The sequential organization of behavior and processes

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Sequences

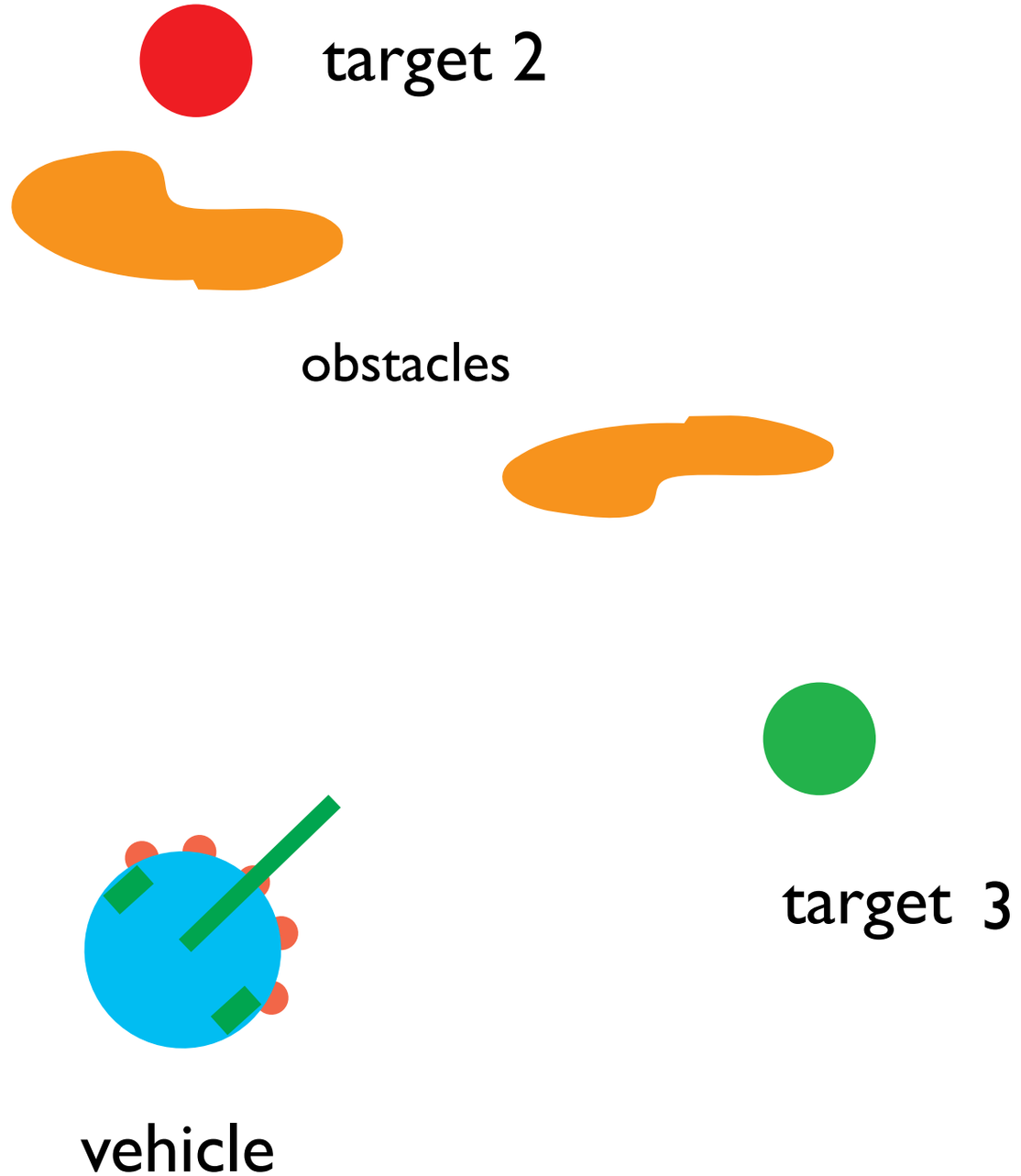
- all actions in real life consist of sequences of movements, perceptual acts, inferences
- often fixed by the logic of action
- or highly automated: routines
- but also flexible: serial order, planning, problem solving

Challenge in DFT

- behaviors/representations are stable states
- and as such resist change…
- to induce change in sequential behavior/ thinking: induce an instability

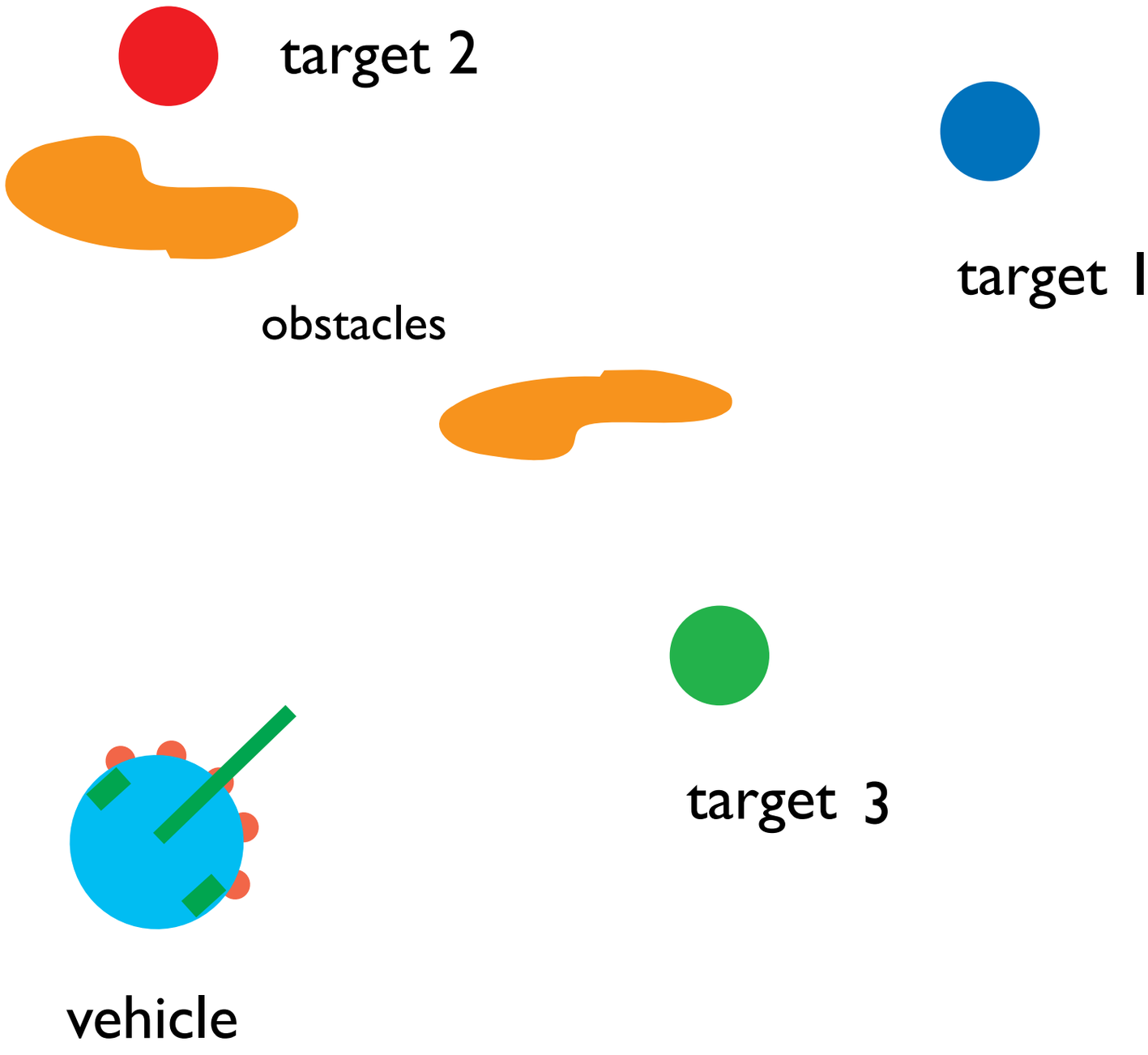
Illustration

- search for objects of a given color in order
  - 1 blue
  - 2 red
  - green



The problem of sequential processing

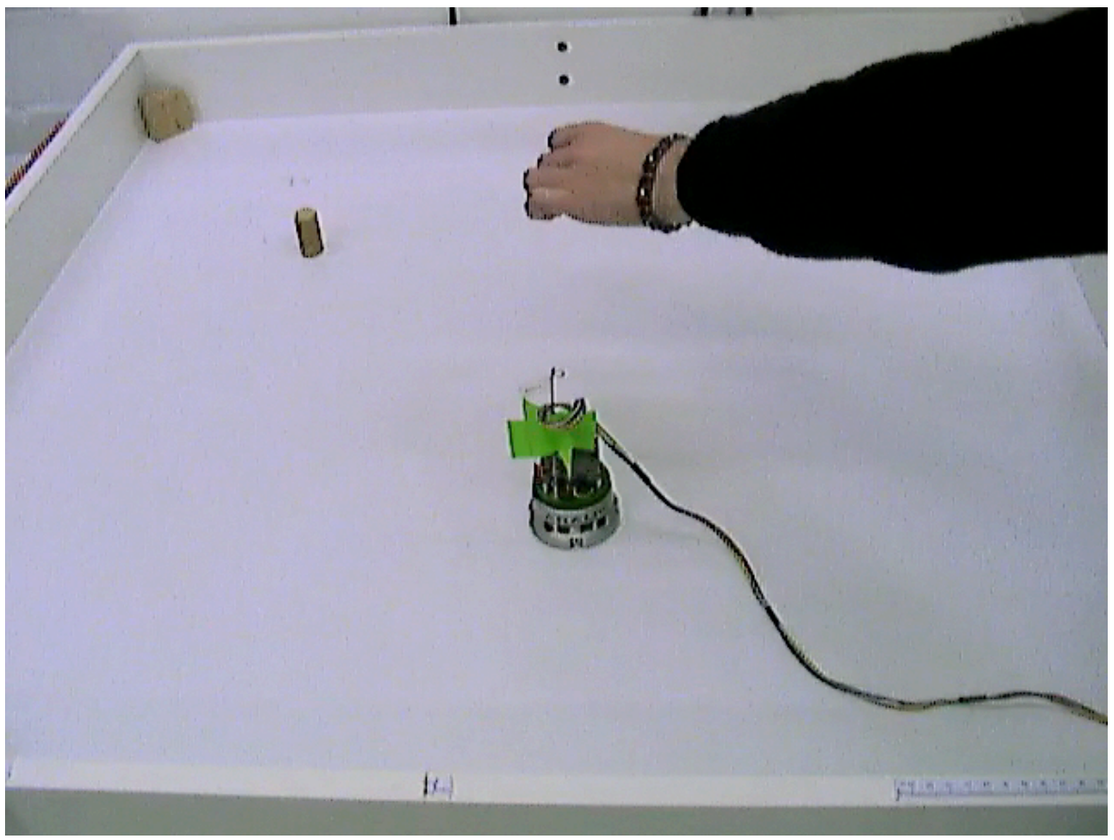
- each step in the sequence is a visual search, which takes a variable (here: unpredictable) amount of time
- so stabilize the goal of the visual search until the search is successful
- only then switch to the next element of the sequence



Implementation as an imitation task

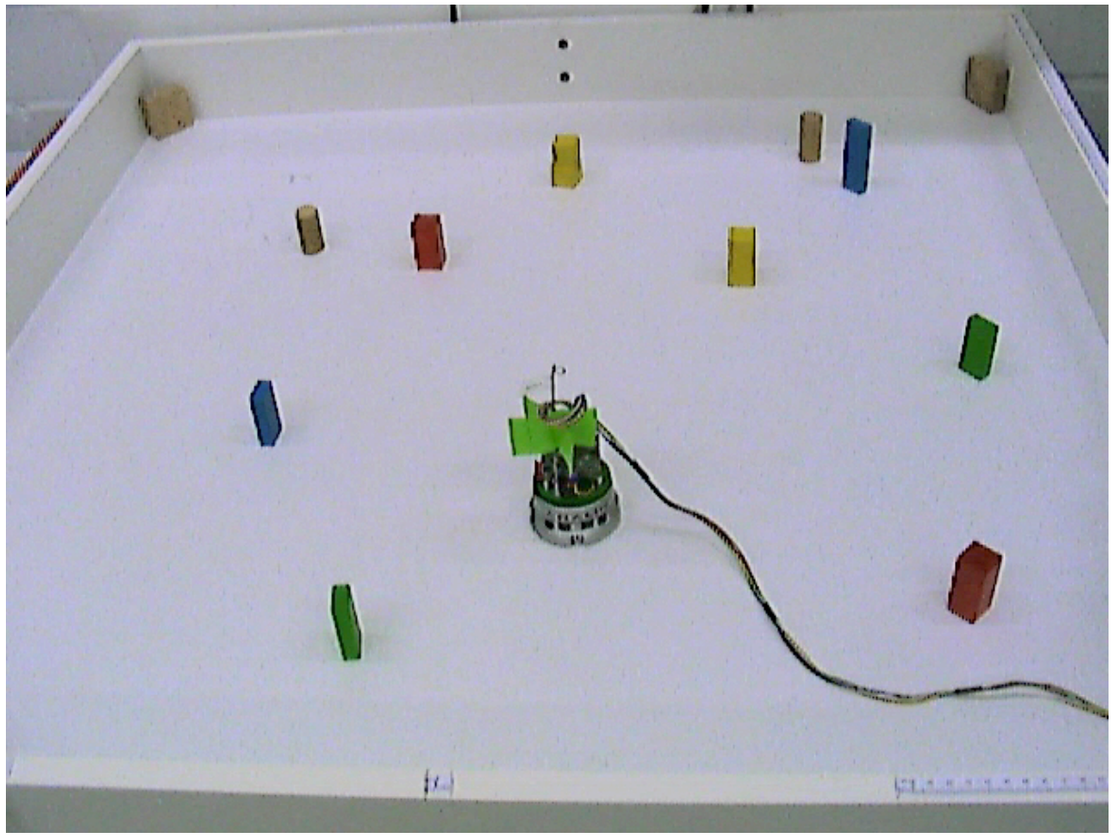
- learn a serially ordered sequence from a single demonstration

yellow-red-green-blue-red



- perform a serially ordered sequence with new timing

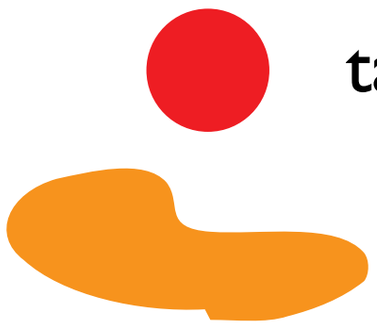
yellow-red-green-blue-red



[Sandamirskaya, Schöner: Neural Networks 23:1163 (2010)]

Neural dynamics of sequence generation

- represent the target color by a stable peak that resists attractors

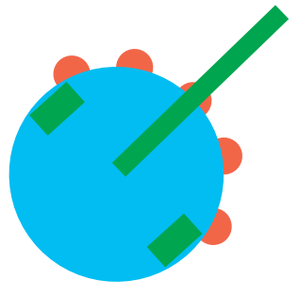


target 2

target 1

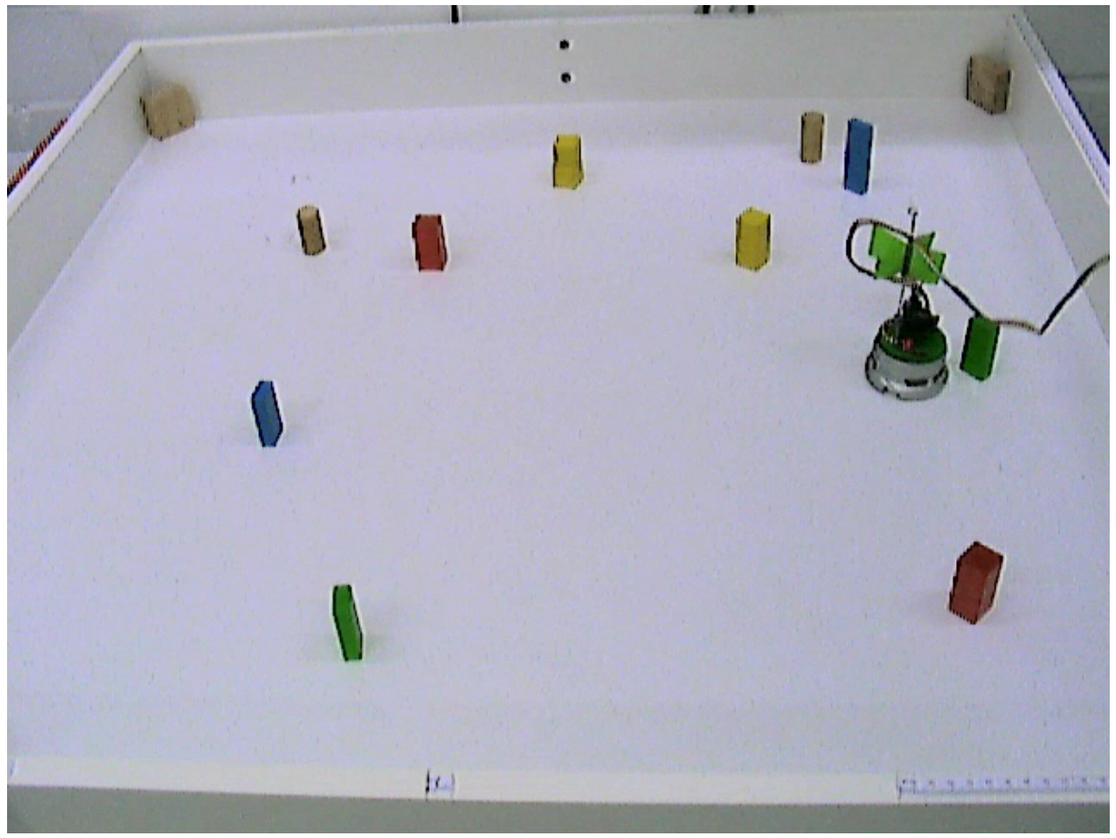
obstacles

target 3

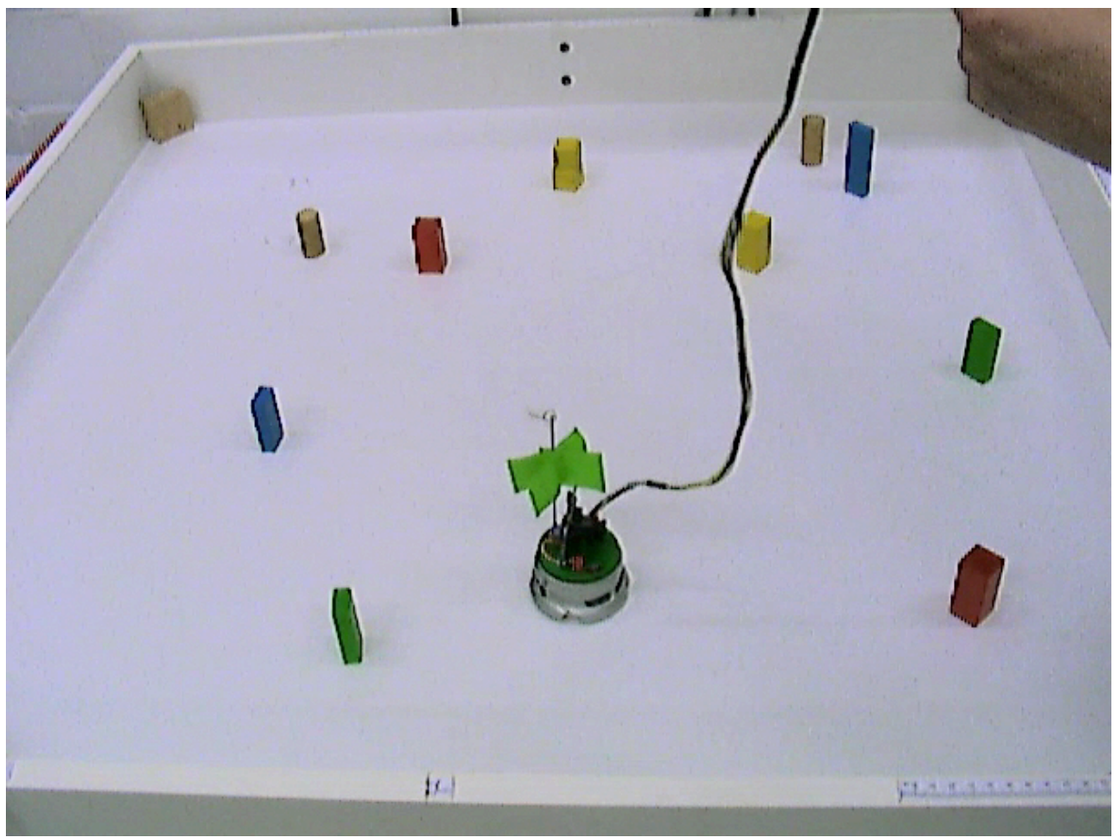


vehicle

red a distractor



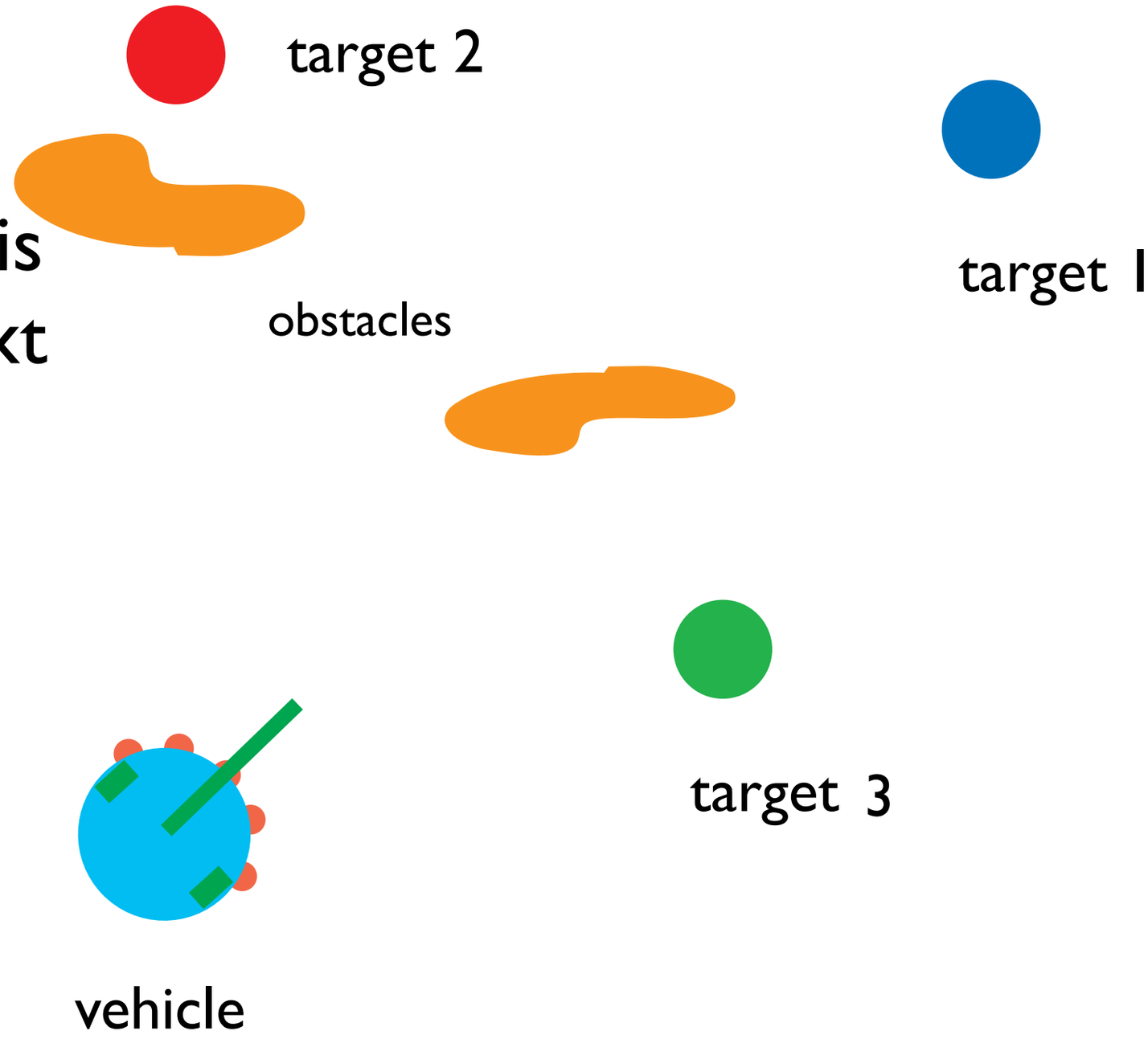
red a target



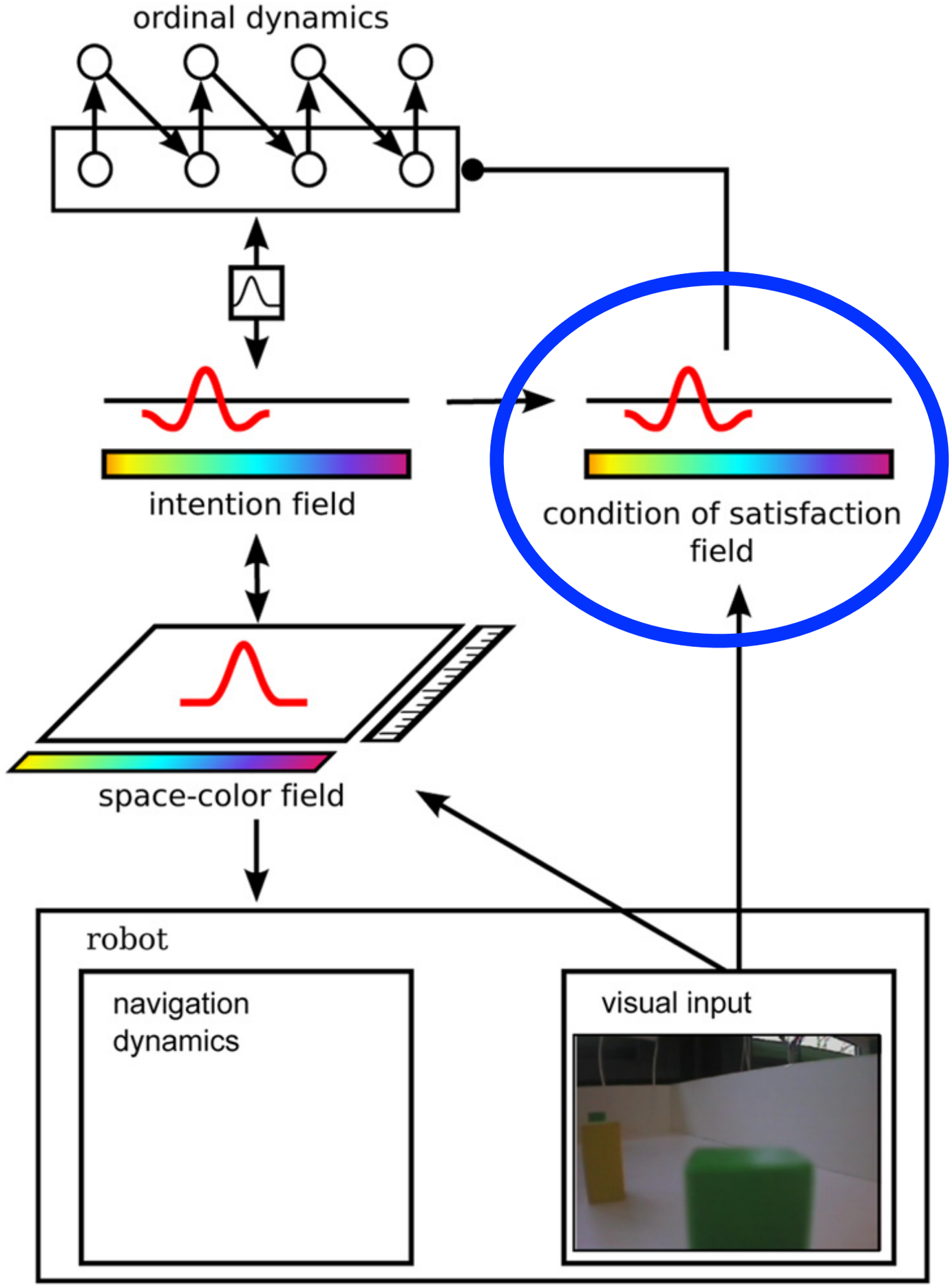
[Sandamirskaya, Schöner: Neural Networks 23:1163 (2010)]

Neural dynamics of sequential processing

- when the sought color is found, switch to the next color by releasing the previous state from stability…through an instability

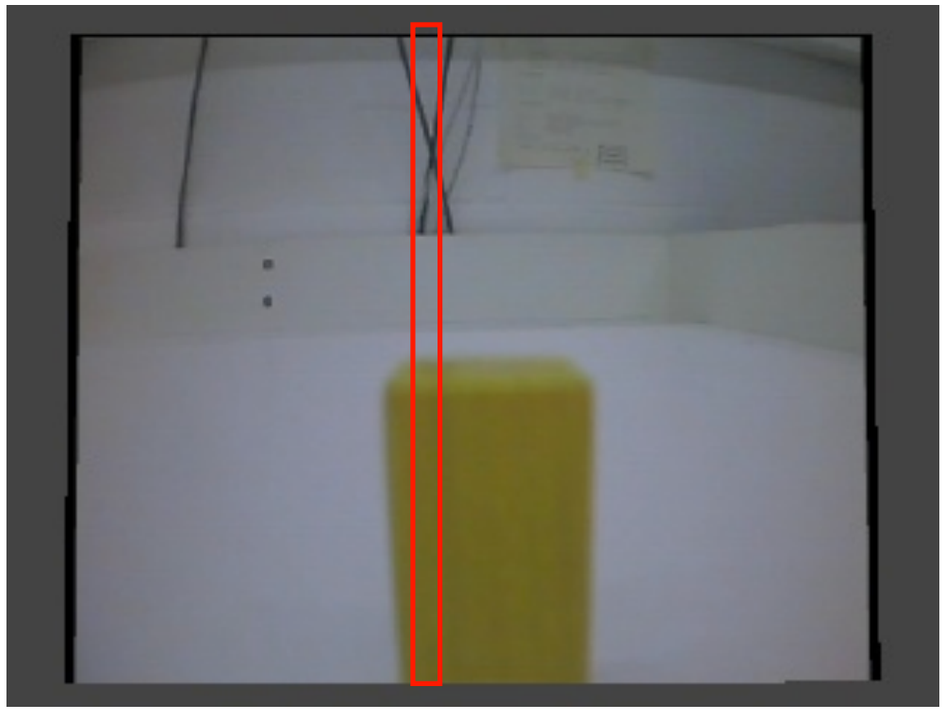


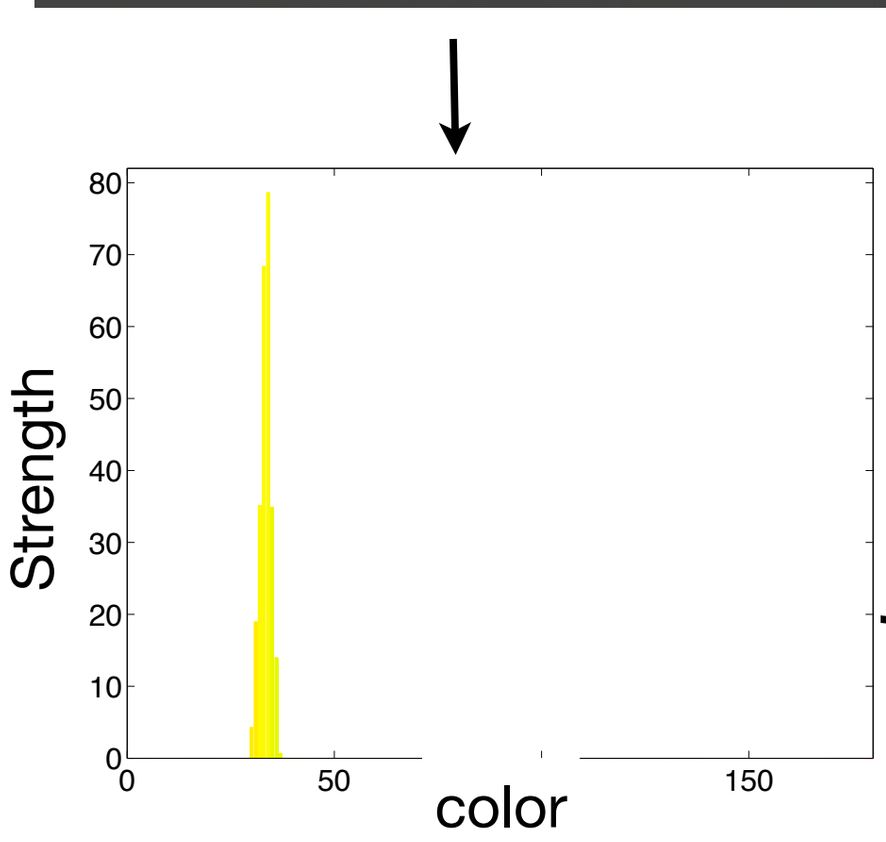
“Condition of Satisfaction” (CoS)



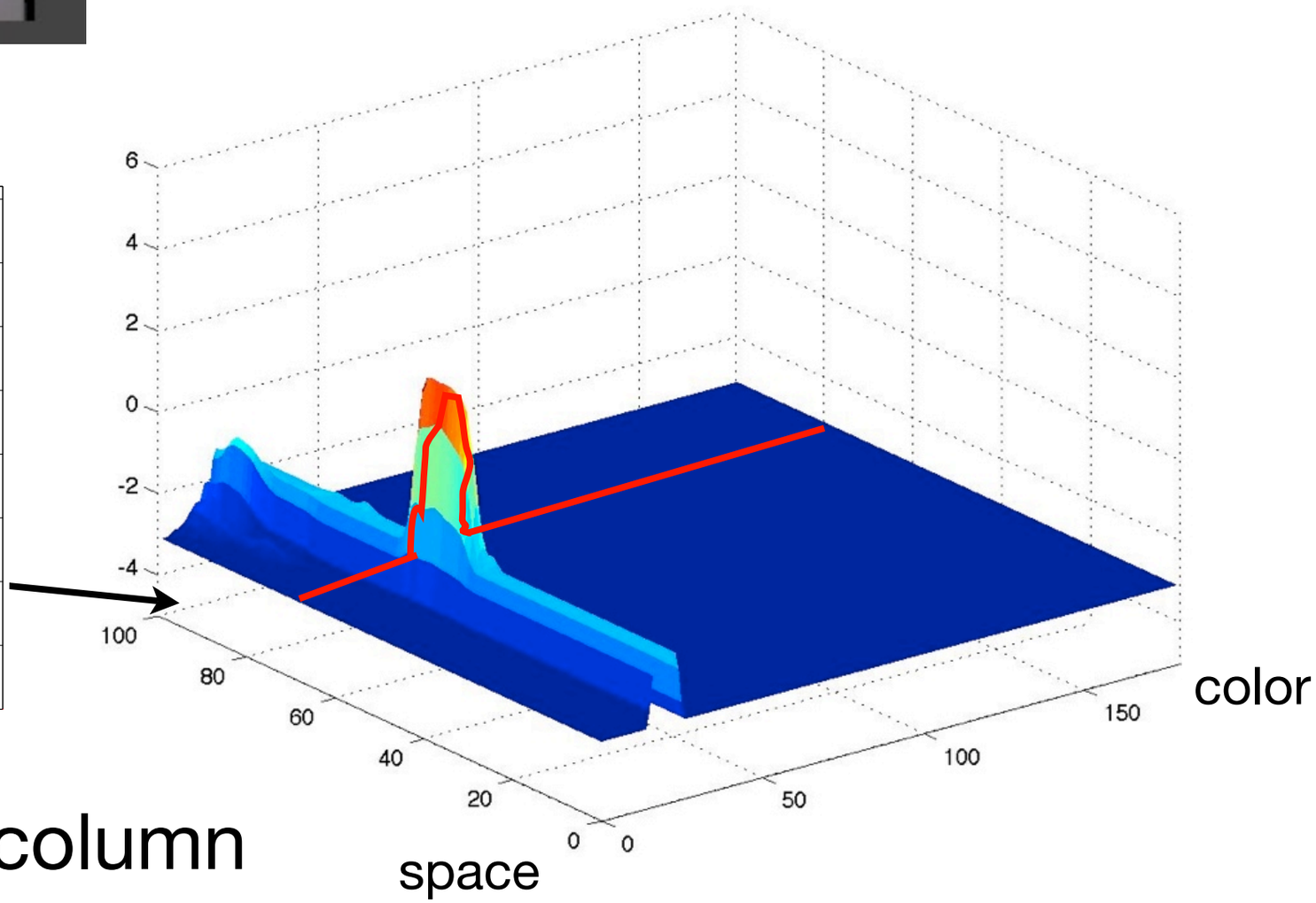
[Sandamirskaya, Schöner, 2010]

Camera image



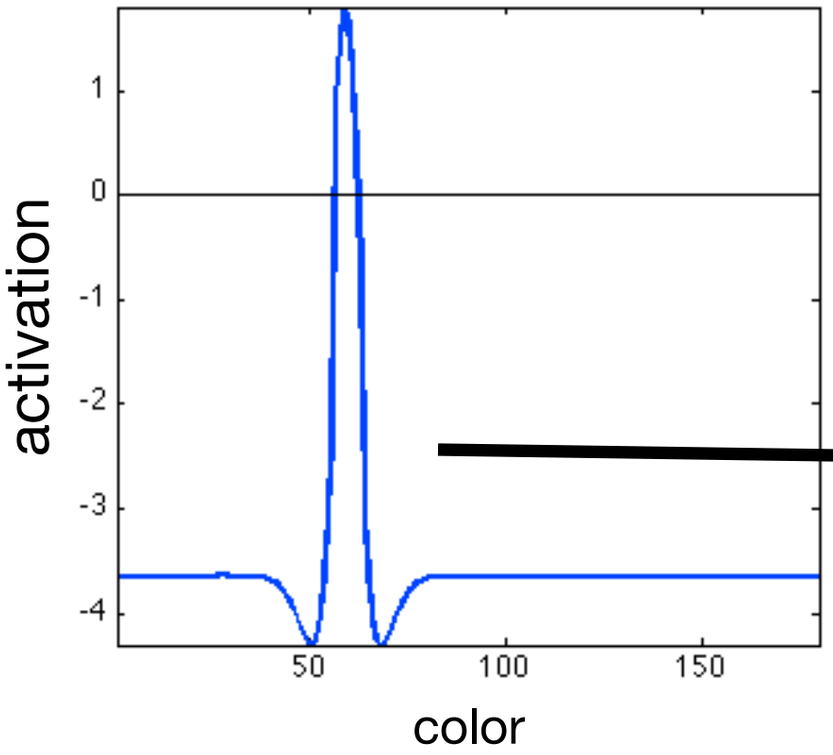


Color-space DF

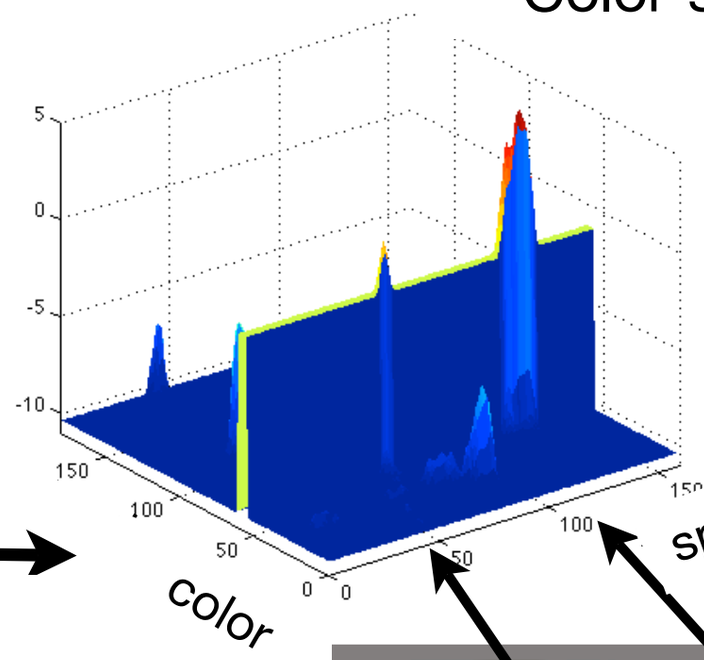


Color histogram of the column

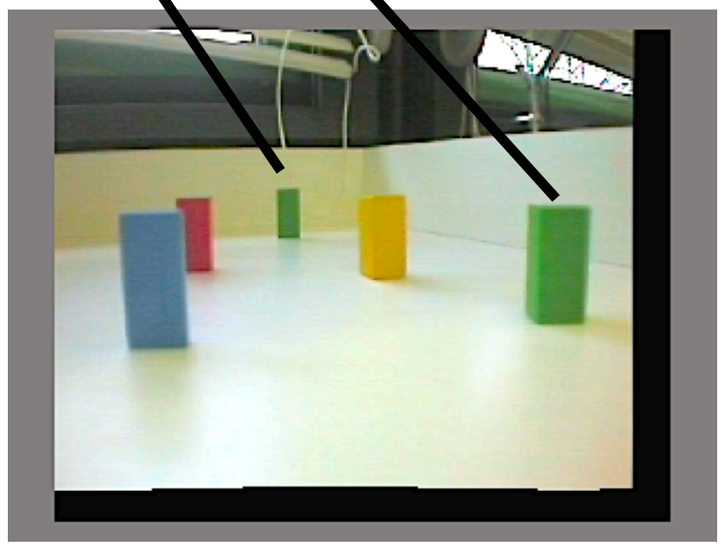
Intention DF



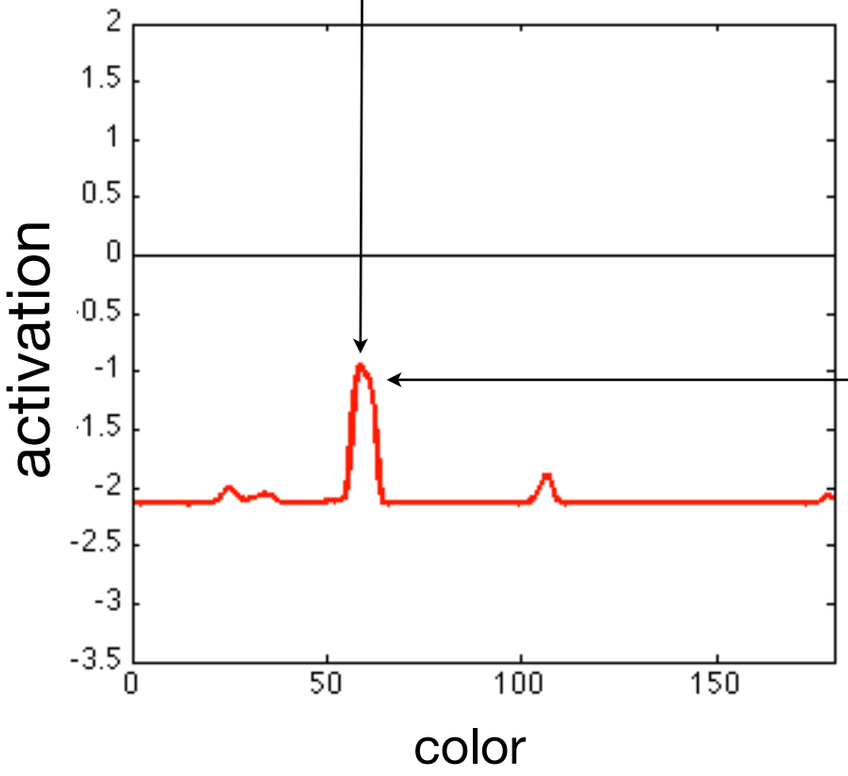
Color-space DF



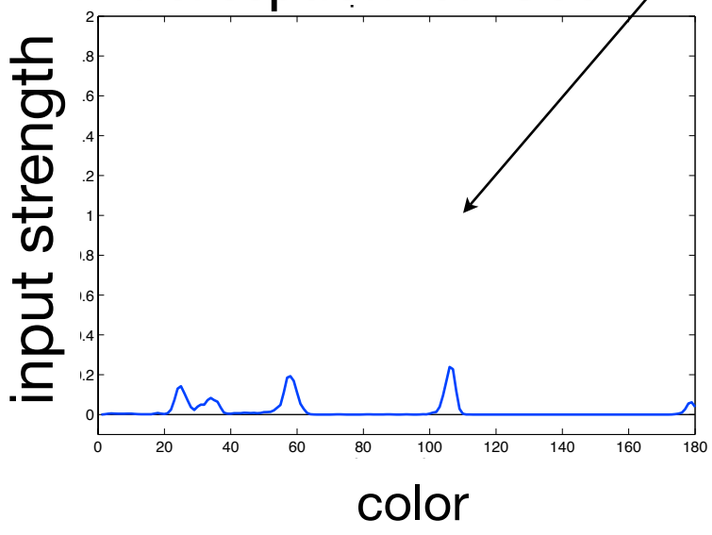
Camera image



CoS DF



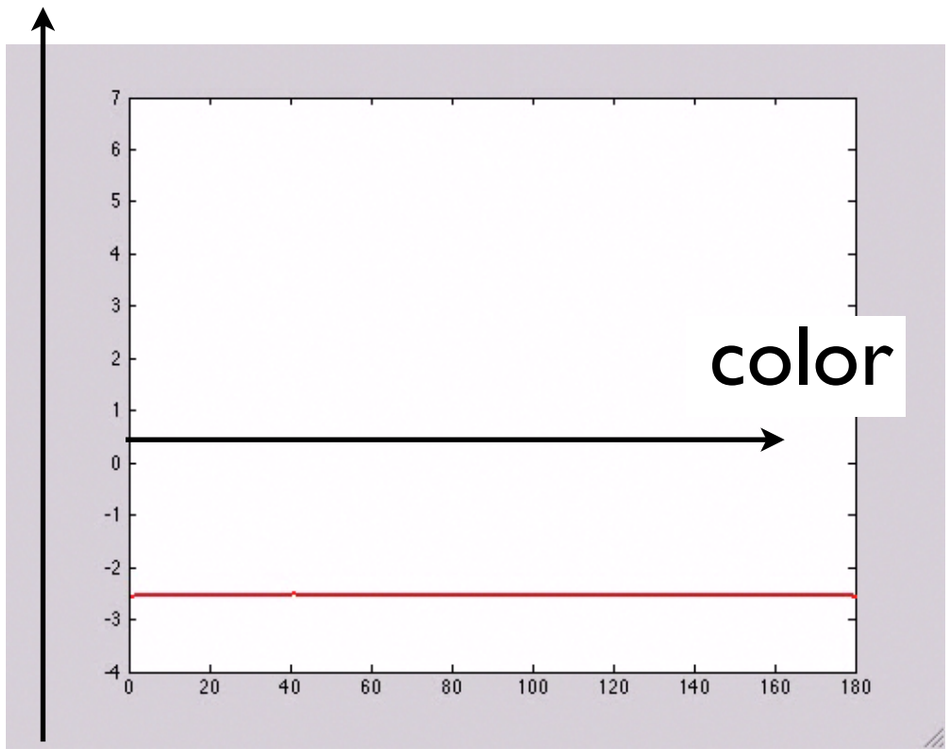
Perception for CoS



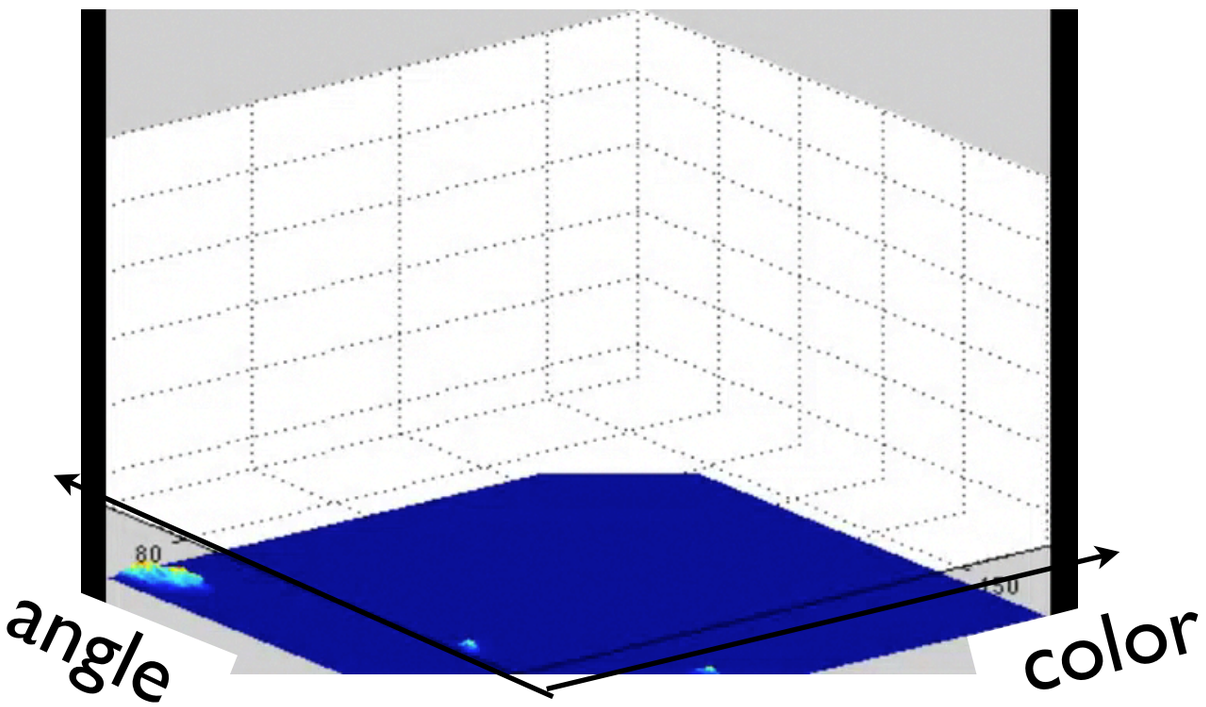
ordinal stack

condition of satisfaction (CoS)

intentional state



2D feature-space field



… continued in part 2