Transforming verbal descriptions into mathematical formulas in spreadsheet calculation

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A common subtask in spreadsheet calculation is the transformation of verbal task instructions into spreadsheet formulas. This task can be used to study the relation of imagery to thinking. Research using physics and mathematics problems has indicated that mental transformation from verbal to mathematical representations is not necessarily direct but is intermediated by imagery. Therefore, a human-computer interaction task such as spreadsheet calculation provides a good task environment for an analyzing mental imagery operations, the role of imagery operations, and the role of intermediate imagery in thinking tasks. Testing the use of imagery in spreadsheet calculations also improves our understanding of representational systems used in this specific task and in user interfaces in general.

Four experiments provided different types of evidence for the intermediate imagery hypothesis, which means that subjects do not directly transform verbal instructions into spreadsheet formulas. In all experiments subjects were asked to calculate some verbally defined values. This means that subjects had to transform verbal messages into mathematical formulas. The idea was to find some specific piece of information and therefore the basic task was called information extraction task. All tasks were real world tasks, e.g., budgeting tasks.

In the experiments subjects first try to code an overall image of the areas referred to by verbal instructions, segment it into suitable fields, and only thereafter do they write down the set of formulas which best extract the information demanded. Typically, the field borders used in this segmentation are often imagined and are not at all presented in the original verbal task instructions. Intermediate imagery is a relevant notion in discussing the construction of user models because the most import ant current models, such as GOMS, assume only propositional representations. Also, the use of images should be taken into account in designing spreadsheet packages by providing features which aid analog information processing.