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Supplemental Information

The Limits of Deliberation in a Perceptual Decision Task

Hatim A Zariwala, Adam Kepecs, Naoshige Uchida, Junya Hirokawa, and Zachary F. Mainen

INVENTORY OF SUPPLEMENTAL INFORMATION

Supplemental Figure S1, related to **Figure 1; Reaction times are sensitive to task conditions.**

Supplemental Figure S2, related to **Figure 2; Amount of water consumed each day in control rats**

Supplemental Figure S3, related to **Figure 3; Go signal delay increased the difference in OSD between easy and difficult stimuli.**

Supplemental Figure S4, related to **Figure 4; Derivation of subjective hazard rate functions (temporal expectation functions).**

Supplemental Figure S5, related to **Figure 4 & 6; Saturating level of accuracy is achieved by 300 ms independent of difficulty.**

SUPPLEMENTAL FIGURES

Figure S1: Reaction times are sensitive to task conditions. The left column in **A**, **B** & **C** corresponds to original task condition and the right column to the low urgency task conditions. **(A)** Distribution of stimulus onset delays in the original task. Example distributions used in the task (black) and the theoretical distributions from which these were drawn (red). In the original condition, **left**, the stimulus delay, d_{odor}, was drawn from uniform distributions with range of [0.3, 0.6]. In the low urgency condition, **right**, the stimulus delay was drawn from an exponential distribution with mean of 0.5 s, clipped between 0.1 and 2.0 s. Note that minimum water delay, d_{water}, and inter-trial interval, $d_{inter\text{-}trial}$ also differed between these two conditions (see **Fig. 1C**). **(B)** Distribution of OSDs of an example rat in a single session with the original RT paradigm. Blue: correct trials, black: error trials. **(C)** Distribution of MTs of the same rat in the same single session. See **Fig. 1C** for measurement of OSD and MT. Random odor onset delays prevent rats from performing an odor poke of stereotyped duration. **(D)** Odor port and odor valve signals illustrating the measurement of odor onset delay, d_{odor}, and odor port stay duration, the time that the subject's snout is in the odor port (equal to the sum of d_{odor} and OSD). (**E**) Odor port stay durations pooled across 4 rats for the low urgency task condition (in which the d_{odor} was drawn from an exponential distribution). Each dot represents a single trial. Green: invalid short trials (odor port withdrawal before odor valve onset); blue: correct valid trials; red: incorrect valid trials; black: invalid trials in which the subject failed to make a left/right choice. Note that only valid trials (blue and red) contribute to accuracy and OSD measurements.

Figure S1, related to Figure 1

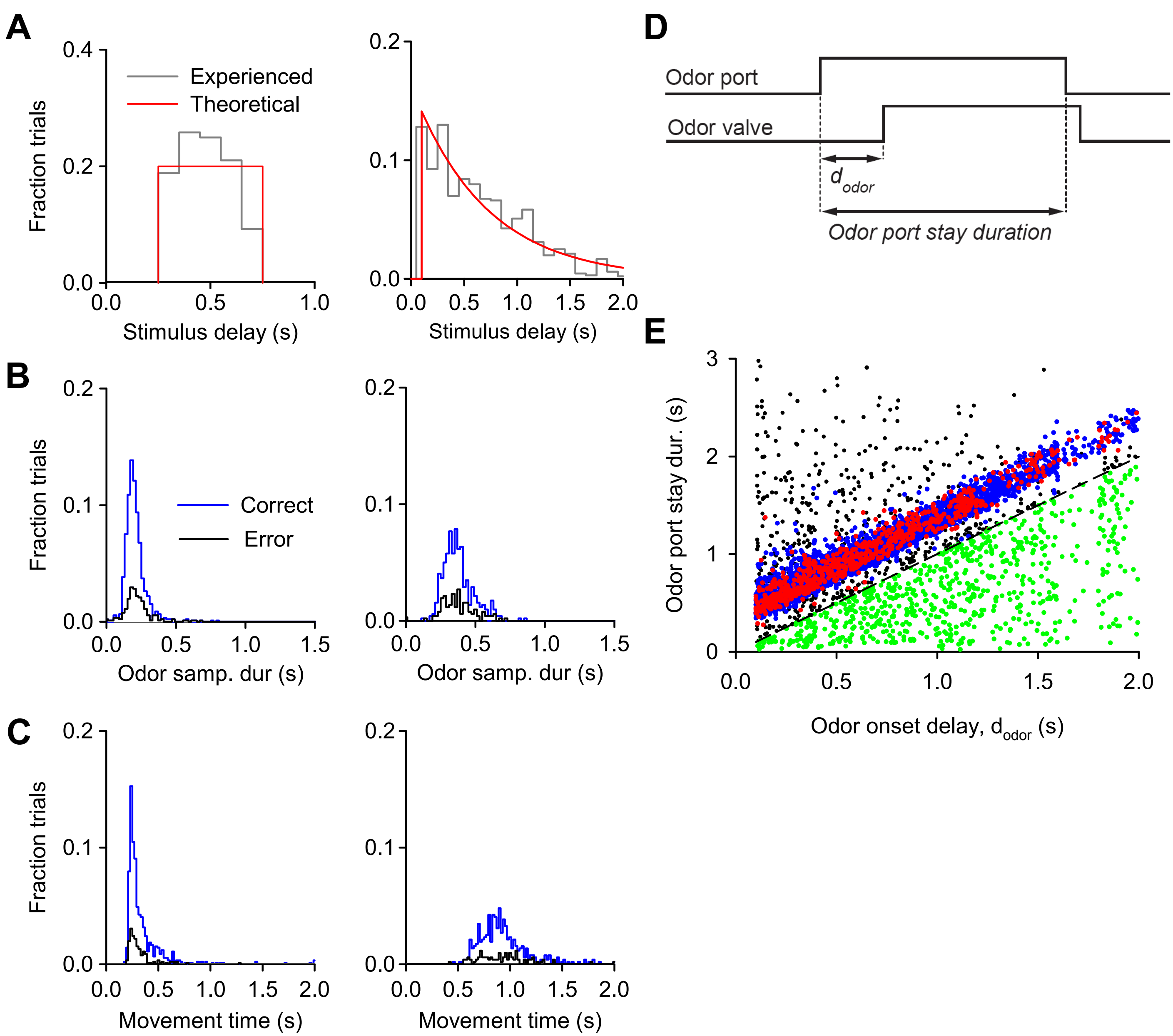

Figure S2: (**A, B**) Amount of water consumed each day in control rats (A) and test rats (B). Amount of water consumed in the task (upward triangles) and outside the task (downward triangles) are represented in terms of fraction of ad libidum water consumption. Error bars (n = 4 rats for each condition) are smaller than symbols in most cases. Three phases of task conditions (I - III) are indicated above (see text for details).

Figure S2, related to Figure 2

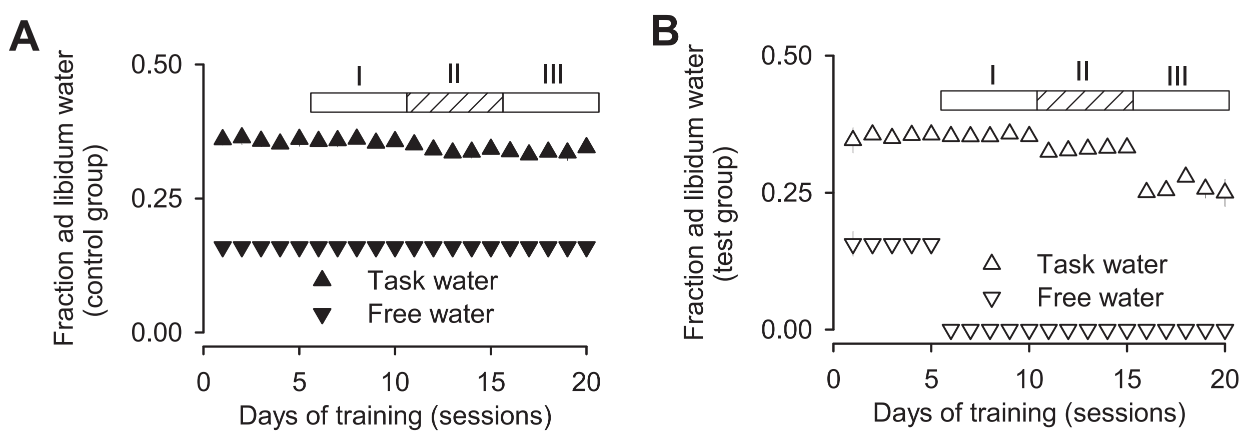

Figure S3: Go signal delay increased the difference in OSD between easy and difficult stimuli. (A) Mean difference in OSD between the easy and difficult odor mixtures is plotted as a function of the median OSD in a session. These variables were significantly correlated ($P < 0.001$). Go signal delays are coded from grey to black as indicated within the figure. Interestingly, the fractional change in OSD with difficulty remained constant at around 10% of the median OSD, a fraction similar to that reported previously in the RT paradigm (Uchida and Mainen 2003). **(B)** Accuracy as a function of go signal delays and mixture contrasts. The go signal delays are coded from grey to black and mixture contrast is color coded. Note that longer OSDs did not result in an increase in performance accuracy. It must be stressed, however, that no improvement in accuracy was observed regardless of go signal delays despite the substantial changes in OSD.

Figure S3, related to Figure 3

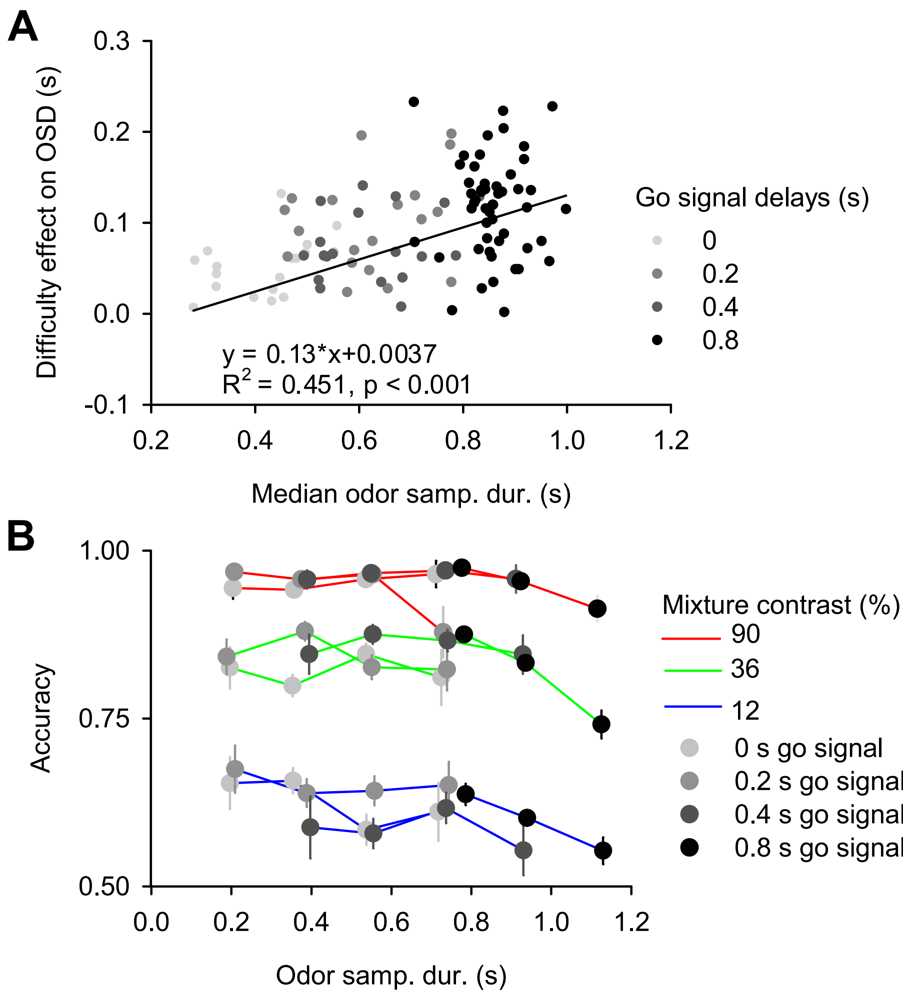

Figure S4: Derivation of subjective hazard rate functions (temporal expectation functions). (A**, B**) Theoretical probability density functions of go-signals for uniform (A) and exponential (B) distributions. **(C, D)** Theoretical hazard rate functions for **A** and **B** respectively. F(t) is the cumulative probability of f(t). **(E, F)** Subjective time estimation function for a given go-signal delay: a normal distribution whose variance is proportional to the elapsed time. **(G, H)** Subjective hazard rates (temporal anticipation functions) (Janssen & Shadlen 2005) obtained by blurring the theoretical probability distributions with the subjective time estimation functions.

Figure S4, related to Figure 4

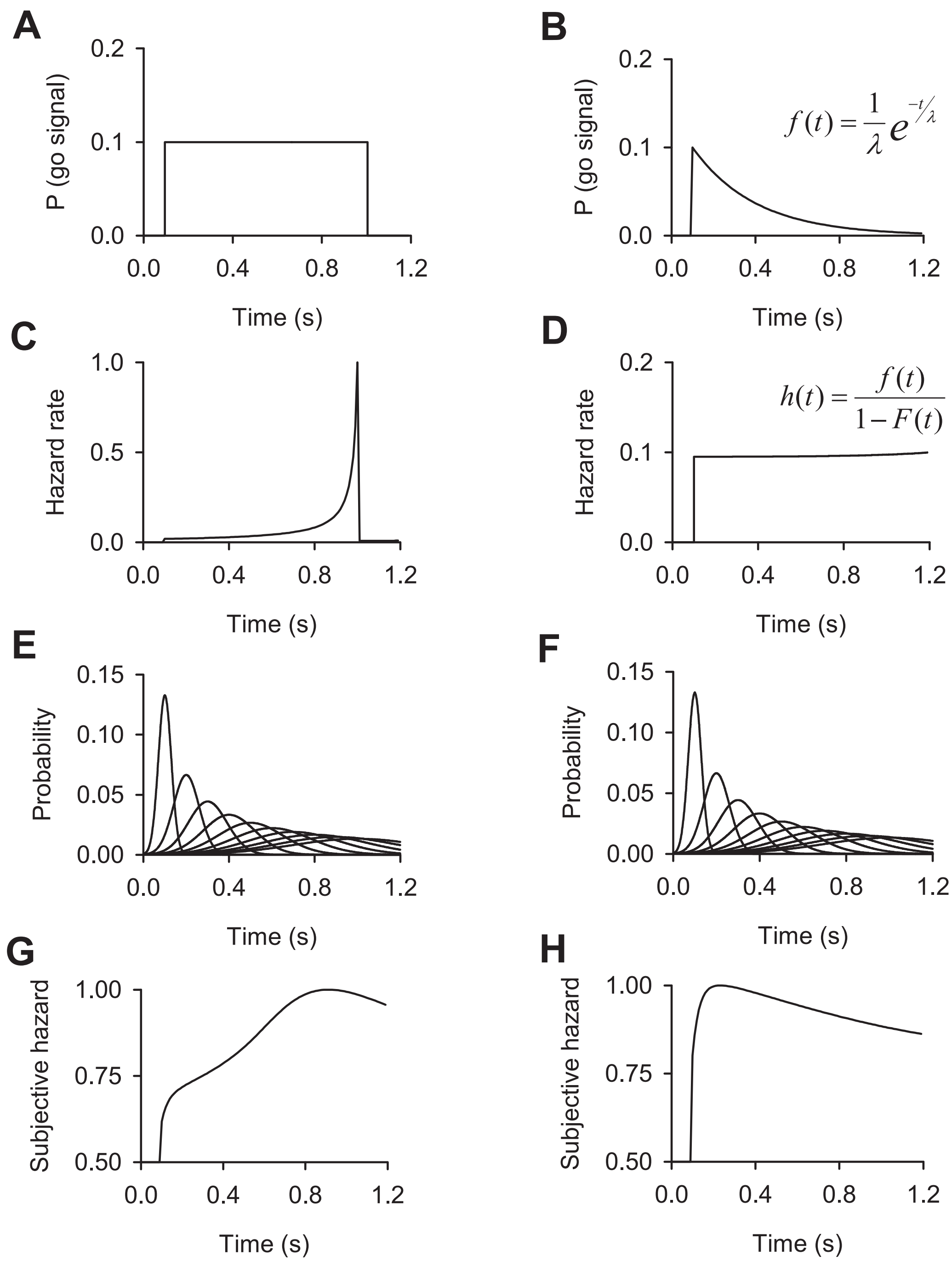

Figure S5: Saturating level of accuracy is achieved by 300 ms independent of difficulty. (**A**) Accuracy as a function of OSD (conditional accuracy) in the go signal task where probability of go signal delay as a function of time (P_{go}) was chosen from a uniform distribution (range 0.1 - 1.0s). Data was pooled from all rats and all trials. (**B**) T-95 for mean across rats and individual rats plotted as a function of mixture contrast. Individual rats are shown with different symbols (four oriented triangles). T-95 is defined as the time to reach 95% accuracy. (**C & D**) Accuracy and T-95 values plotted as above for experiments where P_{go} was chosen from exponential distribution. (**D**) T-95 value for P_{go} exponential. (**E & F**) Accuracy and T-95 values plotted as above for experiments using the reaction time task in which each of the stimulus difficulties (mixture contrasts) was presented non-interleaved (blocked) in individual sessions. For C and E pooled data was grouped in 9 increasing quantiles of equal number of trials. Error bars in (**A**), (**C**) and (**D**) are derived using a binomial model and (**B**), (**D**) and (**F**) are mean ± s.e.m (n = 4 rats).

Figure S5 related to Fig 4 & 6