the strategies of novices and advanced learners is found in the amount of time spent on experimenting. As this research separated the experimenting phase (doing the ZAP) from the modeling phase, experimenting as an activity was only scored when participants referred to the experimental task or its results. That should explain why collectively a relative small amount of time was spent on experimenting. However, the difference between novices and advanced learners in experimenting time indicates that novices seem to prefer working with a concrete example, whereas advanced learners are able to solve such a task in a more abstract or more general way.
Participants' model scores don't show significant differences between novices and advanced learners, even if an effect might be reached with a higher amount of participants.
Referring to the question how reasoning activities influence model strength data shows that time spent on implementing the model seems to have negative impact on the model score for all participants. A reason therefore might be that implementation of the model does not enhance understanding of the product as it is implicated for orientation and hypothesizing. Thus, participants who are only busy with drawing the model, while neglecting other reasoning activities seem to work less accurate and seem to make more mistakes. The positive correlation between time spent on off tasks and the model strength gives room for speculations. It seems that participants who have problems with the task wanted to finish the task as fast as possible, whereas some participants, who seemed to enjoy the task, also spent time on a joke or questions not related to the task. That would indicate that more fun leads to better results. This finding is opposed to the findings of Löhner et al. (2004), who found a negative correlation between time spent on off tasks and modeling product of students. A reason for therefore might be that in the study from Löhner et al. (2004) participants worked in pairs, so it is likely that the off-task occurred between the participants and was perceived as distraction from the task from both. In the current experiment most off-tasks happened in interaction with the experimenter or were a short comment about the experiment. So it could be able that in the first experiment off-task were foremost perceived as distraction, whereas in this study participants perceived the off-task as short rest period.
Comparison between the groups shows that only advanced learners seem to profit by time spent on evaluating. A closer look within the groups shows that in general advanced learners seem to evaluate more. But one of the novices who spent 30% of time with evaluating (novices evaluating: M= 8.1%, N= 7) and who obtained a low model strength might influence the results. That's why evaluating should be valued high for all experiential groups to achieve a good model. This is also emphasized in the results from Löhner et al. (2004), who found a positive correlation between time spent on evaluating and achieved model score of students. Another difference between the groups was found in relation to experimenters´ talking time. Advanced learners show a negative correlation between

model strength and amount of time the experimenter talks. That might be due to the reason that the experimenter only interrupted the participant when he observed problems in task understanding or performance. So, it might be concluded that advanced learners with general problems in performing a modeling task create models with lower strength. That seems plausible, but why don’t novices show such an effect? This might be due to the reason that novices in general have problems with domain specific tasks and that’s why they seem to profit more by help from the experimenter. But for advanced learners (with different amounts of domain knowledge), who don’t show such a homogeneity in task understanding, it seems the experimenters´ talking time is only an indicator for worse understanding and thus for worse results.
Referring to the question how reasoning activities influence acquired knowledge data shows that, above all, time spent on orientation seem to lead to a better post-test score. As that result is found for all participants and subgroups, orientation should be seen as (perhaps most) important part of the modeling cycle for inquiry learning. Together with the amount of actions, which was without exception reading of the instructions and of the information, orientation seems to build the framework for the storage of knowledge acquired during the task.
High percentage of time spent on implementation correlates marginally negative with post-test scores, which indicates that participants who spent much time in this activity neglected other ones, which where more important for knowledge acquisition. As it was the case for the model product, implementation also seems not to be of adding value for the acquisition of knowledge, but seems to have negative impact on the relevant activities.
Comparison between the groups shows that novices profit more from hypothesizing and experimenting than advanced learners. The difference in the impact of hypothesizing is hard to explain and might be due to small number of participants, as both groups show positive correlations. But that novices profit more from experimenting seems to indicate that they not only prefer using experiments while building a model. They also might use experiments to strengthen their achieved knowledge with help of single examples, whereas advanced learners try to store their knowledge in more general terms. That indicates a more inductive knowledge acquisition for novices and a more abstract one for advanced learners.
Because of the different results of post-test scores between the groups someone might argue that it is not surprising that participants with different domain knowledge score different on a knowledge test. To diminish such an argument it has to be mentioned that all participants (including expert) stated never having encountered underlying theory or experiment. Further most of the test items were visual pictures, which made it hard for participants to bring in knowledge which has nothing to do with the task. About the textual items of the test it should be mentioned that the expert scored at least 2.5 of 6 possible points better than all other participants. That might indicate on the one hand that the expert could had earlier contact with relevant terms like “conjunctive search“ or “distractor“. But on the other hand it also might indicate that the expert is possible to integrate specific terms in his concept about the phenomenon, whereas not that experienced people aren’t able to do that.
That the post-test score correlates with the achieved model score highlights the importance of inquiry modeling tasks for knowledge acquisition as described in the introduction.

5. Conclusion

It can be concluded that the results of this study indicate a general difference in modeling strategy and knowledge acquisition between novices and advanced learners in the field of psychology. Foremost the role of experimenting seems to suggest that difference. As the experiment was separated from the modeling process in this study it is recommended to bring together both processes in further studies. Further this thesis shows some results which need a closer look in further studies. So is it unlikely that model implementation has a direct negative influence on the product, but it might have an indirect, if other modeling activities get neglected for it. If off-tasks are helpful or disrupting seems to depend on the context and needs to be investigated. For the knowledge acquisition it can be concluded that the most important part seems to be the orientation phase. This should be considered by creating modeling based learning tasks. But also the shown differences between novices, advanced learners and the expert might help to improve inquiry learning tasks, if they got attention in further studies.

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Appendix A (Experiment material)

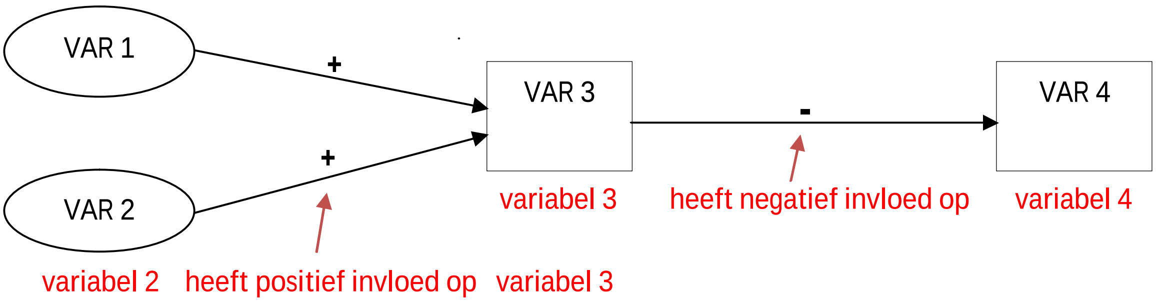
Beste proefpersoon,

Modeleren is een aanpak om fenomenen (of theorieën, ideeën, gedachten) te externaliseren. Door de onderliggende variabelen uit te vinden, in samenhang met elkaar te brengen en te schetsen ontstaat een externe representatie, die de structuur en de werking van een fenomeen verheldert. Op die manier kan men hypothesen afleiden, modellen testen of gewoon begrijpen hoe iets in elkaar zit. Het is een methode om leren en begrip te ondersteunen en te verdiepen.
Dit onderzoek wil de structuren van het modelleerproces uitvinden.
In het volgende zal je aan hand van een klein experiment en een theorie daarvan zelf een model maken, dat verbanden tussen variabelen verklaart. Het is de bedoeling dat je hierbij de hele tijd hardop gaat denken.
Voordat je met het modelleren echt gaat beginnen, krijg je twee kleine opgaven om het modelleerproces en het hardop denken te oefenen.

Opdracht 1: Puzzel
Maak uit de 4 puzzeldelen een vierkant. Probeer de hele tijd hardop te denken.

Opdracht 2: Een lekkende emmer water
Onder een lopende kraan staat een wateremmer, dus er stroomt water in de emmer. Onderaan, op de zijkant, heeft de emmer een gat waar ook weer water uitstroomt. Hoeveel water er door het gat uit de emmer stroomt, hangt af van twee dingen. Ten eerste: hoe groter het gat, hoe meer water er doorheen kan en ten tweede: hoe meer water er in de emmer zit, hoe groter de druk van de waterkolom, waardoor het water harder uit het gat zal stromen.
Modelleer de lekkende emmer water en probeer weer de hele tijd hardop te denken.

Voorbeeld van elementen in een model:



Je staat op het centraal station en komt een vriend ophalen. Er lopen echter tal van mensen van en naar de treinen en tussen de massa door probeer je vriend te detecteren. Geen gemakkelijke opgave, tenzij je vriend een rode jas en een bolhoed zou dragen. In dat geval zou hij zeker opvallen tussen de vele andere mensen daar aanwezig. Je zou dan zeker niet veel tijd nodig hebben om hem te detecteren. In de psychologie wordt er dan gesproken van een **pop out effect**: het te identificeren item, je vriend in dit geval, kan snel gedetecteerd worden omwille van zijn opvallende kenmerken.
Maar stel je voor dat je je vriend in een treinstation in Engeland staat op te wachten, waar het vol loopt met 'gentlemen' met bolhoeden. De zoektocht naar je vriend wordt dan al een stuk moeilijker, want al die andere mensen met een bolhoed treden immers op als afleiders of **distractors**.

Je hebt in het experiment net kunnen ervaren dat deze distractors onder bepaalde omstandigheden meer verwarring veroorzaken in vergelijking met andere condities. Wanneer we zoeken naar een item met opvallende **kenmerken** (bv. kleur, grootte, afstand tot andere items), kunnen we een zogenoemde **feature search** uitvoeren. Bij een feature search wordt de omgeving eenvoudigweg gescand op het kenmerk of de kenmerken waar we naar op zoek zijn. Er is hier vaak sprake van een **pop out effect** van het item. Distractors spelen in dit geval geen (grote) rol. Het te zoeken item springt er tussenuit, je zoekproces kan zodoende erg vlot verlopen. Sterker nog, omwille van de opvallende kenmerken van het te zoeken item, wordt het haast onmogelijk om het item te ontwijken op onze zoektocht.

Het wordt echter moeilijker, wanneer een item waar we naar op zoek zijn, geen opvallende kenmerken heeft. In zo'n geval moeten we een conjunction of **conjunctive search** uitvoeren: we zoeken dan naar een item dat een bepaalde combinatie (in het Engels: conjunction) van distractor kenmerken bevat. Het item valt daarom niet op tegen de distractors en het zoekproces zal bijgevolg langer duren. We moeten ook onze **aandacht actief** richten op het zoekproces, het item dat we zoeken springt immers niet boven de distractors uit.

Anne Treisman ontwikkelde een theorie, de **feature integration theory (FIT)**, om het gemak waarmee we feature searches en de relatieve moeilijkheid waarmee we conjunctive searches uitvoeren, te verklaren. Treisman stelt dat we een **mentale map** hebben waarin kenmerken uit ons visuele veld gerepresenteerd zitten. Zo is er bijvoorbeeld een map voor elke kleur, grootte, vorm enz.
De representatie van deze kenmerken van een bepaald object in een map is:

a) onmiddellijk: er is geen bijkomende tijd nodig voor verdere cognitieve verwerking
b) gelijktijdig: alle kenmerken worden tegelijk gerepresenteerd
c) preattentief: er is geen gerichte aandacht voor nodig

Bij **feature searches** scannen we relevante **kenmerk-mappen** en kijken we of er elementen of items vanuit ons visuele veld in aanwezig zijn. Dit proces kan snel gebeuren en ondervindt relatief weinig hinder van het **aantal** elementen in ons visuele veld. Bij **conjunctive searches** is er echter een bijkomende cognitieve verwerking nodig. We hebben hier onze **aandacht** nodig als een soort mentale lijm om twee of meer kenmerken van een bepaald item te combineren. Het te zoeken item vertoont immers overeenkomsten met de overige items uit ons gezichtsveld. Enkel de kenmerken van 1 object kunnen tegelijk gecombineerd worden door onze aandacht. Hoe meer objecten of items in ons visuele veld aanwezig zijn, hoe langer het zoekproces zal duren.

Invloedrijke variabelen:
Zoektijd (snele feature search vs langzame conjunctive search)
Eigenschap van zoekobject („Featuremaps“: kleur, afstand, oriëntatie, grote)
Aandacht (proces bewust of onbewust)
Distractors (aantal, eigenschappen)

Opgave:
Maak een model, dat de verschillen in de zoektijd kan verklaren. Probeer de feature integration theorie zo duidelijk mogelijk te maken, dat jij en andere het goed kunnen begrijpen. Maak het ook zo compleet als mogelijk en denk daarbij ook aan eventueel andere variabelen, die niet in de tekst staan of niet expliciet gekentekend zijn.
De vorm van het model zou dezelfde zijn als bij de lekkende emmer water.
Vergeet ook het hardop denken niet.
Succes!

Appendix B (post-test)

Deze toets vraagt naar de relaties tussen variabelen in het model over visueel zoeken

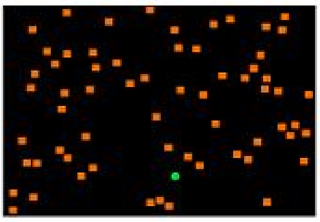
++ sterke positieve invloed
+ positieve invloed
o geen invloed
- negatieve invloed
-- sterke negatieve invloed

	++	+	o	-	--
1. Welke invloed heeft het aantal distractors op de zoektijd tijdens een onbewuste zoekactie?	o	o	o	o	o
2. Welke invloed hebben buitengewone eigenschappen van het zoekobject op de zoektijd tijdens "conjunctive search"?	o	o	o	o	o
3. Welke invloed heeft een "pop out effect" op de zoektijd ?	o	o	o	o	o
4. Welke invloed heeft het aantal distractors op de zoektijd tijdens een bewuste zoekactie?	o	o	o	o	o
5. Welke invloed hebben buitengewone eigenschappen van het zoekobject op de zoektijd tijdens "feature search"?	o	o	o	o	o
6. Welke invloed heeft het aantal distractors op het "pop out effect"?	o	o	o	o	o

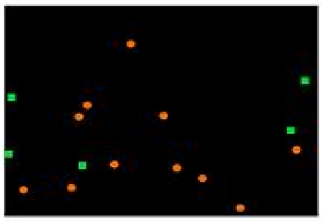
Orden de afbeeldingen naar de zoektijd die nodig zou zijn om te bepalen of er een groene cirkel in de plaatje zit of niet. Begin met de afbeelding die het snelst zou kunnen worden beoordeeld.

1. kortdurend __ __ __ __ langdurend

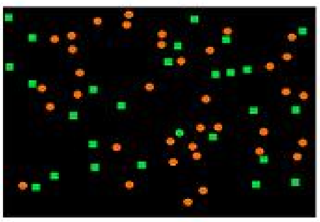
a



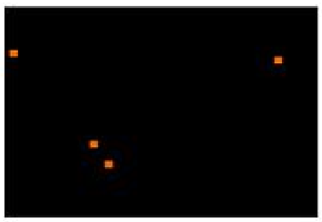
b



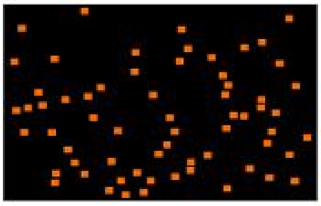
c

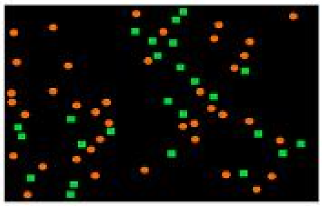


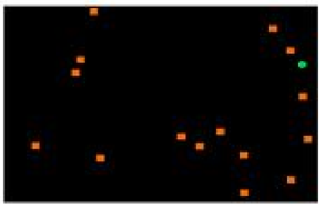
d

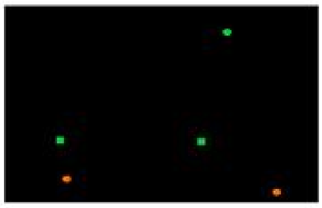


2. kortdurend __ __ __ __ langdurend

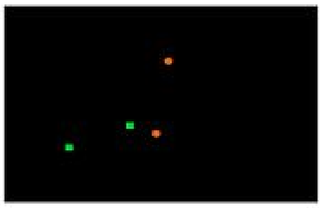
a. 

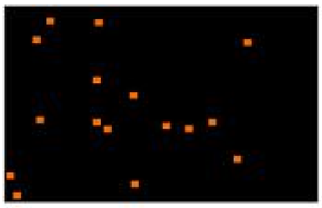
b. 

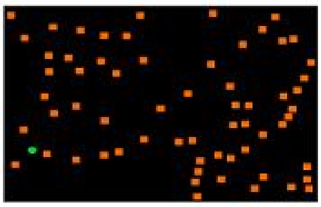
c. 

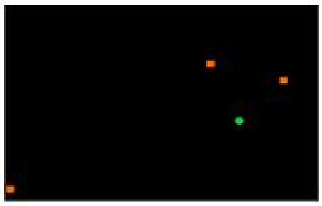
d. 

3. kortdurend __ __ __ __ langdurend

a. 

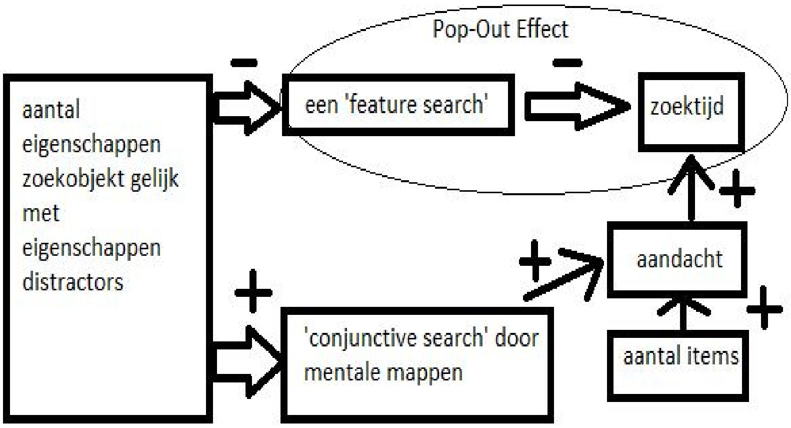
b. 

c. 

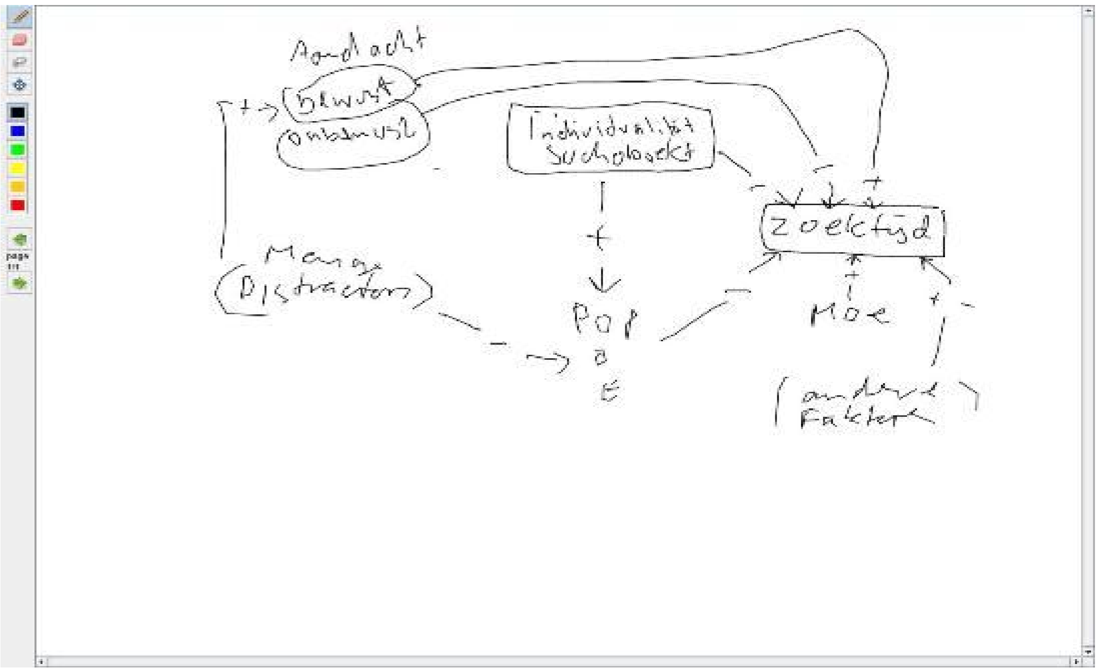
d. 

Appendix C (Models)

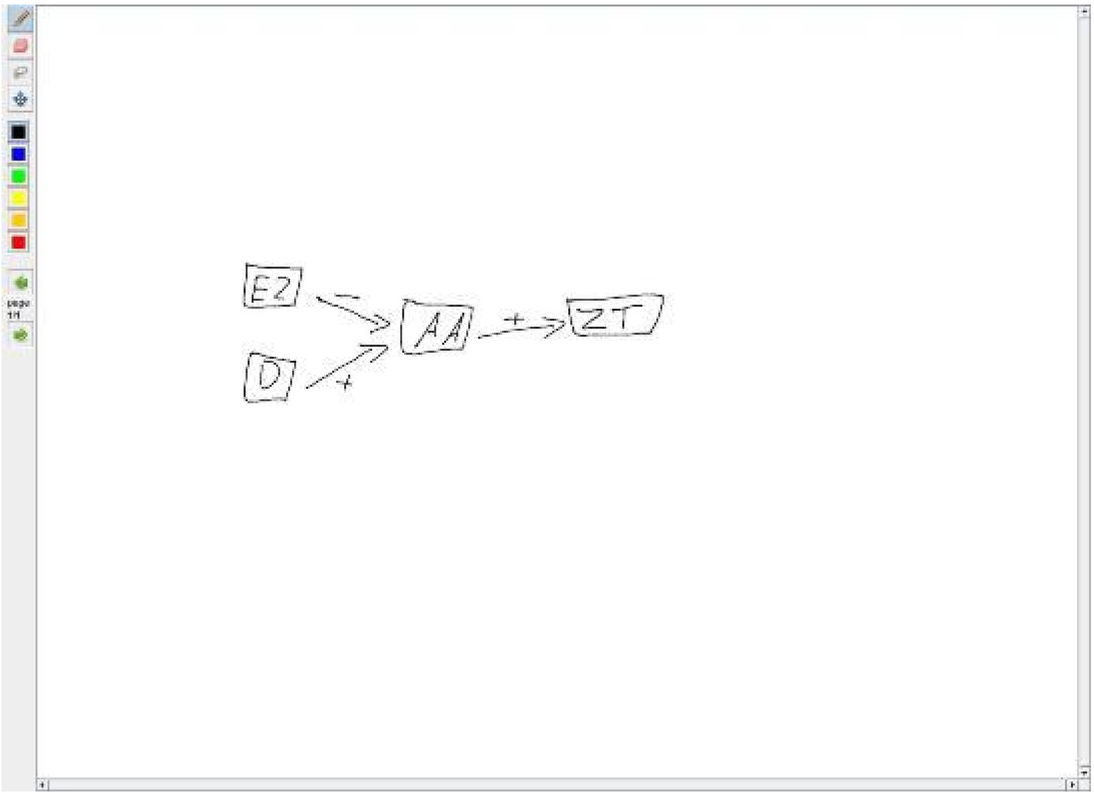
Ideal model:



Best rated model:



Worst rated model: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