The California State University
WORKING FOR CALIFORNIA

Mark Van Selst

San Jose State University

COGNITION

Mental Models
Naïve Physics
Human Factors

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The simplest definition of a mental model is your knowledge of a domain – with a specific interest in the reasoning difficulties people have because of an incomplete representation of the domain (regardless of meta-cognitive awareness of the deficits in representation).

For most cognitive scientists today, a mental model is an internal scale-model representation of an external reality. It is built on-the-fly, from knowledge of prior experience, schema segments, perception, and problem-solving strategies.

Stimuli used by McCloskey. (From McCloskey, 1983.)
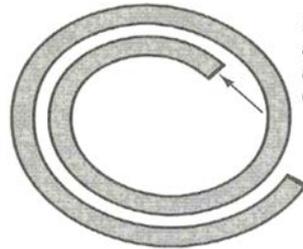
Imagine that the curved tube is on a tabletop, and a marble is tossed in as shown by the arrow. Draw the path of the marble when it exits the tube.

(a)

The airplane is traveling at a constant speed and drops the bomb. Draw the path of the bomb as it falls to the ground.
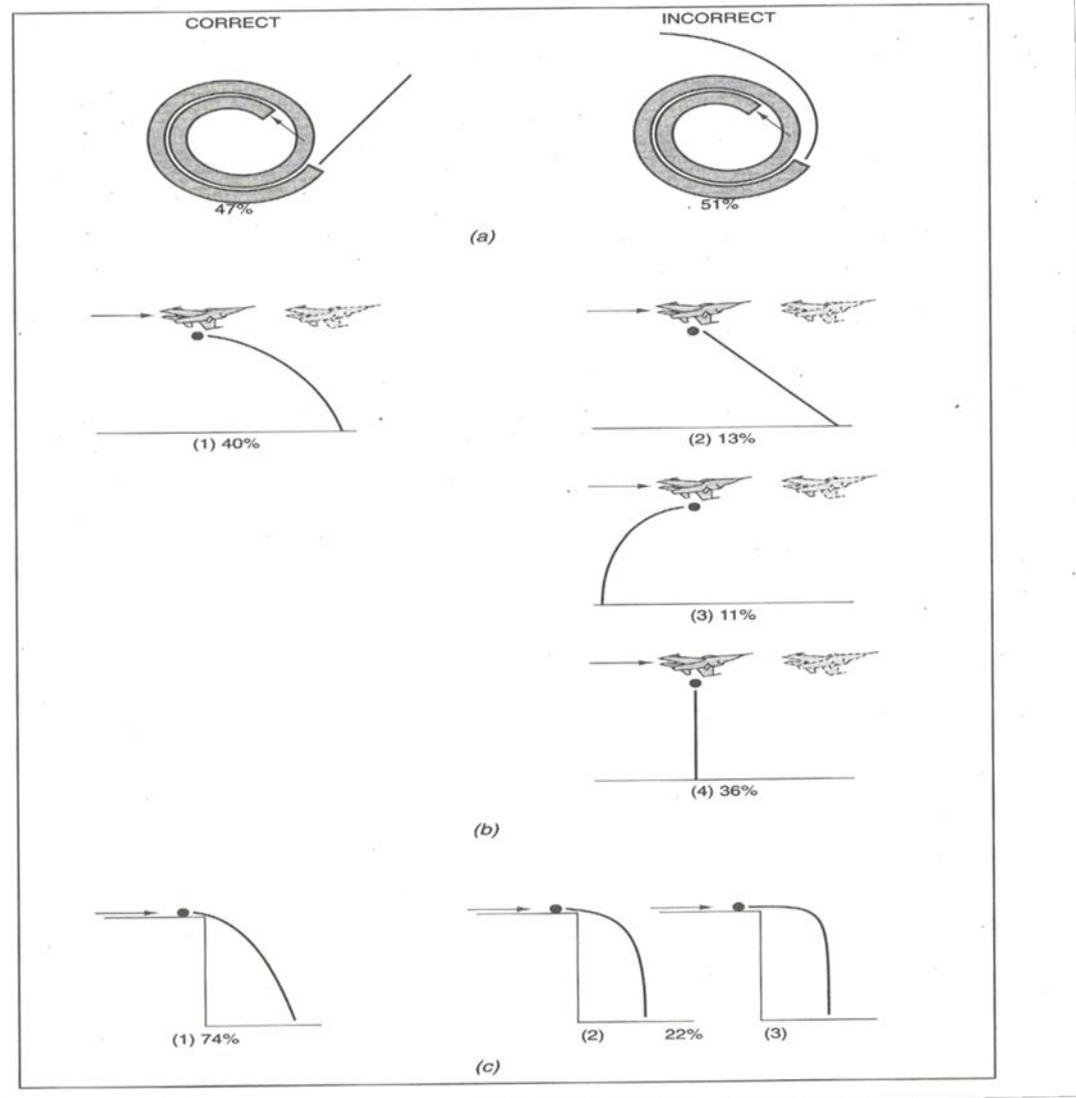
Ground

(b)

The ball is rolling toward a cliff. Draw the path of the ball as it goes over the edge.

Ground

(c)

Correct and incorrect pathways, along with the percentages of participants making each response (From McCloskey, 1983.)

Various different perspectives on the current state of knowledge and action are illustrated by the concept of the **'user' model** (the mental model), the **'display' model** (that which is displayed to the user as an aid for situational awareness, etc.), and the **'system' model** (the actual state of the system). The experience of the astronauts on Apollo 13 provides a good illustration of these three different levels of models.

Usability is strongly tied to the extent to which a user's mental model matches and predicts the action of a system. Ideally, the interface design is consistent with people's natural mental models. E.g., a calculator program with similar functionality and appearance to a physical hand-held calculators is easy to learn and use.

Through various design methods, we can build cues into a system that help users create new, accurate mental models even where real-world equivalents do not exist.

Forcing Functions (vs. **Affordances** which just 'suggest' actions)

- Human Factors
- Naïve Physics
- Mental Models
    - User model
    - System model
    - Display model
- Forcing Functions
- Affordances

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