SUPPLANTATION EFFECT (MULTIMEDIA)

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Synonyms

Script and/or schema acquisition through external representations; media-based observational learning;

Definition

The Supplantation Effect describes a function of media that conducts a mental operation by an external representation. If a learner is not able to accomplish a mental, covert operation internally and an external representation is able to replace this process, supplantation occurs. External representation supporting supplantation can either be static representations like graphs or dynamic representations like animations or film. The basic function of the external representation is to show a functional link between objects that cannot be constructed by a learner on his or her own. Learners can internalize this link and, thus, reconstruct a relationship between internally represented objects without greater mental effort. Nevertheless, an active cognitive processing is required.

Theoretical Background

The term and the basic concept of supplantation are derived from the work of Salomon and colleagues in the late 1970s and 1980s. Based on socio-constructivism theories, Salomon (1970a, 1979) assumes that symbol systems are not only communicational devices but rather tools for thinking. A basic assumption of supplantation is that media as external representations are related and interact with internal mental operations and representations. The mapping process between external and internal representation depends on the learners' prior knowledge, because learners have to understand the coding system as well as the objects and their relationships. This does not include that the relation between objects is already known but rather that learners are able to understand this relation.

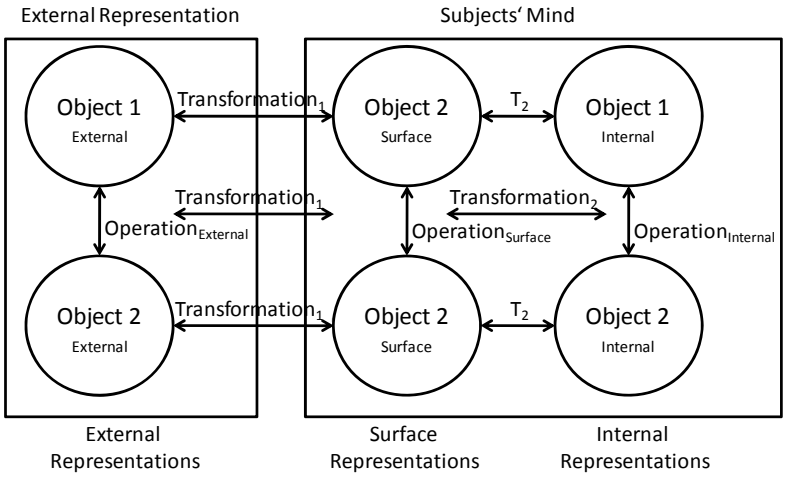

Figure 1: Supplantation of operations.

Vogel, Girwidz and Engel (2007) describe this process as followed (see Figure 1): A learner might have an internal representation of two objects (Object 1 and Object 2) but does not have a representation of the operation that links these two objects. The external representation shows this operation. At a first step ($Transformation_1$) a surface representation is built in the learner's mind. In a second step, an internal representation ($Transformation_2$) is built. This process is not a unidirectional mode of information processing but rather an interactive mapping and schema construction process between external, surface and internal representations. While Figure 1 presents a complete process, Salomon (1970b) as well as Vogel et al. (2007, p. 1289) single out that several degrees of supplantation are possible:

- Including the necessary mental activities by showing nothing but the beginning state of a process.
- Presenting the initial situation and its final modification.
- Presenting the initial situation and its transformation but not the final modification.
- Maximal supplantation: presenting the initial situation, its transformation and the final modification.

The degree of supplantation varies depending on learners' aptitudes, especially regarding their prior knowledge and mental skills (i.e., supplantation is a process that underlies an Aptitute-Treatment-Interaction; ATI). For example, Salomon (1979) shows that prior knowledge is necessary for understanding the objects and the transformation that should be supplanted but – on the other hand – might also inhibit the supplantation process; with already fair skill mastery it is more effective to just activate this skill instead of providing complete skill supplantation, because interference processes are likely to occur. With poor initial mastery, learners benefit rather from supplanting codes but not from codes that only aim to activate skills.

In general, the process of supplantation remains in the tradition of observational learning transferred to media- and, meanwhile, multimedia-based learning environments. Supplantation is compatible with most of recent models of processing information from pictures and text as well as multimedia learning environments like Mayer's S-O-I-model of multimedia learning or the model of text and picture comprehension by Schnotz and Bannert (cf. Vogel et al., 2007).

Important Scientific Research and Open Questions

Support for the supplantation hypothesis is provided within several studies. Salomon (1972) used film as media in order to show the effect of supplantation. In several studies, he used different versions of films. Within a supplantation version, an operation between two states was presented by zooming in and out (the material was about the overall impression and details of Breughel's paintings). In control group versions these operations were shortened by only showing the initial and the final state of an operation. Both of these conditions were compared to an activation condition where learners were presented only the initial state of an operation and were required to activate the appropriate mediating operation from their own mental repertoire. Results reveal that the supplantation version and the activation version led to superior results in selecting details out of the presented paintings. There was also a strong ATI-effect showing that poor scorers on cue-attendance (important for singling out details) and verbal reasoning benefited far more from filmic supplantation than learners with high scores in these aptitudes. A subsequent study using a different task (laying out solid objects and folding them back again) compared supplantative vs. short-circuited film and replicated the findings from the prior study.

Nevertheless, not only films can be used to achieve supplantation effects. In a study by Seel and Dörr (1994) sets of images integrated in a computer program were used to show different objects as well as their transformations in a supplantation condition (the learning domain was to watch a three-dimensional object and then to imagine the corresponding orthogonal projection and vice versa). This was compared with an imagery condition without the visualization of the transformation. Authors found strong evidence for the supplantation hypothesis stating that showing the operations within both types of visualizations leads to

superior task performance than just presenting single object states without the transformation process. Similar results by using a computer program for interpreting data and graphs are reported by Vogel et al. (2007).

In a study by Zumbach, Reisenhofer, Czermak et al. (2008) authors compared animations – within the domain of eutrophication of lakes – to static versions about the same topic presented as text with pictures. The animations showing dynamically the transition between different states of a lake during the year proved to be more effective in building up a mental model about the process and underlying parameters and their relationship than text and pictures. This also supports the supplantation hypothesis showing that media itself can overtake cognitive functions by supporting knowledge construction through internalizing supplanted operations.

Cross-References

→ Aptitude-treatment-interaction

→ Children's learning from TV

→ Multimedia learning

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