# Testing for Mental Affordances (Tom McC 03/11/16)

## First Proposed Experiment: Affording Mental Rotation

Task

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| Subjects are presented with a series of images in which a puzzle-piece would have to be rotated to fit into a puzzle. The task is to identify whether the optimal rotation of the puzzle-piece (i.e. the direction of rotation that gets the puzzle piece to the correct orientation most quickly) is clockwise or anti-clockwise. | C:\Users\user\AppData\Local\Microsoft\Windows\INetCacheContent.Word\anti clockwise rotation.jpeg  *Example:* answer is ‘clockwise’ |

The answer ‘clockwise’ is given with a right-click of the mouse (say) and the answer ‘anti-clockwise’ is given with a left-click of the mouse. The twist is that the puzzle is presented on a table with an observer.

|  |  |
| --- | --- |
| C:\Users\user\AppData\Local\Microsoft\Windows\INetCacheContent.Word\anti clockwise rotation.jpeg | C:\Users\user\AppData\Local\Microsoft\Windows\INetCacheContent.Word\anti clockwise rotation.jpeg |
| **Example of an congruent trial**  **(clockwise/clockwise)** | **Example of an incongruent trial**  **(clockwise/anti-clockwise)** |

In control trials the puzzle is presented on the table but with no observer.

Hypothesis

Performance (measured by RT and error rate) will be:

improved relative to control cases in congruent trials

impaired relative to control cases in incongruent trials

## Merits of first experiment:

If the hypothesis is confirmed, this would suggest that subject are at least primed to mentally self-rotate to the same position as the experimenter. This mental self-rotation might be: a) primed but not initiated; b) started but not completed or; c) completed. Any of these would result in interference in the main task.

An interesting question one might ask about mental action is: *are there cases in which the environment automatically triggers the performance of a mental action?* Confirmation of the hypothesis would suggest that the answer to this question is ‘yes’. This would count against anyone who claims that mental self-rotation is only ever performed deliberately.

## Limitations of first experiment:

The first limitation is that it looks like the hypothesis wouldn’t be confirmed. Kessler & Thomson (201) say that mental self-rotation is *deliberate* not automatic. They’re reasoning seems to be that: you get similar patterns of results in trials where the relevant perspective is that of an empty chair rather than a person; in the empty-chair cases one’s mental self-rotation is surely deliberate (nobody thinks empty chairs automatically trigger mental self-rotation to the same perspective); if the occupied-chair cases automatically triggered mental self-rotation one would expect different patterns of results; therefore mental self-rotation in the occupied-chair cases is deliberate.

The deeper problem is about what it would tell us if the hypothesis were verified. The experiment doesn’t reveal whether the action is performed (in part or in full) or whether it is just potentiated. If the results are explained by mental self-rotation actually being performed, it wouldn’t be a terribly interesting result as it looks like there are already fairly clear cases in which a mental act is automatically performed in response to a stimulus, e.g.:

* + Automatic shifting of covert attention
  + Automatic counting
  + Automatic reading

It would be much more interesting to find cases in which a mental act is potentiated but not performed. The interesting thing about affordances for bodily action is that they tell us something about how we arrive at deliberate actions. We don’t receive action-neutral perceptual data then work out the best thing to do in an environment with those features. Rather, we select actions from a range of options presented to us by perception itself. It’s worth working out whether something similar holds for mental action. The fact that some mental actions are performed automatically doesn’t tell us whether there are ever mental actions that fit this priming-and-selection model.

## Second Proposed Experiment: Affording Mathematical Operations

Task

Subjects are asked whether a simple piece of arithmetic presented on a screen is correct or incorrect. They click the left-button of the mouse for ‘true’ and the right for ‘false’.

The twist is that preceding each test image is a briefly-presented cue which is an image of a mathematical operator. This image is irrelevant to the task. Subjects can be explicitly instructed to ignore the cue image. Or the cue image could be presented rapidly so that perception is subliminal.

|  |  |  |  |
| --- | --- | --- | --- |
| **Trial kind** | **Cue image** | **Test image** | **Right Answer** |
| Congruent | + | 1+4=5 | Correct |
| Standard incongruent case | x | 1+4=5 | Correct |
| Special incongruent case (note, the test image would be true if it had the cue operator instead) | x | 2+3=6 | Incorrect |
| Control case  (blank cue image) |  | 2x4=8 | Correct |

Hypothesis

Performance (measured by RT and error rate) will be:

improved in congruent cases

impaired in incongruent cases

Somewhere between the above in control trials where there is no cue

*And* errors will be more common in special incongruent cases where the test image is false but *would* be true if it had the cue-image operator instead.

## Merits of Second Experiment:

If the hypothesis were true, this would suggest that the cue potentiates performance of a particular mathematical operation. Since there’s nothing in the cue-image on which to perform the operation, this is not a case in which the mental act is actually performed, nor as a case in which the mental act is started but not completed.

Being primed to perform the cued operation is likely to be automatic. If subjects are instructed to ignore the cue-image, then they are unlikely to deliberately ready themselves to perform the operation in the cue-image. And if subjects only perceive the cue subliminally, they *couldn’t* deliberately ready themselves.

A plausible way of describing this is that the cue affords (or appears to afford) the act of multiplication, and this cueing interferes with performance. Affordances to perform this mental act are automatic environment-led processes, which is why there is interference despite the task-irrelevence of the cue.

## Limitations of Second Experiment:

The interesting thing about the teapot case is that grasping is afforded even though grasping is totally irrelevant to the task at hand. The limitation of the cueing experiment is that subjects may be actively looking for the mathematical operator needed to perform the task successfully. Perhaps the cue-image only primes subjects to perform a certain operation when they’re in this state of looking for instructions on what operation to perform. This means that the experiment wouldn’t show that performance of the operation is potentiated automatically i.e. potentiated regardless of what kind of task the subject is engaged in.

## Conclusion:

If the aim is to show that mental acts are automatically initiated by the environment, something like the first experiment could work, but we’d need to work out what this result tells us that can’t be inferred from existing studies.

If the aim is to show that mental acts are automatically primed by the environment, the second experiment is a good start, but something more subtle is needed to get really informative results.