Bounded Rationality in *C. elegans*

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Supplementary Materials

Fig. S1

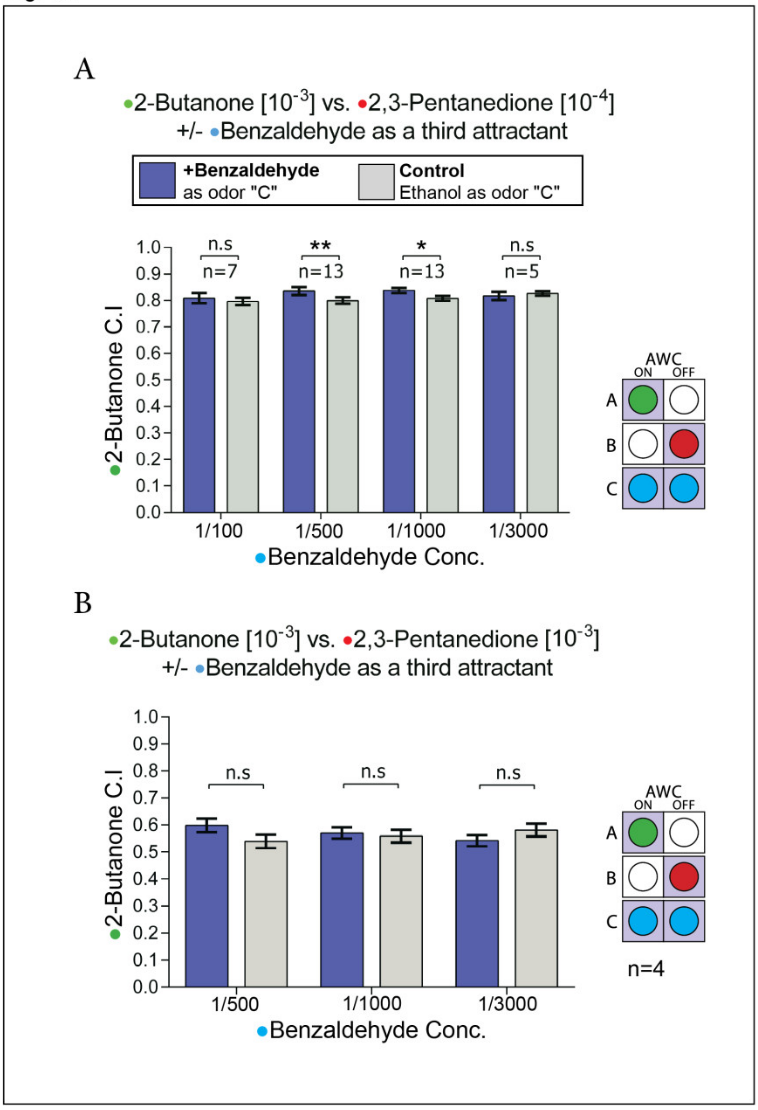

Fig. S1. Benzaldehyde (AWC^{BOTH}) as a third attractant does not change the relative preference between 2-butanone (AWC^{ON}) and 2,3-pentanedione (AWC^{OFF}), in wild-type mutants. (A) Benzaldehyde as a third attractant does not influence the relative preference between (a) 2-butanone (10^{-3}) and 2,3-pentanedion (10^{-4}) (Wilcoxon Signed-Ranks Test, C=10^{-2}: W=332, p=0.367 ; C=1/500: W=1395, p=0.003 ; C=10^{-3}: W=1280, p=0.017 ; C=1/3000: W=82, p=0.495, n=4) and (B) 2-butanone (10^{-3}) and 2,3-pentanedion (10^{-3}) (Wilcoxon Signed-Ranks Test, C=1/500: W=175, p=0.167 ; C=1/1000: W=141, p=0.642 ; C=1/3000: W=96 , p=0.57; n=4). The very weak differences that were observed here were considered physiologically irrelevant. Each replication consisted of 3 experimental plates and 3 control plates, for each concentration of odor C.

Fig. S2

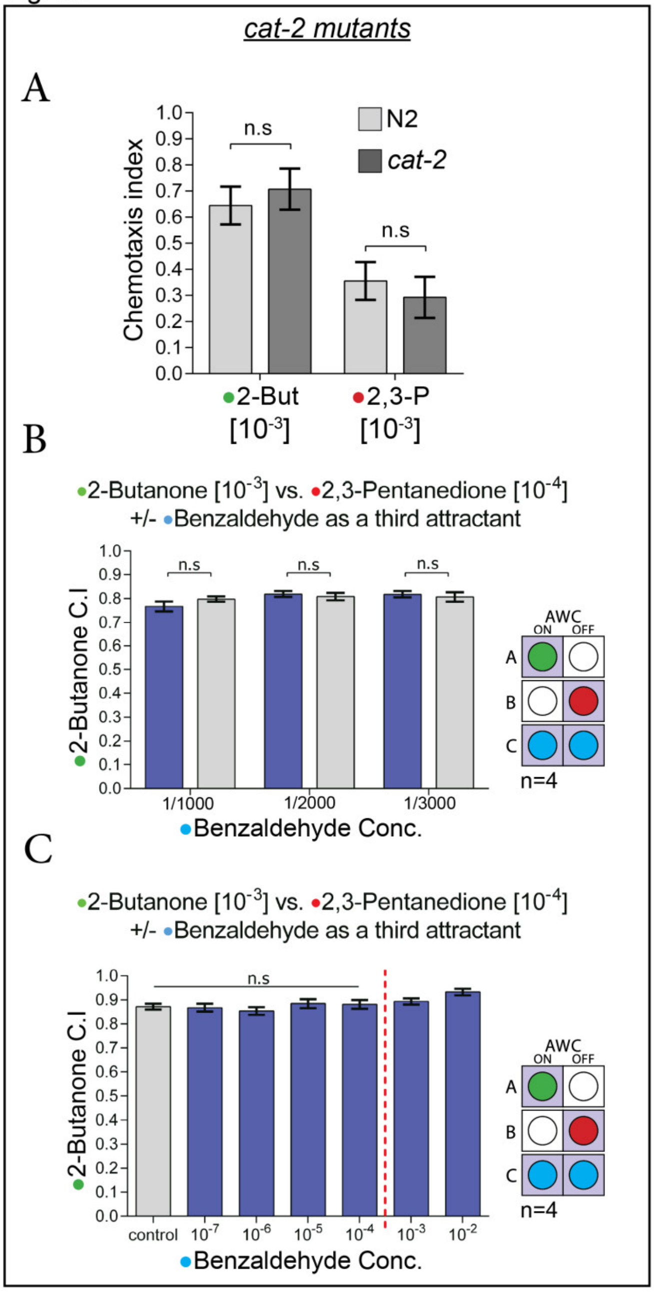

Fig. S2. The introduction of the benzaldehyde as a third attractant did not have any significant effect on the preference between 2-butanone and 2,3-pentanedione in *cat-2* mutants.

The *cat-2* gene encodes for tyrosine hydroxylase, the rate limiting enzyme in the synthesis of dopamine. **(A)** There are no significant differences between wild-type (N2) and *cat-2* mutants in their relative preferences between 2-butanone (10^{-3}) and 2,3-pentanedion (10^{-4}) (2-butanone: W=38 ,p=0.28 ; 2,3-pentanedione: W=18 , p=0.28 ; n=8, namely 8 biological replications). Error bars represent standard deviation. **(B)** The effect of benzaldehyde as a third attractant on the relative preference between 2-butanone (10^{-3}) and 2,3-pentanedion (10^{-4}) in *cat-2* mutants (C=1/500: W=175, p=0.167 ; C=10^{-3}: W=141, p=0.642 ; C=10^{-3}/3: W=96 , p=0.57 ; n=4). **(C)** *cat-2* mutants' relative preference between 2-butanone (10^{-3}) and 2,3-pentanedion (10^{-4}) is unaffected by the introduction of benzaldehyde as a third attractant (C=10^{-7}: W=172, p=0.718 ; C=10^{-6}: W=148, p=0.314 ; C=10^{-5}: W=206, p=0.602 ; C=10^{-4}: W=193, p=0.862; n=4). Bars represent the mean C.I of 2-butanone. Wilcoxon Signed-Ranks Tests, Error bars represent standard error of the mean C.I.

Fig. S3

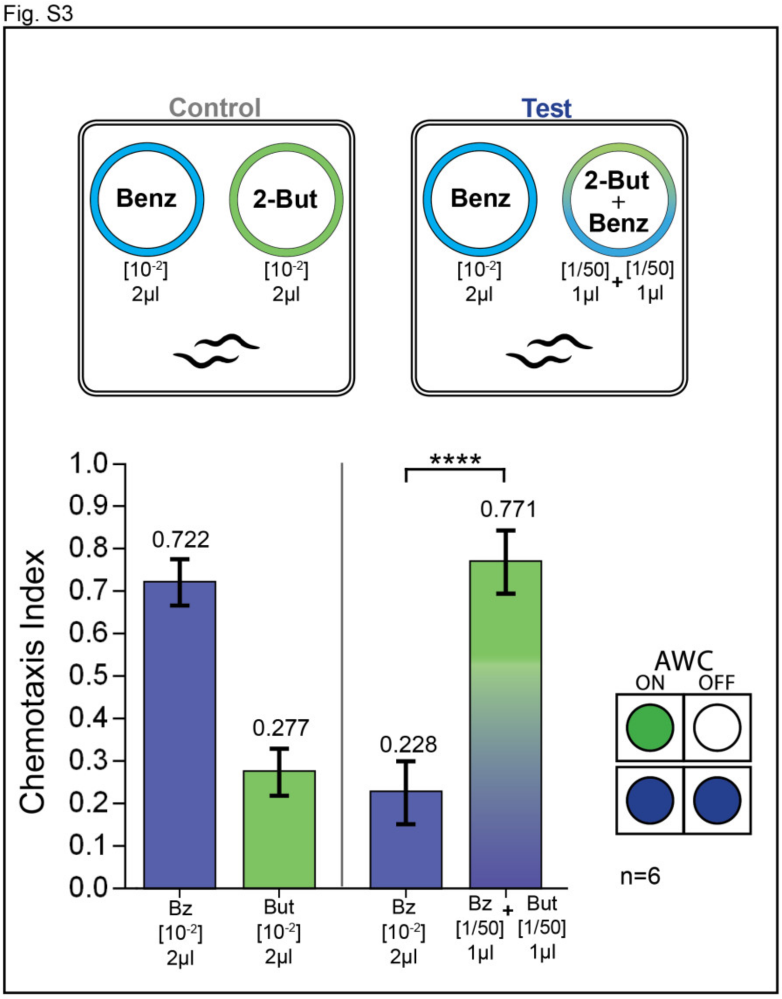

Fig. S3. 2-butanone and benzaldehyde together are as attractive as would be expected based on the simple summation of the attractiveness of each of the odors alone. A binary preference between benzaldehyde and a mixed combination of benzaldehyde and 2-butanone (placed in the same spot on the plate, see methods). We found that the combination of 2-butanone and benzaldehyde was more attractive than benzaldehyde alone (Wilcoxon Signed-Ranks Test, W=16.5, p=0.0000; n=6).

Fig. S4

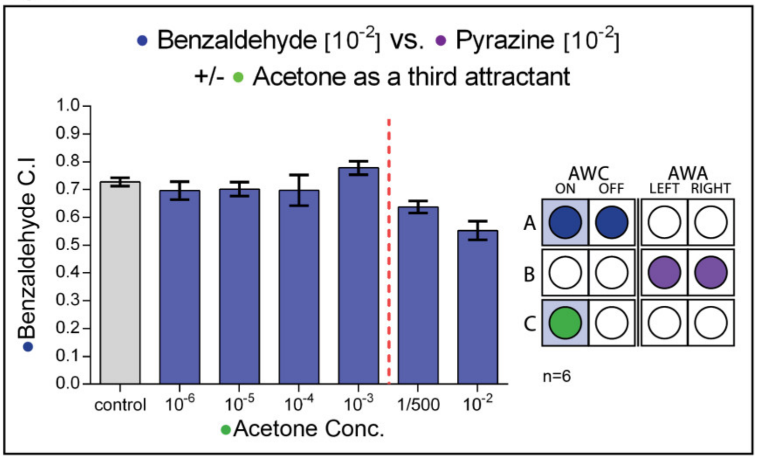

Fig. S4. Increasing concentrations of acetone (AWC^{on}-sensed odor) as a third alternative, disproportionally reduce the preference for benzaldehyde over pyrazine.

The influence of acetone (AWC^{ON}) as a third attractant on the relative preference between benzaldehyde (10^{-2}) (AWC^{BOTH}) and pyrazine (10^{-3}) (AWA) (Wilcoxon Signed-Ranks Test, $C=10^{-6}$: W=13, p=0.484; $C=10^{-5}$: W=16, p=0.818 ; $C=10^{-4}$: W=14, p=0.588 ; $C=10^{-3}$: W=24, p=0.393 ; C=1/500: W=9, p=0.179; $C=10^{-2}$: W=7, p=0.093; n=6). Bars represent the C.I of odor A. Dashed red lines indicate the point where odor C was too attractive for our purposes, i.e. it rendered B irrelevant to the choice task. Colors correlate between an odor and the specific neuron recognizing it. Error bars represent the standard error of the mean C.I.

Fig. S5

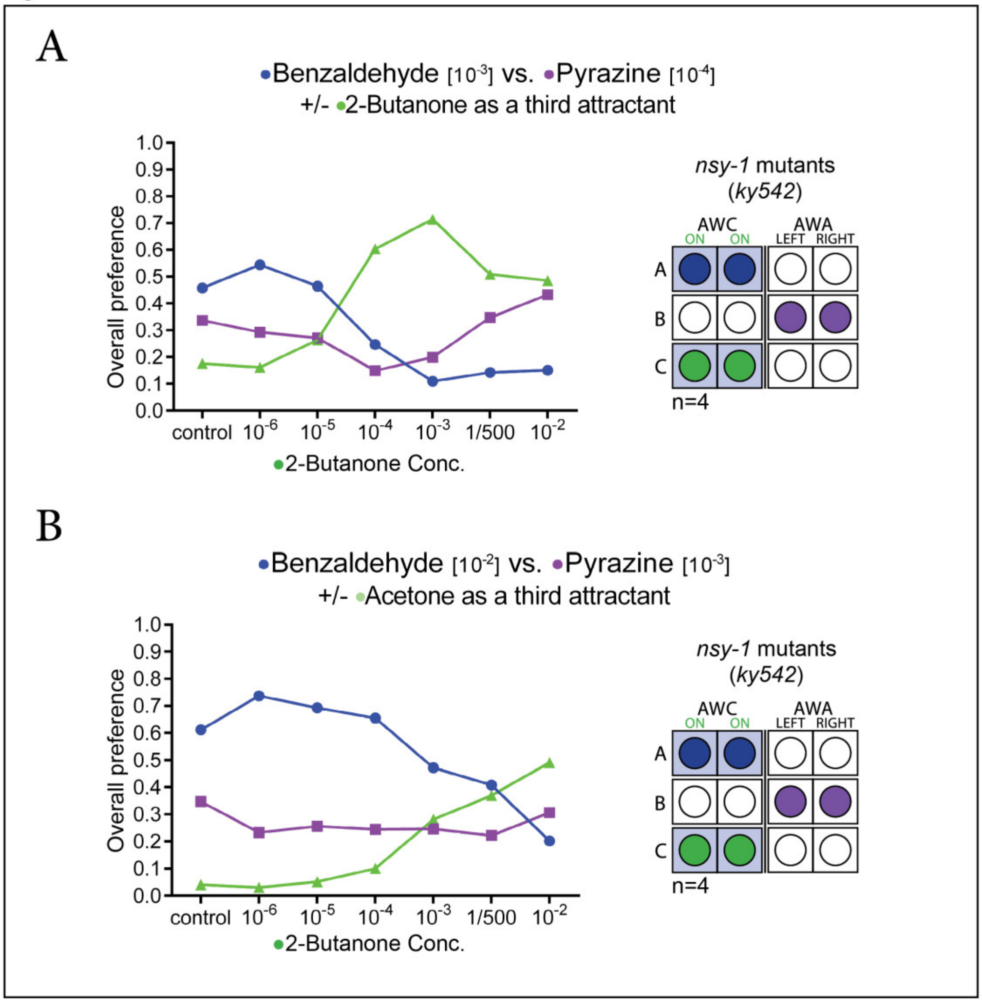

Fig. S5. The effect of 2-butanone and acetone on the relative preference between benzaldehyde and pyrazine, in *nsy-1(ky542)* mutants - Overall preferences.

Overall preferences (number of worms arrived at an odor spot, devided by the total number of worms on the assay plate) in the two experiments described in **Fig.3,a-b.** AWC$^{ON/ON}$ mutants are hypersensitive to acetone and butanone, since they sense these odors using two AWC^{ON} neurons instead of one; therefore in relatively low concentrations, these odors instantly became the most attractive odors on the plate (n=4)**.**

Fig. S6

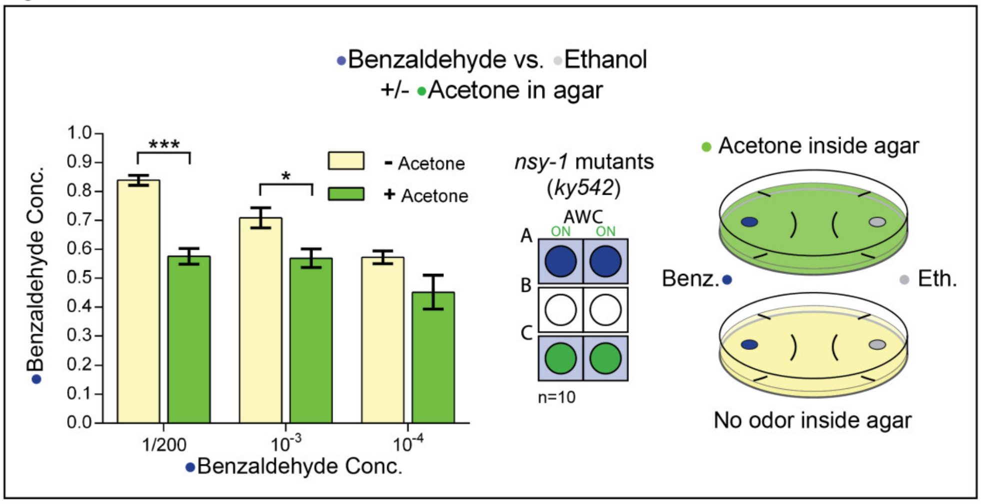

Fig. S6. *nsy-1(ky542)* mutants (AWC$^{ON/ON}$ phenotype) fail to detect benzaldehyde (AWC^{BOTH}) when aceton (AWC^{ON}) is mixed into the agar.

The relative preference between 2ul of benzaldehyde (10^{-2}) (A) and 2ul of butanone (10^{-2}) (B) was measured, and compared it to the relative preference between 2ul of benzaldehyde (10^{-2}) (A), and a mixture of 1ul of butanone (1/50) and 1ul of benzaldehyde (1/50) (Wilcoxon Signed-Ranks Test, C=1/200: W=1, $p<0.000$, n=10; C=10^{-3} : W=11, $p<0.012$, n=10; C=10^{-4} : W=35, $p<0.28$, n=10). Bar represent chemotaxis index of benzaldehyde, on an aceton agar plate (green) and on a plain agar plate (yellow). Each data point represents the mean of 10 assays performed on two different days. Error bars represent standard error of the mean C.I. Colors correlate between an odor and the specific neuron recognizing it.