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-DIRECT MANIPULATION A STEP BEYOND PROGRAMMING LANGUAGES-

For decades there has been an growing enthusiasm for easy to use interfaces, and this ease of use is becoming a necessity rather than being optional. It can be seen that central movement is towards the visibility of object of interest, and this is attributed to direct manipulation which utilizes, revocable, rapid, and gradual actions to replace intricate commands or procedures. Three main application fields of direct manipulation are spatial data management, problem-solving and learning and syntactic/semantic model in which impact of direct manipulation techniques can be seen clearly.

First application field of direct manipulation is on spatial data management. The main problem arises in the monitoring of large and complex systems such as military intelligence on oceans. For example, person who is responsible for monitoring process can see all the ship convoys on the pacific ocean, and moving joystick to related part of the ocean can make all the ships located on that part of the ocean visible. Furthermore by zooming onto specific ship, stuctural details of ship and even the captain of that ship can be seen. This is an one example of direct manipulation in which user is not overwhelmed by the huge amounts of data, but whenever he wants to see the details of the related part of the ocean, he can see it via simple joy stick movement and simple zoom click to get the detail of the ships. Another example is representing the different parts of any company such as organization, production, travel, budget, or personnel. By simple joy stick movement and zoom user can get a detailed information related to that part of company. In this way, rather than presenting the huge bulk of data, user can direcly see and perform anything he wants on related part. In summary achievement of spatial data management system depends on the

selected data layouts, icons, and graphical representations which should be inherently easy to understand.

Second application field of the direct manipulation is on problem solving and learning. Accroding to studies in psychology focusing on problem solving, adequate representations of problems are crucial in finding solutions. For example it was proposed to use physical instruments such as sticks and beads to teach mathematical concepts like subtraction, addition, multiplication, and division. According to experiments carried out by researchers in the field, subjects who memorized the mathematical equation for parallelogram, become proficient on similar calculations. Conversely, subjects who were given a constructional explanation keep the knowledge and applied it in analogous situations. This experiment has shown that rather than teaching concepts as stereotyped unchanging knowledge, teaching mathematical concepts with structural explanations allows learners to apply same information more easily in similar circumstances. Another study has shown that while proving theorems related to plane geometry, using spatial representations of concepts makes discovery of proof procedures easier as compared to axiomatic explanations of concepts. From the results of this study it can be said that pictorial digrams supply heuristics which may be difficult to obtain from axioms. To conclude creating pictorial representations of problems facilitates the understanding of the problem or concept, also provides learners to apply the same solution to similar problems rather than specific type of problem.

Third application of direct manipulation is related to syntactic/semantic model. Syntactic model is related to syntax of anything for example, a syntax of a text editor command. These syntactic rules differ greatly from one text editor to another, because of this reason it can be obtained by pure memorization. Accroding to studies, as the syntactic knowledge depends on pure memorization, it can be forgotten easily unless it is used constantly. In contrast to syntactic

knowledge, semantic knowledge is independent from specific system. For instance, in a text editor text editing functions such as inserting, deleting lines or moving, centering sentences are existing in nearly all text editors even though syntax for performing these operations may vary greatly. If one knows the basic operations performed by those functions then it will be very is easy to make use of same functions in another text editor. This exactly the difference between syntactic and semantic knowledge, semantic knowledge is obtained through analogy and generalization, due to this reason it can be easily associated with familiar concepts and it is usually long lasting in memory. On the whole as knowledge obtained in generalized form accumulates, people increasingly tend to think in semantic terms, which frees us from thinking syntactic details and makes thinking procedure more system independent, thus facilitates learning process and aids long term retention of knowledge.

Summing up, direct manipulation is related to making some procedures revocable, easy to learn by providing increments of data rather than bulk view. Three main application fields of direct maipulation are respectively spatial data management, problem-solving and learning, and syntactic/semantic model. In spatial data management data is provided as fragments of whole system in order to reduce complexity and ease use of large-complex systems. When solving problems, pictorial diagrams are used to represent intricate axioms as a direct manipulation technique to make learners grasp general idea which can be applied to familiar systems, not only to specific system. In syntactic/semantic model approach, learning semantics means acquiring the general comprehension of a concept or a system rather than memorizing particular concept or understanding specific system so that learned concepts can be applied in general, thus it facilitates learning familiar concepts and systems indeed. These are just three applications in which anyone can observe the direct manipulation techniques but many more application fields exist which can utilize from direct manipulation techniques.