How Irrelevant Information Influences Judgment

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Abstract. This paper presents JUDGEMAP2 model for judgment based on DUAL cognitive architecture. Context is considered like the content of WM that comprises both some external elements from the surrounding environment and some internal memories elicited from the LTM. The paper focuses on the mechanisms of construction of the dynamic content of the WM. In JUDGEMAP2, the mechanism responsible for building the content of the WM (e.g. context) is a spreading activation mechanism. It leads to an unusual prediction – that irrelevant dimensions takes part in judgment. The data, obtained by the simulations are tested and confirmed in a psychological experiment.

1. Introduction

Suppose that a person has to judge the height of a particular target person. His/hers judgment will be affected from the extra knowledge about the target. If the target person were a teacher, the stimuli, which would be elicited in the WM during the process of judgment, would be prevailing teachers. Moreover, if the target is blond, more blond teachers would be retrieved from memory and hence would take part in judgment.

On the contrary, some theories understand judgment as a process of precise measurement where contextual elements add some noise. Rather, we assume that *context sensitivity* is a necessary condition for a flexible and effective cognition. Flexibility usually is considered to be a sequence from having a large base of possible alternatives, while effectiveness – from restrictions upon the amount of the considered alternatives. This obvious contradiction might be resolved by searching only the *relevant* paths.

As far as DUAL architecture [4,5] was explicitly design to model context sensitivity of human cognition, it terns to be a natural groundwork for designing the model JUDGEMAP2 that describes relative judgments. DUAL takes the advantage of decentralized representations of concepts, objects and events, and parallel emergent computations. According to JUDGEMAP2, judgment is a process of *mapping* between a set of retrieved and perceived stimuli and the set of scale ratings. During this mapping, the main pressure is to keep as much as possible the order relations – higher magnitudes to receive higher ratings and vice versa. In this respect,

JUDGEMAP2 is strongly interconnected with AMBR model for analogy-making, since the process of judgment is described like involving memory (construction of the comparison set in working memory) and mapping (which is a central mechanism in analogy-making).

Existing theories that try to explain the relativism in human judgment stress on different characteristic of context and usually do not describe the process of judgment but rather its result. Part of them look at judgment as a process of *measuring the similarity/dissimilarity to a standard*. People have their "ideal points" and when judge they measure the distance between the stimulus and this ideal point [1,8]. Some of the theories that share the same point of view assume that the standard (adaptation level) dynamically changes depending on the context [2] or even that it is constructed on the spot rather than retrieved from long-term memory [3].

Others look at judgment as a process of *classification*. Each rating forms a subcategory and the target stimulus has to be classified into one of those subcategories. The Range-Frequency Theory [6] postulates two independent constraints that such category subdivision should satisfy: the range of value variation within all subcategories should be about the same, and the number of examples in all subcategories should be about the same. The ANCOR model [7] falls under this approach. It describes the process of learning of the prototypes of these subcategories, their dynamically updates, and the process of classification of the target stimulus into one of them.

JUDGEMAP2 assumes a third point of view. The target stimulus is not compared to the comparison set, but is rather included in it and then a mapping is established between the elements of the comparison set and the set of rating labels (or scale elements). This mapping should satisfy as much as possible the specified (sometimes implicitly) in the instruction structural constraints – higher stimulus magnitudes should receive higher ratings, and almost equal differences between magnitudes should correspond to almost equal differences between the corresponding ratings.

JUDGEMAP2 starts to judge by constructing the so called comparison set in the WM. It comprises the target as well as some contextual stimuli perceived in the environment and also some exemplars retrieved from long-term memory (familiar or recently presented exemplars as well as generalized prototypes, if such exist in LTM). The mechanism responsible for that construction is spreading activation. The sources of activation are INPUT and GOAL nodes, i.e. the perceived target (and possibly context) stimuli and the goal to judge the stimuli on a required scale (e.g. a scale from 1 to 7). Thus the representations of the target and the scale elements become sources of activation which is then spread through the network of micro-agents. Naturally, concepts related to the representation of the target become active, e.g. various features of the target – these include both relevant and irrelevant features (of course, relevant features receive more activation than irrelevant ones).

Each instance-agent that enters WM emits *marker*. The marker passing mechanism, like in the classical semantic network tradition, serves for searching ways between the agents. Those markers one by one will cross in nodes called *comparison-relations*, which can compare two magnitudes and are able to create new agents, responsible for the specific relation between them. Another type of agents, called *correspond-relations***,** are responsible for creation of *hypotheses* for mapping. Their task is to seek for local similarities in the structure of the stimuli and ratings. Number of new

hypotheses for correspondence between the target stimulus and the ratings might emerge. In this way, in parallel with the other processes, a constrain satisfaction network is formed. When a certain hypothesis wins its competitors, the system is ready to give response.

2. Psychological Experiment

In this experiment human participants rate the length of red and green lines of various sizes. The interesting question is whether we will obtain a main effect of color, i.e. whether there will be a difference between the ratings of the red and green lines of the same size.

Method

Design: The experiment has a 14x2 within-subject factorial design. The independent variables are length (varying at 14 levels) and color (varying at 2 levels: green and red) of the lines. The dependent variable is the rating of the length of the lines on a 7-point-scale. The experimental question is whether there will be a main effect of color, which is supposedly an irrelevant factor in judging length.

Material: A set of 14 color lines has been presented horizontally against a gray background on a 17-inch monitor. The shortest line was 12 pixels; the longest one was 727 pixels and the increment was 55 pixels. Each particular line length has been shown eight times in red or green color. The short lines were predominantly green while the long ones were predominantly red. The lines with lengths 1 and 2 were presented 7 times in green and one time in red. The lines with lengths 3 and 4 - 6 times in green and two times in red and so on.

Procedure: The participants were tested individually in front of a computer screen where all 112 stimuli were shown sequentially and in random order. They were instructed to judge the length of each line presented on the screen on a seven point scale: 1-“it is not long at all”, …, 7-“it is very long”. No feedback was provided to the participants and no time restrictions have been imposed on them. The whole experiment typically lasted about 15 minutes.

Participants: The participants were 18 undergraduate students from the introductory classes in psychology at NBU who participated in order to satisfy a course requirement.

Results: We had 14x2=28 data points for each participant. The repeated measurements analysis showed that the difference (0.046) between the mean judgment of the green lines (4.239) and the mean judgment of the red lines (4.193) is significant ($F(1, 17)=5.966$, $p=0.026$).

3. Simulation

The simulation replicates the experimental design, reported above. Each line was represented with three agents – one for the agent itself, one for its length, and one for its color. The scale was represented with seven different agents, each one standing for a certain rating. The neighbor ratings was interconnected each other with associative links. All they are instances of one more general concept – ‘seven-rate-scale’. This concept stayed on INPUT during all the time. The correspond relation ‘longer<->higher rating’ was attached to GOAL during all the time. The other relations were in

the long-term memory and were activated due the spreading activation. All stimuli in the set were given to the model (attaching them to INPUT node) in a random order, each line - immediately after judgment of the previous one.

Results: The mean of the mean ratings of all red categories is 3.996, while the mean of the mean ratings of all green categories is 4.022, which makes a difference of 0.026 which turns out to be significant tested with ANOVA analysis (p=0.033).

4. Conclusion

The JUDGEMAP2 model of human judgment has been presented. This model is based on a general cognitive architecture (DUAL) and is thus integrated with the memory and analogy-making model AMBR. Hence, it inherits their underlying assumptions: human cognition is context-sensitive and constructive, judgment included; analogy-making is at the core of human cognition and its mapping mechanisms may be used in judgment.

The JUDGEMAP model is similar to the Norm theory and the ANCHOR model with respect to the constructive approach to the formation of the comparison set. However, judgment in JUDGEMAP is not based on comparison of the target with some aspect of the comparison set, but rather the target stimulus is included in the comparison set and a mapping between the comparison set and the set of scale elements is establishing. Unlike all other models JUDGEMAP does not ignore the irrelevant features of the to be judged targets. The model makes a strange prediction that the color of the target line may play a role in the rating of its length and thus predicts a shift of the mean rating (although a small one) with the change of color. This prediction has been tested in a psychological experiment and has been confirmed.

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