INTRODUCTION

It is well established that a stimulus-onset-asynchrony (SOA) between the fixation-target offset and the saccade-target onset considerably affects saccade latencies (Kalesnykas & Hallett, 1987).

Gap — Shorter latencies
Overlap — Longer latencies
Fixation / Target / Time

Here, we probe the possibility to control saccadic latencies using classical conditioning by systematically pairing a gap with one saccade direction and an overlap with the other.

METHODS

Left fixation Gap / Right fixation Overlap

Fixation [750 1250] ms
Fixation offset SOA = -100 ms
Target onset + saccade
Fixation

Fixation [750 1250] ms
Target onset SOA = +150 ms
Fixation offset + saccade
Fixation

Trial

Classical conditioning (Pavlov, 1927)

Unconditional stimulus (US) — Food → Unconditional response (UR) — Salivate ++

Neutral stimulus (NS) + US — Metronome + Food → UR — Salivate ++

Conditional stimulus (CS) — Metronome → Conditional response (CR) — Salivate +

Classical conditioning of saccadic latencies

US — Gap // Overlap → UR — Short // Long latencies

NS + US — Saccade direction + Gap // Overlap → UR — Short // Long latencies

CS — Saccade direction → CR — ?

Experimental conditions
Baseline - 0% probe - 20% probe - Reversal

RESULTS

Saccade direction (CS) came to elicit specific latencies (CR)

Saccadic latency (ms)

S1, S2, S3, S4, S5, S6, S7

Experimental condition: BL 1 / 0% 1 / 20% 1 / BL 2 / 0% 2 / 20% 2 (and variants per subject)

Legend:
- Left fixation
- Right fixation
- Quartiles
- Only probe trials are represented

144 ms latency difference for pairing and 31 ms for probe

Latency difference (median & 98 CI)	S1	S2	S3	S4	S5	S6	S7
0% probe 1	190 ms CI = [0.36;36.63]	245 ms CI = [0.43;36.79]	156 ms [3.18;80.44]		131 ms CI = [0.08;34.71]	123 ms CI = [0.20;15.52]	98 ms CI = [0.18;23.05]
20% probe 1	78 ms CI = [0.17;16.95]	124 ms CI = [0.33;41.90]	26 ms CI = [0.01;9.28]		1 ms CI = [0.06;7.75]	9 ms CI = [1.09;15.39]	6 ms CI = [0;4.83]
0% prone 2	161 ms CI = [0.49;57.20]	209 ms CI = [0.26;20.35]		87.73 ms CI = [0.04;14.49]	122 ms CI = [0.22;28.39]	79 ms CI = [0.08;18.13]	124 ms CI = [0.03;39.14]
20% probe 2	37 ms CI = [0.20;19.38]	62 ms CI = [0.02;21.42]		12 ms CI =[0.01;7.18]	2 ms CI = [0.09;6.81]	15 ms CI = [0.07;13.68]	14 ms [0.52;6.65]

REFERENCES

Kalesnykas, R. P., & Hallett, P. E. (1987). The differentiation of visually guided and anticipatory saccades in gap and overlap paradigms. *Experimental Brain Research, 68*, 115–121.
Pavlov, I. P. (1927). *Conditional reflexes: an investigation of the physiological activity of the cerebral cortex.* Oxford, England: Oxford Univ. Press.
Vullings, C., & Madelain, L. (2018). Control of saccadic latency in a dynamic environment: allocation of saccades in time follows the matching law. *Journal of Neurophysiology, 119*, 413–421.

Contact:
cecile.vullings@gmail.com

Université de Lille — CNRS

CONCLUSION

- Saccadic latencies can be controlled by classical conditioning.
- Necessity to consider learning and historical effects when studying reaction time.
- Learned environmental contingencies affect the temporal allocation of saccades (Vullings & Madelain, 2018).