

Automatic Processing of Spatial Information

In the 19th century, Wilhelm Wundt proposed that, at any given time, humans must actively attend to a single stimulus at the expense of attending to other stimuli in their field of consciousness (Weisberg & Reeves, 2011). As research into attention refined this theory, Hasher and Zacks (1979) developed a framework for attention and encoding that distinguished between *automatic* and *effortful* processes. They suggested that attending to spatial, temporal, and frequency information requires less effort because humans are genetically predisposed to these tasks (Hasher & Zacks, 1979).

Since the framework includes limited developmental trends as a distinguishing factor, Zacks, Hasher, Sanft, Alba, and Caniglia (1984) tested whether attention to temporal information is an automatic process by measuring the effect of practice on temporal processing (Zacks et al., 1984). They found a significant effect, which led to a discussion of degrees of nonautomaticity. This present study examined whether spatial processing is automatic by comparing performance under intentional and incidental conditions. The researcher has suggested that a significant difference between intentional and incidental performance does not exist.

Method

Participants

Eighty-one students enrolled in a cognitive psychology course at the University of Texas at Austin participated in this study. Participants received credit and learning experience in return for their time and participation. All participants were capable of reading English and completing a memory task.

Stimuli

The stimuli consisted of 12 low-frequency, high-imagability words distributed randomly between four adjacent quadrants numbered clockwise from the upper left. Quadrant one words were “Saloon,” “Palace,” and “Juggler.” Quadrant two words were “Oven,” “Cradle,” “Blossom,” and “Meadow.” Quadrant three words were “Bagpipe” and “Pepper.” Quadrant four words were “Ticket,” “Glacier,” and “Elbow.” See Appendix 1 for full list of stimuli.

The stimuli were displayed to participants using a PowerPoint presentation projected onto a blackboard-sized screen. The four quadrants were arranged to form a large rectangle with vertical and horizontal bisecting lines that intersected at the center. This large rectangle was located on the center of the slide, which had a white background. Relative to the slide, each quadrant was approximately 35% in width and 25% in height. The words were written in 48pt Arial font.

Procedure

The experiment used a two-way between-subjects design, with half of the participants randomly assigned to each condition. Participants were tested simultaneously by viewing stimuli on a large screen at the front of a classroom.

To split participants into either the incidental or intentional condition, each participant randomly received one of two sets of instructions on a letter-sized piece of white paper, as shown in Appendix 2, and was asked to keep his or her paper face down. After everyone received a set of instructions, participants quietly read their instructions to themselves and looked up at the researcher when finished. Participants in the incidental condition were told to remember words that appeared on the screen, while participants in the intentional condition were told to remember the location of words that appeared on the screen.

Words were presented one at a time in this order: Oven, Ticket, Saloon, Cradle, Glacier, Bagpipe, Palace, Elbow, Blossom, Juggler, Pepper, Meadow. Each word appeared in its associated quadrant for five seconds. Then, the word disappeared for five seconds while participants encoded spatial information either incidentally or intentionally. Participants were not allowed to write down or otherwise construct a visual representation of what they were trying to remember. This continued for each word until all 12 words had been presented.

After the encoding phase, participants were asked to turn their instruction sheets over and write down the quadrant where each word had appeared as the researcher read the words out loud in order of presentation, pausing for 10 seconds between each word. Then, the researcher provided the correct locations for each word, so participants could tally their correct answers. Finally, the researcher collected data from participants anonymously using a pre-drawn table with columns for condition and number of locations recalled correctly.

Results and Discussion

The mean and standard deviation of word locations recalled per condition are illustrated in Figure 1. A between-subjects t-test suggested no difference between performance under incidental and intentional conditions and indicated that there is no significant effect of condition on spatial processing, $t(79) = 1.713, p > .05$. This confirms the hypothesis that spatial processing is automatic and performance should not vary between intentional and incidental conditions.

According to Hasher & Zacks, attending to spatial, temporal, and frequency information requires less effort because humans are genetically predisposed to these tasks (Hasher & Zacks, 1979). This study seems to contribute evidence to their theory.

However, because visual information is sometimes used as a mnemonic device, these results may have been influenced by intentional spatial processing in both conditions. For

example, participants in the incidental condition may have used spatial location to memorize the semantic information in their task. Furthermore, a one-tailed between-subjects t-test showed that participants in the incidental condition performed significantly better, $t(79) = 1.713$, $p < .05$.

In order to clarify the true reason for the high incidental performance, future studies could use a less demanding task as the control, such as having participants count the number of letters in the stimulus words or neglecting to mention the memory test at all.

References

- Hasher, L., & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology: General*, 108, 356-388.
- Weisberg, R. W., & Reeves, L. M. (2011). *Cognition: From Memory to Creativity*. Unpublished manuscript.
- Zacks, R. T., Hasher, L., Sanft, H., Alba, J. W., & Caniglia, K. (1984). Is temporal order encoded automatically? *Memory & Cognition*, 12, 387-394.

Appendix 1. Stimuli (in order of presentation)

All words were low frequency, high imaginability.

<i>Word</i>	<i>Quadrant</i>
Oven	2
Ticket	4
Saloon	1
Cradle	2
Glacier	4
Bagpipe	3
Palace	1
Elbow	4
Blossom	2
Juggler	1
Pepper	3
Meadow	2

Appendix 2. Instructions

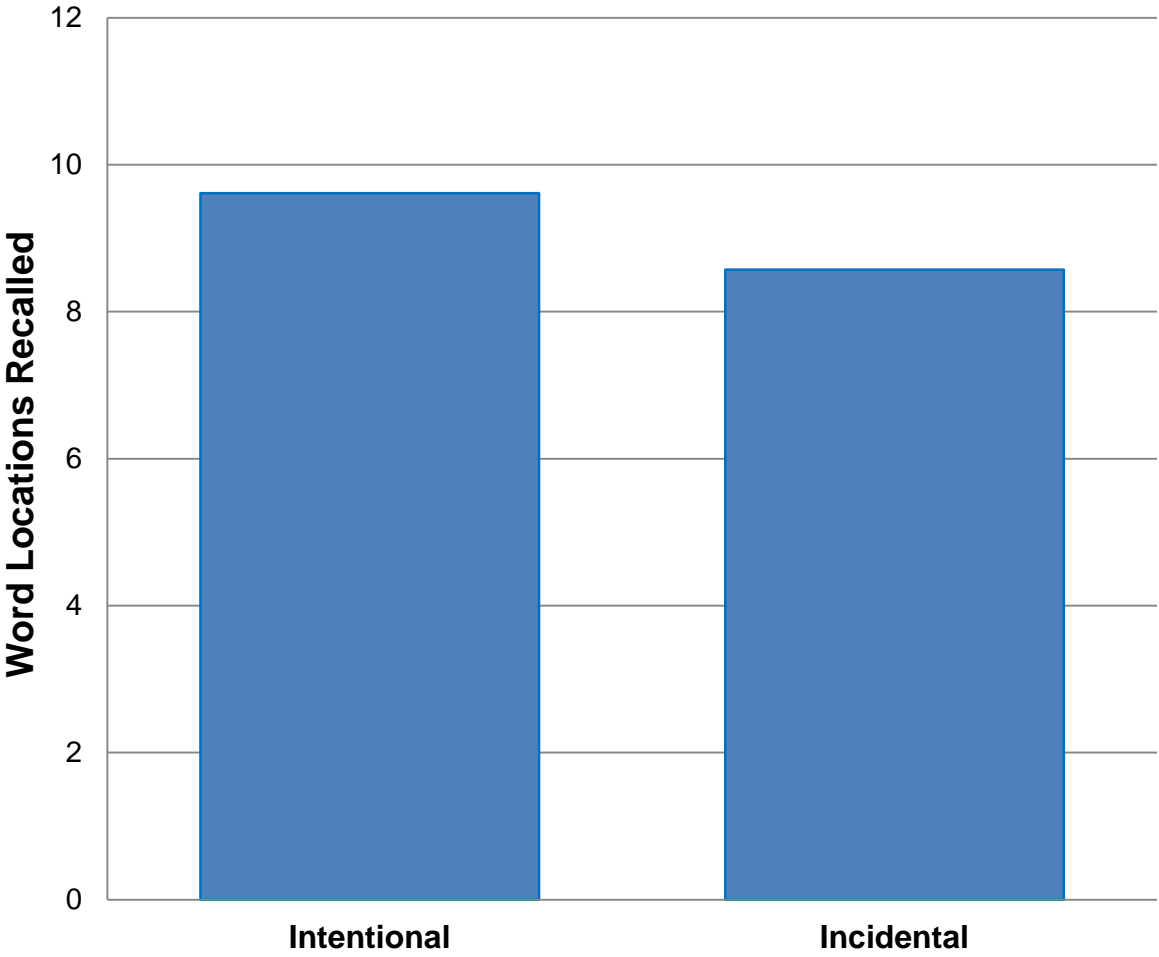
Incidental Processing Instructions:

You will see a list of 12 words appear within some squares. Try to memorize the **words** as best you can. There will be a memory test at the end.

Intentional Processing Instructions:

You will see a list of 12 words appear within some squares. Try to memorize the **location** of the **words** as best you can. There will be a memory test at the end.

Figure 1. Mean of word locations recalled per condition



* out of 12 words