

The Effect of Sensory Stimuli on the Performance of Security-Critical Tasks

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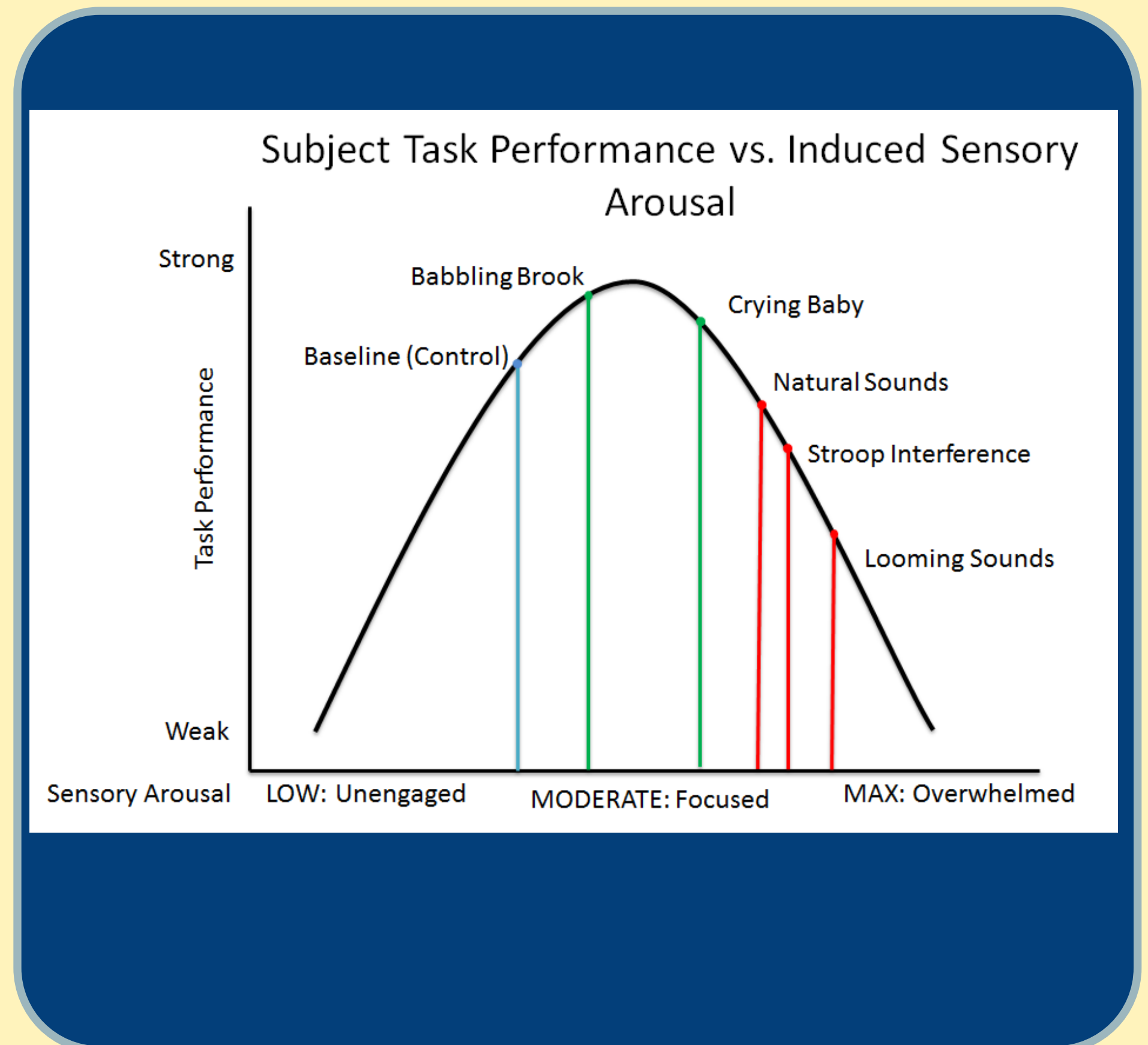
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OBJECTIVE

To recognize and define the impact of both deliberate and incidental sensory stimulation on users performing security-critical tasks.

Developers of security-critical tasks with humans in the loop assume humans are the weak link. Tasks are thus designed to be as easy as possible. However, external sensory stimulation are not considered. We seek to understand the effects of auditory and visual stimulation on task completion.

In line with the Yerkes–Dodson law, we found that sensory stimuli can impact performance positively or negatively, depending on the type of stimulation. We explore the relationship between sensory stimulation and task performance, as well as implications for whomever (benign or malicious) controls the environment.



Approach

- Examined subjects performing Bluetooth pairing while exposed to sensory stimuli
 - Subjects' performance was enhanced by static sound stimuli
 - Subjects' performance was hindered by dynamic stimuli
- Examined subjects solving CAPTCHAs while exposed to auditory stimuli
 - Simple stimuli led to performance improvements
 - More complex stimuli led to degraded performance

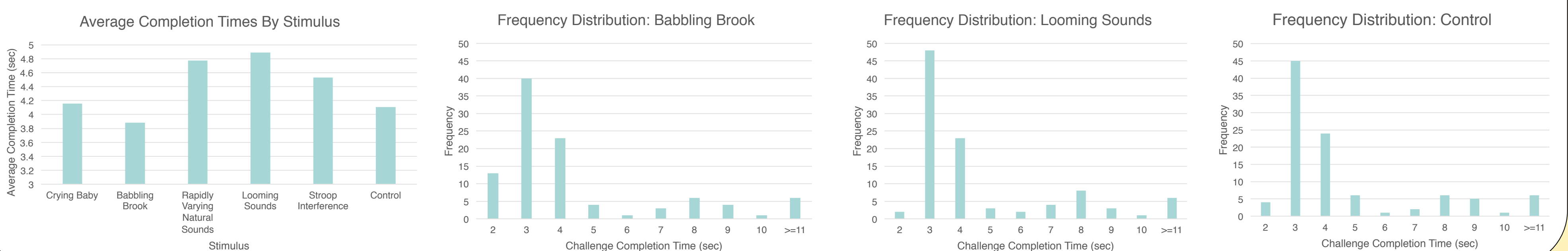
Results: Bluetooth Pairing Failure Rates

Stimulus	Total Pairings	Successful Subjects	Failed Subjects	Subject Failure Rate	Wald Statistic	Nuisance Parameter	p
Control	47	32	15	.32	-	-	-
Baby Crying	24	23	1	0.04	2.65	0.95	0.03
Hammering	36	33	3	0.08	2.58	0.91	0.01
Helicopter	25	24	1	0.04	2.71	0.89	0.01
Saw Revving	22	20	2	0.09	2.05	0.84	0.03
Looming B	21	8	13	0.62	2.32	0.86	0.01
Solid Red Light	20	11	9	0.45	1.02	0.88	0.17
Flickering Red Light	20	9	11	0.55	1.77	0.86	0.04
Solid Blue Light	20	14	6	0.3	0.15	0.05	0.49
Flickering Blue Light	20	8	12	0.6	2.14	0.96	0.03
Solid Yellow-Green Light	22	10	12	0.54	1.79	0.94	0.06
Flickering Yellow-Green Light	20	7	13	0.65	2.51	0.91	0.01

Results: CAPTCHA Challenge Completion Times

Stimulus	Average Completion Time	Std. Dev	Degrees of Freedom WRT Control	T-Value WRT Control	P
None(Control)	5.60	4.07	-	-	-
Babbling Brook	4.87	5.53	366	2.40	0.0171
Crying Baby	5.39	5.84	345	0.40	0.6864
Looming Sound	7.78	7.08	350	3.56	0.0004
Rapidly Varying Natural Sounds	7.41	5.23	364	3.69	0.0003
Stroop Interference	7.32	8.13	344	2.53	0.0119

Example CAPTCHA Challenge Subject Average Times and Frequency Distributions



Interested in meeting the PIs? Attach post-it note below!

