# Pacing Visual Attention: Rate and Rhythm Effects

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## Introduction

Effective management of high priority tasks in a rapidly changing environment is an especially important concern in the military. An operator's failure to update, or take appropriate action in a timely manner can have serious consequences. The dynamic complexity of these work environments is one where information does not arrive in neatly packaged task-by-task bundles. Instead, multiple streams of information exist and these are interleaved in time.

This research examines the efficacy of employing Rate and Rhythm manipulations to dynamic information for the purpose of reducing clutter confusion associated with attending to complex situational awareness (SA) displays. The intent here is to manipulate the timing structures of incoming data sources to aid memory and attentional management of task relevant information.

### Previous Research

Skelly argues that a temporal interface naturally emerges between the viewer and the environment anytime we attend and process dynamic information. Further, temporal interfaces possess dynamic structures (spatio-temporal relationships) that can affect "how" and "what" information we perceive, select, and remember. This is because when we are exposed to persisting timing relationships associated with patterns of environmental stimulation (e.g., auditory or dynamic visual information flows) we can become synchronized to these timing relationships. In essence, we become primed to pickup and use these temporal relationships to anticipate upcoming events and thus, reduce uncertainty. This synchronization permits us to reduce cognitive energy expended as well.

### Study Description and Results

Eleven subjects performed a continuous and attentionally demanding short-term (ST) memory task presented against two different display backgrounds; one cluttered and the other an uncluttered plain background.

The task used is a dynamic version of the classic Sternberg ST memory task. Two timing formats (Fast Rhythmic or Slow Rhythmic) are used to present memory set items sequentially. Task irrelevant items (small balls) also appear; timed to occur either synchronously with memory set items or asynchronously (i.e., different rhythmic timing). Results indicate that performance in this ST memory task can improve (fasters RTs and fewer errors) when dynamic irrelevant information is "added" to the display. Performance facilitation is best when the timing of task irrelevant balls and the task relevant memory set are the same. Results suggest that these rate and rhythm manipulations can guide attention and enhance situational awareness by: (1) highlighting task relevant items via a dynamic "pop out" effect, or (2) aiding the operator in tuning out certain dynamic irrelevant data. Either way, further research is needed to clarify the mechanism associated with what we are referring to as Pacing Visual Attention.

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