# Span Theory and Multidimensional Absolute Judgment[1]

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According to Span Theory (Bachelder & Denny, 1977a, 1977b) there is a common ability underlying and constraining performance in immediate memory span tests and absolute judgment tasks. The memory spans of college students are about $7 \pm 2$ items and the $\text{antilogs}_2$ of information transmitted in unidimensional absolute judgment tasks fall in the same range. Miller (1956) noted the similarity but concluded it was coincidental because information transmission in multidimensional tasks greatly exceeds $7 \pm 2$. This paper shows how Span Theory can explain high information transmission in a multidimensional task while retaining the notion of a limited capacity in the $7 \pm 2$ range. In addition, the analysis illustrates the process of Span Task Analysis which is beginning to be used at Western Carolina Center to diagnose and remediate learning difficulties.

Pollack & Ficks (1954) presented complex sounds varying along 6 or 8 dimensions and had normal adults respond on a written protocol to indicate which stimulus value had occurred within each dimension. Each correctly judged stimulus element earned 1, 1.58, or 2.32 bits of transmitted information for binary, trinary, and quinary dimensions, respectively. Mean information transmitted ranged from about 5 to 7 over several variations of the basic task. The $\text{antilogs}_2$ of these scores range from 32 to 128, greatly exceeding $7 \pm 2$.

This task is a type of memory span task because each complex sound comprises 6 or 8 stimulus elements which the subject retains for response. The specification of a particular stimulus within a dimension, however, is an absolute judgment task. Each subject has a limited Span Ability which must be divided between absolute judgment and retention. Given a complex stimulus varying along 6 trinary dimensions it is theorized that a subject with a Span of 5 behaves as follows. He uses 3 of his 5 units of Span to derive the first stimulus value via absolute judgment. He retains this stimulus so has 4 span units remaining for the next trinary judgment. He judges successfully because he has 4 available span units but needs only 3. He retains the 2 items and therefore has only 3 span units for the next judgment which he does correctly because he needs only 3 units for a trinary judgment. His next judgment requires 3 span units but he has only 2 available because he is using 3 to retain the previously derived stimuli. Two units of span are insufficient for a trinary judgment so it is assumed that he guesses on this and all subsequent stimulus elements.

His predicted score is calculated as follows. He correctly judged and retained 3 of the 6 stimulus elements and correctly guessed (on the average) 1 more item (the probability of guessing a trinary dimension is 1/3). He thus achieved 4 items, each of which earned 1.58 bits of information for a total score of 6.32. This predicted score is obviously quite similar to the scores actually earned in Pollack & Ficks' task. The Span Abilities I observe in college students fall between 4 and 8 and average about 5. Based upon these norms the model nicely predicts the full range of scores observed by Pollack & Ficks in 4 variations of the basic task.

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