In Search for a Human Path Planning Model

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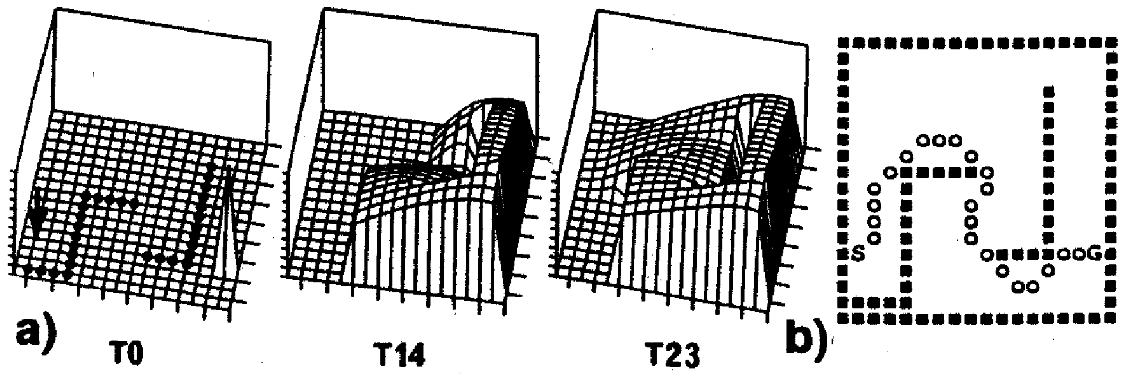
For a navigating autonomous agent, like a robot in a warehouse or an animal in its daily life surrounding, the knowledge of how to plan trajectories on the basis of the information provided by the environment is of great importance for fitness and survival. Many mathematical and engineering algorithms are dealing with path finding and path planning problems, emphasizing analytical top down strategies. In contrast to these technical solutions we are performing psychometrical experiments with human probands in order to create a model of human path planning behavior. We confine us to the domain of problems where full information is available. The probands are confronted on a computer monitor with start-obstacle-goal-situations (SOGS) providing two path alternatives. We are investigating both decision-making based on the imagined paths and real trajectory generation, while taking into account the prespecified decision- criteria length, speed and comfort of a path and variations in the geometry of the SOGS. We developed methods to quantify the degree of difficulty of the imagined paths, while characterizing each SOGS with a psychometrical decision value which can be adjusted by the probands. The trajectories and the decision-making of the probands will enable us to identify parameters which allow to describe the human path planning behavior and to develop a computer model. By reason of biological plausibility our computer models concentrate upon algorithms which use local rules working upon a parallel architecture, which can be regarded as an internal map on the outside environment. The algorithms are based on the 'dynamical-system metaphor' and make use of the properties of natural dynamical systems. A general framework was been defined which appeared to be a promising modelling-basis of our experimental results. Several algorithms are elaborated or developed and tested concerning their applicability to model the experimental results. One of these algorithms is based on the diffusion approach (Steels, Proc ECAI, 1988) and the figure below sketches a simple application of this algorithm to a 18x18 grid. **Fig. a** shows the spreading diffusion front depicting the activation distribution (vertical axis) at three different moments. At **T0** the goal-point is initialized with a high positiv value since it is the origin of the diffusion front. Only for the sake of clearness the start- point is marked with an arrow and the obstacle- cells with filled circles. **T14** shows an intermediate state with the activation front shifting around the obstacles. After 23 iteration cycles (T23) the diffusion front reaches the start point and a steepest ascent search results in the path shown in **b** connecting start and goal.



a) T0 T14 T23 b)