

Eyeblink Classical Conditioning, Awareness, and Brain Systems

Robert E. Clark



VA San Diego Healthcare System
&
University of California, San Diego
School of Medicine



Brain Substrates for Delay and Trace Eyeblink Conditioning

Delay Conditioning

Cerebellum
(and associated brainstem structures)



Trace Conditioning

Cerebellum
(and associated brainstem structures)

Hippocampus
(and prefrontal cortex)

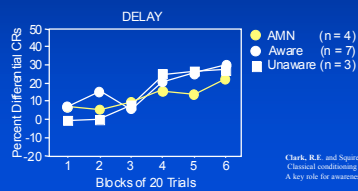
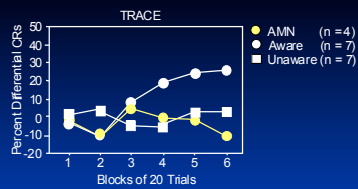


Questions of Interest:

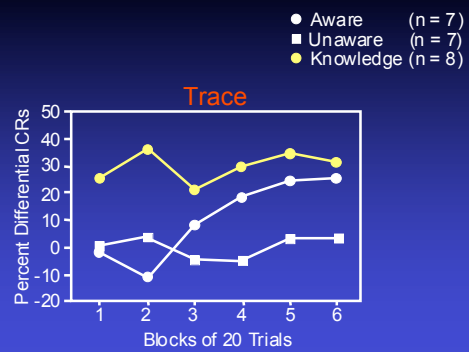
- When conditioning occurs, do individuals become aware of the relationship between the CS and US?
- Is awareness of the stimulus contingencies necessary for successful conditioning to occur?
- Does the importance of awareness differ for delay and trace conditioning?

Awareness and Differential Conditioning

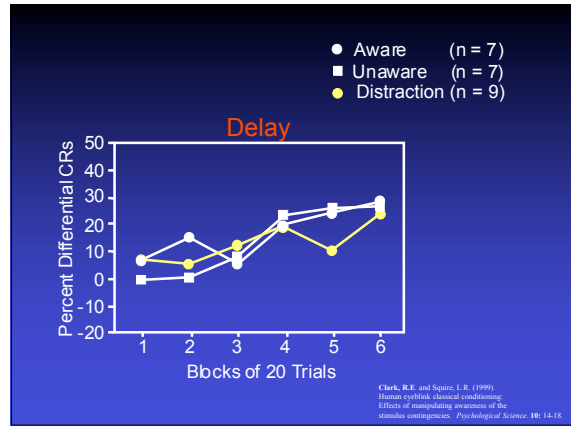
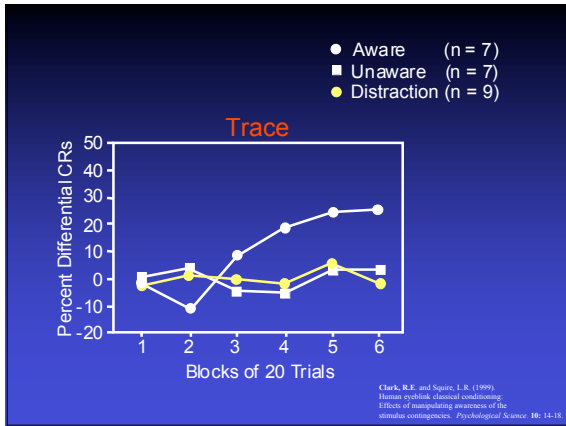
Trace vs. Delay



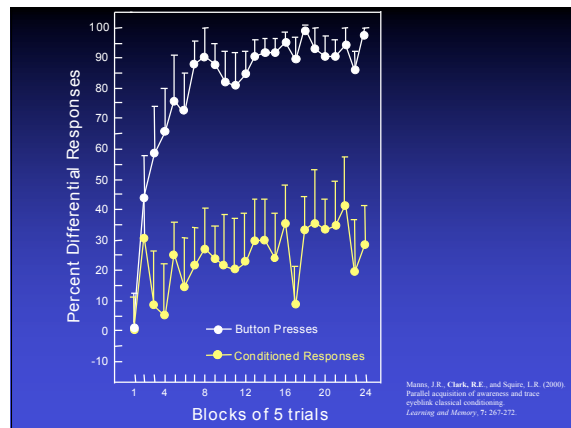
Clark, R.E. and Squire, L.R. (1999). Classical conditioning and brain systems: A key role for awareness. *Science* 286: 77-81.



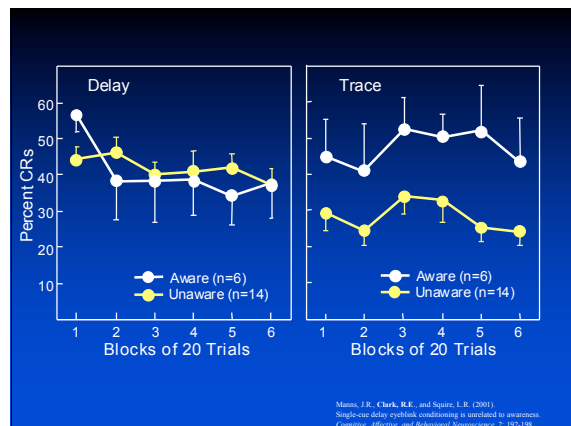
Clark, R.E. and Squire, L.R. (1999). Human eyeblink classical conditioning: Effects of manipulating awareness of the stimulus contingencies. *Psychological Science* 10: 14-18.

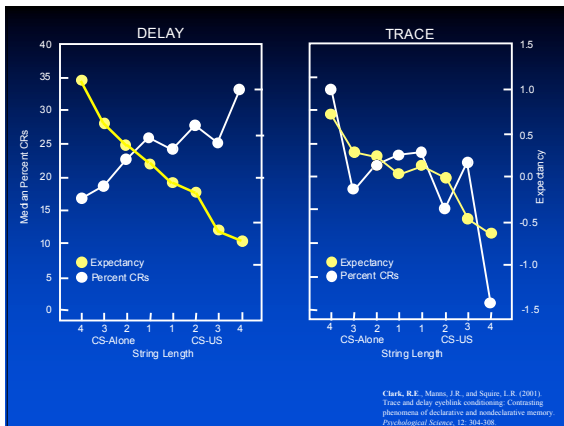
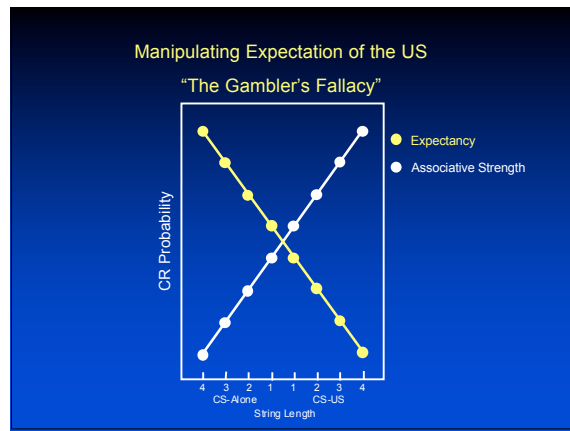
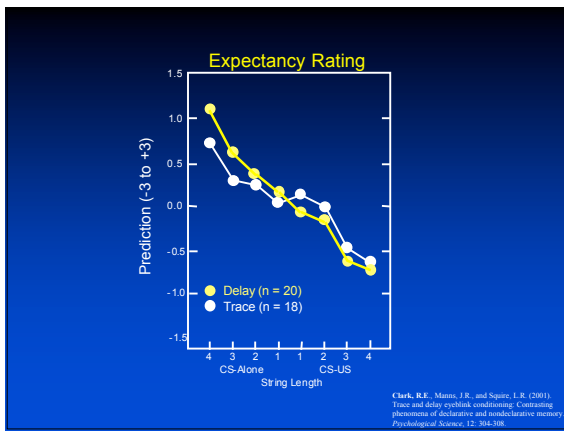
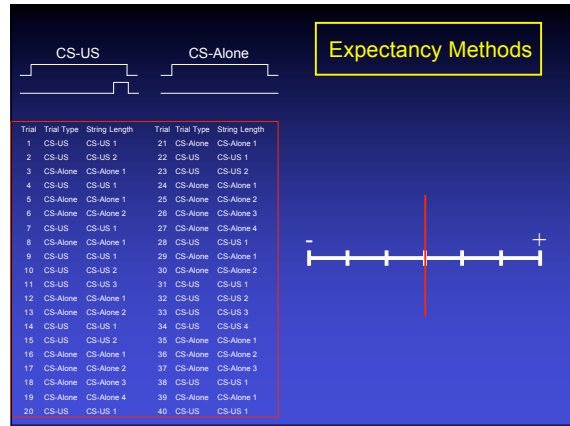
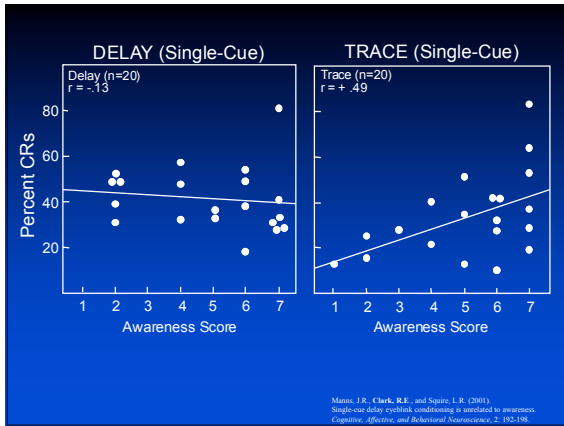


Does Awareness
Precede, Follow, or Parallel
Successful Differential Trace Conditioning?



Awareness and Single-Cue Conditioning
Trace vs. Delay





- Conclusions**
- Results can be understood in terms of the declarative and nondeclarative memory systems that support eyeblink classical conditioning
 - For Delay Conditioning, declarative knowledge is superfluous to the acquisition of the CR, and conditioned performance can be completely supported by cerebellar circuits
 - For Trace Conditioning, declarative knowledge is important for the acquisition of the CR which could explain why the hippocampus and neocortex are also required for successful acquisition

Acknowledgments for Pavlovian Conditioning Projects

<p><u>Collaborators</u></p> <p>Larry R. Squire, Ph.D.</p>	<p><u>Graduate Student</u></p> <p>Joe Manns</p> <ul style="list-style-type: none"> -Data collection -Eyeblink waveform -Statistical analysis -Manuscript preparation 	<p><u>Technicians</u></p> <p>James Moore</p> <ul style="list-style-type: none"> -Subject recruitment -Data collection <p>Joyce Zouzounis</p> <ul style="list-style-type: none"> -Subject recruitment <p>Jennifer Frascino</p> <ul style="list-style-type: none"> -Subject recruitment -Data collection <p>Leah Swalley</p> <ul style="list-style-type: none"> -Subject recruitment -Data collection -Eyeblink waveform scoring
---	--	--

