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Psych 350/650
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CogLab Response Paper #2

Topic: Attention **Experiment: *Simon Effect***

Task description

This experiment was easy to do. The task was just to hit the "v" key if the square was green and the "m" key if the square was red. If the green square appeared on the LEFT, nearest the "v" key, the trial was said to be congruent. If the green square appeared on the RIGHT, the trial was said to be incongruent. The situation was reversed for the red square. If it appeared on the RIGHT, nearest the "m" key, it was a congruent trial. If it appeared on the LEFT, it was an incongruent trial. The Simon effect theory predicted that people would be able to process congruent information faster than incongruent. In other words, once the color of the square was determined, one then had to select the correct key to press, which was a left/right orientation response. In this experiment, the independent variables were the color and location of the stimulus squares, and the dependent variable was the number of milliseconds it took for me to respond to the congruent and the incongruent trials.

Summary of results

My results confirmed and demonstrated the Simon Effect. The first time I did the experiment, it took me 536 ms to respond to the congruent condition and 630 ms to respond to the incongruent condition. I found that by keeping my eyes fixated on the center of the screen, I was able to register the location of the square without actually moving my eyes. I am assuming that this helped my response time because when compared my results to a group of four, I had faster times for both congruent and incongruent trials.

I decided to do the experiment a second time because I noticed that using the **v** and the **m** keys on my laptop was awkward when it came to pressing the space bar. I had to hold my right hand at an angle to use both my index finger on the **m** key and my thumb on the space bar, which was uncomfortable. I thought that the discomfort was slowing down my response time, so I programmed the **f** and **j** keys

instead. This allowed my thumb to rest naturally on the space bar. In the second experiment, my response time for the congruent trials decreased from 536 to 482 ms; but for the incongruent trials, my response time increased from 630 to 638 ms (but I also made two mistakes in those trials). Although a faster response time for congruent trials is predicted by the Simon Effect, I wondered whether right-handedness or left-handedness was playing a part. I copied and pasted the results from all the trials and the results are in the table below:

Left Hand	**Right hand**
Green congruent - 478 ms	Red congruent - 488
Red incongruent - 605	Green incongruent - 632

I was not surprised that the times for the congruent trials were faster, but I was surprised that my left hand was faster than my right. I would have expected just the opposite. The only explanation I have for this is that my right hand is doing double duty: pressing a letter key as well as pressing the space bar immediately afterwards. If the experiment was designed so that the software presented the next trial as soon as you pressed a key, then it would be possible to eliminate the use of the space bar. This would give a truer indication of how fast you were responding to a) color and b) location. .

Discussion of research & theory

In information-processing theory, there are three stages of decision-making. The first component is stimulus identification, the second is response selection, and the third is response execution. The Simon Effect supposedly results from interference during the response selection stage. According to the CogLab Manual, the person uses a rule (what rule?) to translate the "relevant stimulus dimension" - i.e. color in this case - to the correct left or right response. Although it should not matter whether the stimulus appears on the right or the left side of the screen, your first impulse is to press the key on the same side that you see the stimulus. You have to tell yourself "green left" even if you see it on the right, and vice versa. This

is called interference in response selection in the book, but I wonder if it might also be the result of having to process the same stimulus twice - once to determine color, and again to determine location or orientation of the correct key. The book says, "Primarily, it shows that location information cannot be ignored, and will affect decision making, even if the user knows that the information is **irrelevant**." (p.4) It is irrelevant in the sense that it doesn't matter where on the screen you see the stimulus, but it is hardly irrelevant in your executing the correct response, I would say. I looked into this a bit further by searching for 'Simon effect attention' in PsycArticles. Although most of the articles were above my head, I did finally manage to gain a greater understanding of the response selection phase. This quote comes from Rubichi, S., Nicoletti, R., Iani, C. and Umiltà, C. (1997). The Simon Effect Occurs Relative to the Direction of an Attention Shift. *Journal of Experimental Psychology: Human Perception and Performance*. 23 (5) 1353-1364.

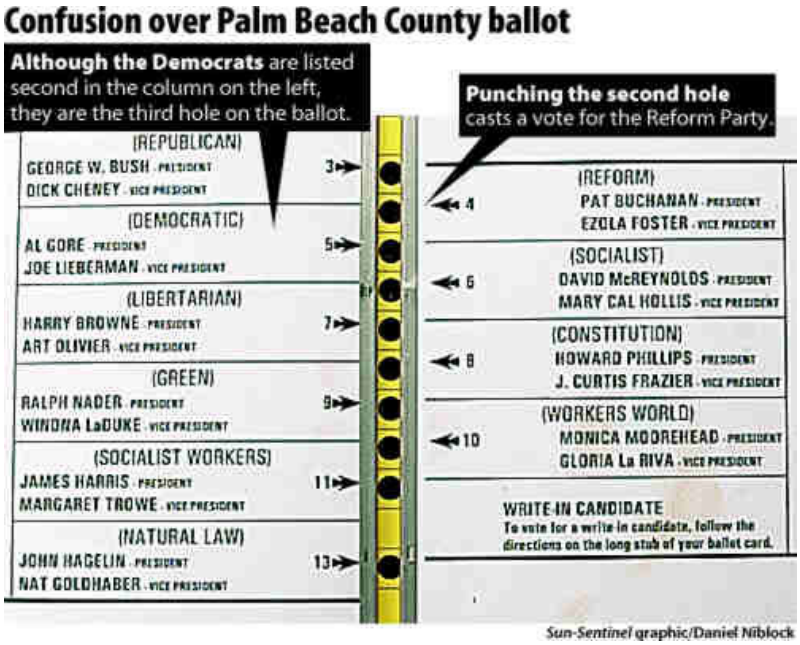
> ….Most accounts of the Simon effect share two basic assumptions (for reviews and discussions of the various accounts, see Lu & Proctor, 1995; Umiltà & Nicoletti, 1990; for dissenting views, see Hasbroucq & Guiard, 1991; Simon, 1990; Verfaellie, Bowers, & Heilman, 1988). One assumption is that a spatial code is generated for the irrelevant stimulus location attribute. In fact, multiple locational codes, all of which perhaps contribute to the Simon effect, are likely produced for a single stimulus (De Jong, Liang, & Lauber, 1994; Lamberts, Tavernier, & d'Ydewalle, 1992). In most situations, spatial coding is a function of the location of the target stimulus relative to the location of the alternative stimulus (e. g. , Umiltà & Liotti, 1987; Umiltà & Nicoletti, 1985). Spatial coding is also thought to occur in terms of egocentric hemispace (e. g. , Umiltà & Liotti, 1987), relative to the position of the attentional focus (Nicoletti & Umiltà, 1989), or as a function of configural cues in the display (Hommel, 1995).
> The other widely shared assumption is that the Simon effect occurs at the response-selection stage. The idea is that, provided there is enough similarity between the (irrelevant) spatial stimulus dimension and the (relevant) spatial response dimension (i. e. , the two dimensions overlap; see Kornblum, 1994; Kornblum, Hasbroucq, & Osman, 1990; Kornblum & Lee, 1995), a stimulus automatically activates its spatially corresponding response code (also see Eimer, 1995; De Jong et al. , 1994). For trials in which the automatically activated response code is the same as that signaled by the relevant stimulus feature (e. g. , a red light that is shown to the left of fixation and signals a left-side response), there is no competition at the response-selection stage and possibly even a benefit from the redundant response codes. For trials in which the automatically activated response code is different from the one signaled by the relevant stimulus feature (e.

> g. , a red light that is shown to the right of fixation and signals a left-side response), *competition between the two response codes occurs that must be resolved before the correct response can be executed.*
> ***(my italics)***

I think that the significance of the Simon effect is that when a task is time-dependent, we need all the systems to work together, including the motor system that will execute a physical response to a stimulus. Designers and engineers need to be aware of the extra processing time required when we develop expectations that are not relevant to the task.

Application

A real world application that should pay attention to the Simon Effect into account is a voting ballot. Witness the confusion over the so-called "butterfly ballot" design in 2000!



In addition, an example that shows how real this effect is can be seen at "Mike's Movies" store on Cambridge street in Boston. For some reason, the right-hand door is kept permanently locked. This does not matter when you enter the store, because you usually enter Once you are in the store, however, a large sign on the left-hand door asl to exit. In spite of the sign, people ALWAYS try to exit through the closed and locked right-hand door! If the sign was placed on the right-hand door with an arrow pointing to the left-hand door, perhaps this would not occur.