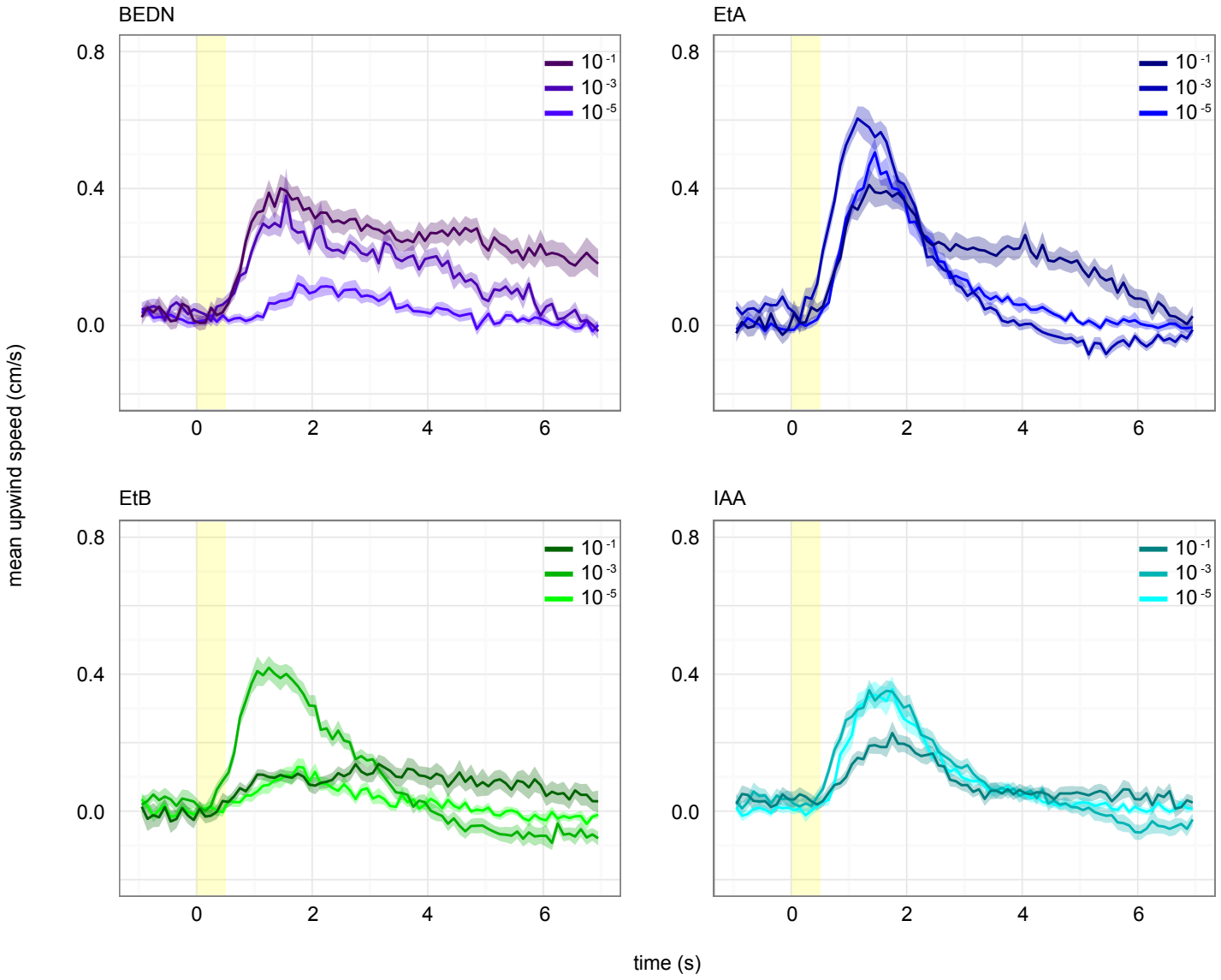

Fig. S1. Response time courses for dose-response characteristics of attractants (mean ± SEM; n=28-30 flies). Yellow bar represents odor pulse.

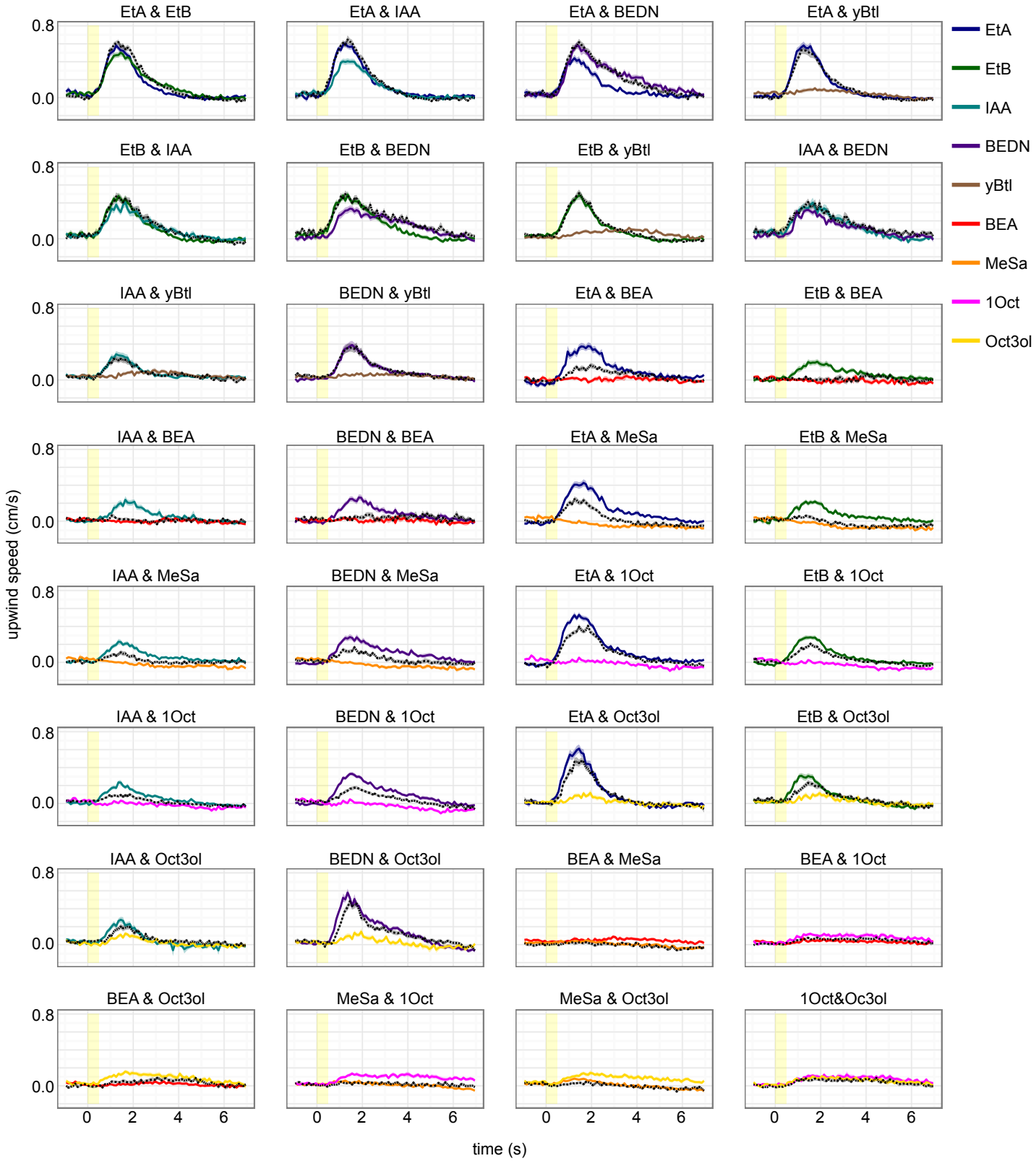

Fig. S2. Response trajectories for all tested mixtures in comparison to mixture constituents (mean ± SEM; n=30-45 flies). Mixtures are always shown in dotted black. Yellow bar represents odor pulse.

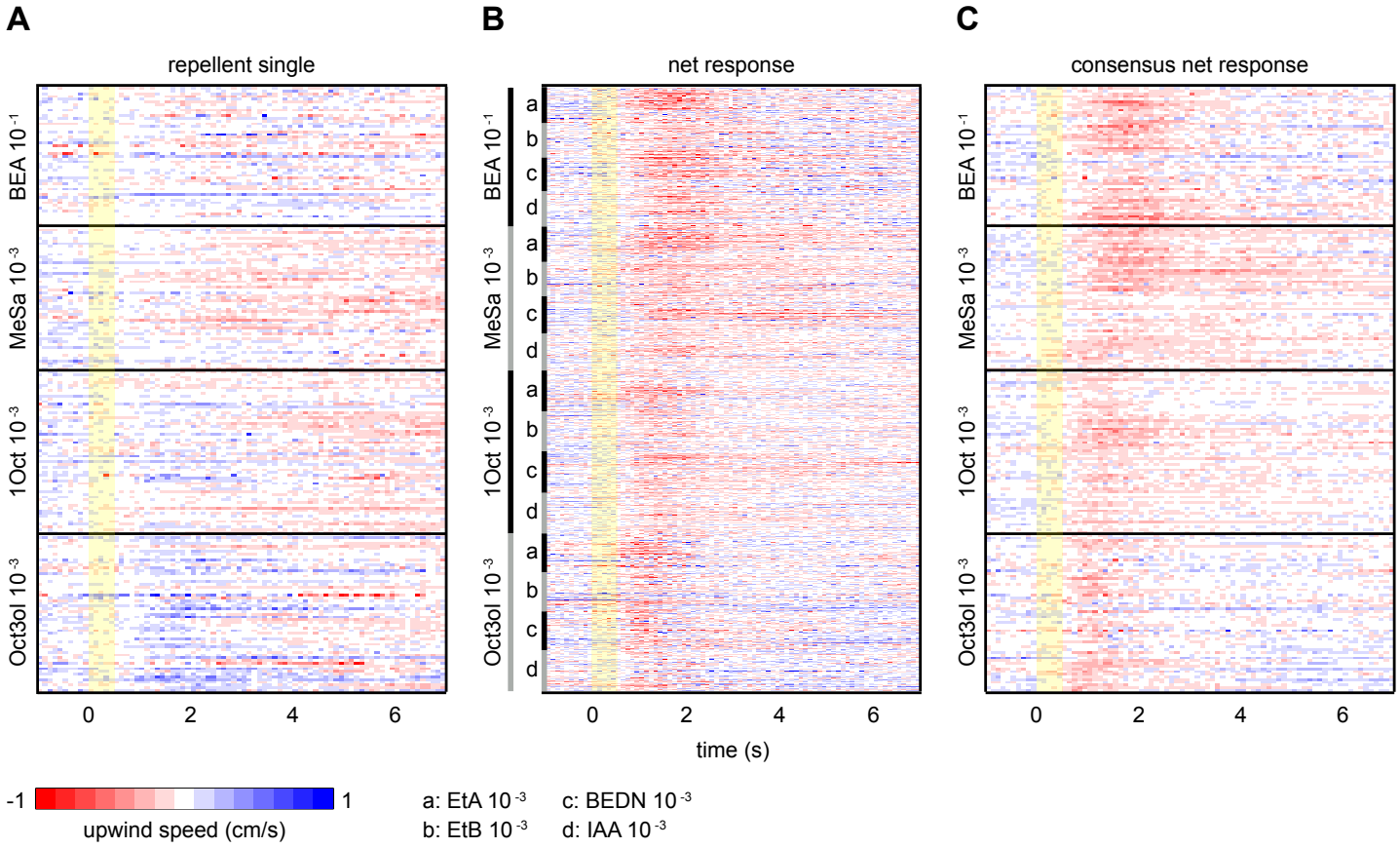

Fig. S3. Response time courses of repellents. (A) Color-coded individual mean response trajectories towards repellents benzaldehyde (BEA), methyl salicylate (MeSa), 1-octanol (1Oct) and 1-octen3ol (Oct3ol; n=51-60). (B) Color-coded net response for repellents extracted from mixture with different attractants. (C) Color-coded consensus net trajectories for repellents (see Results section for details on the analysis). Corresponding rows in A and C are extracted from the same individuals. Note faster response onset and higher degree of inter-individual similarity in B and C

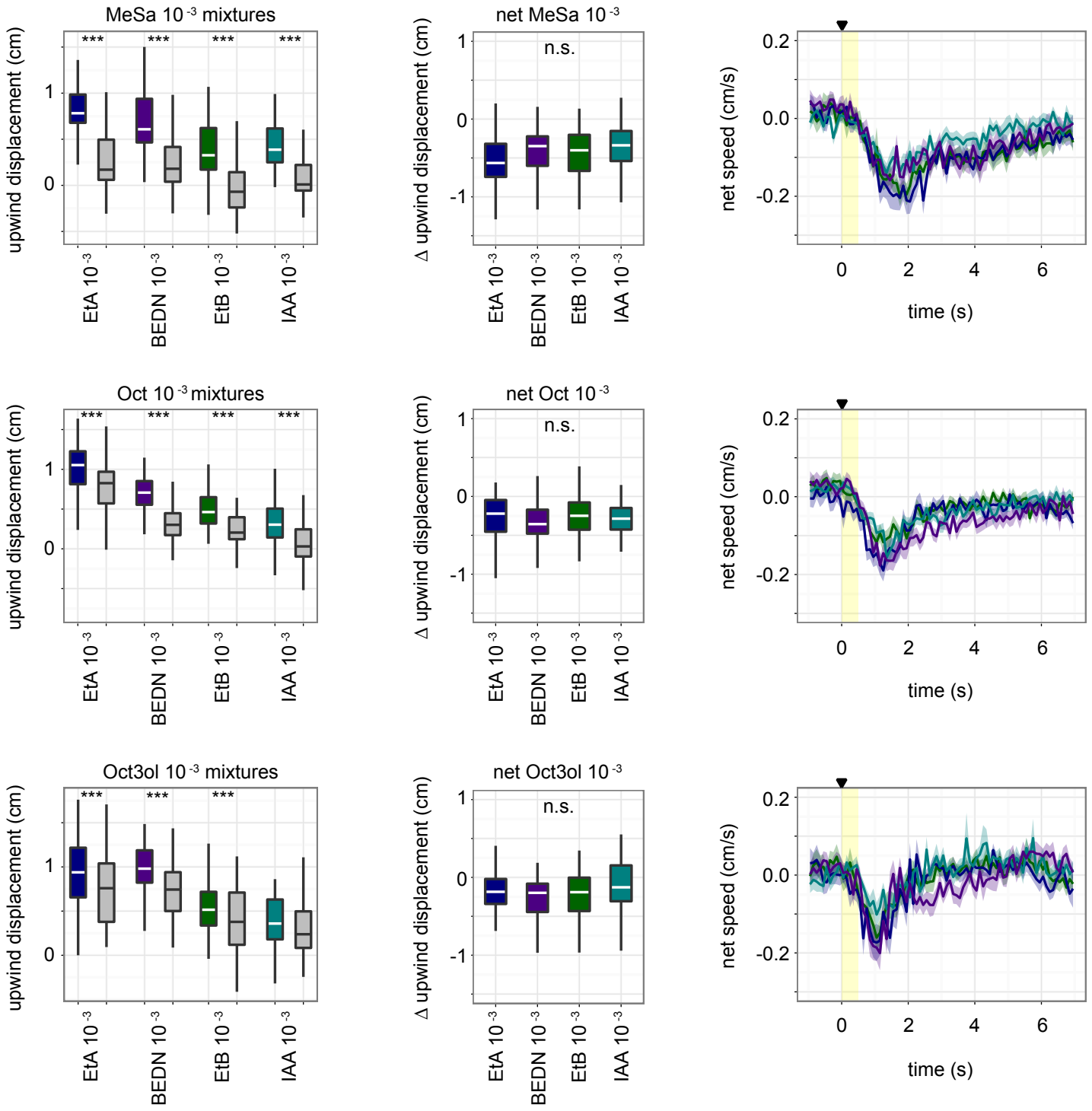

Fig. S4. Mixtures of attractants and repellents. Analysis of mixtures of attractants and repellents analogous to Fig. 3B,C,F; n (MeSa)=38-41 flies, n(1Oct)=45 flies; n(Oct3ol)=43-45 flies.

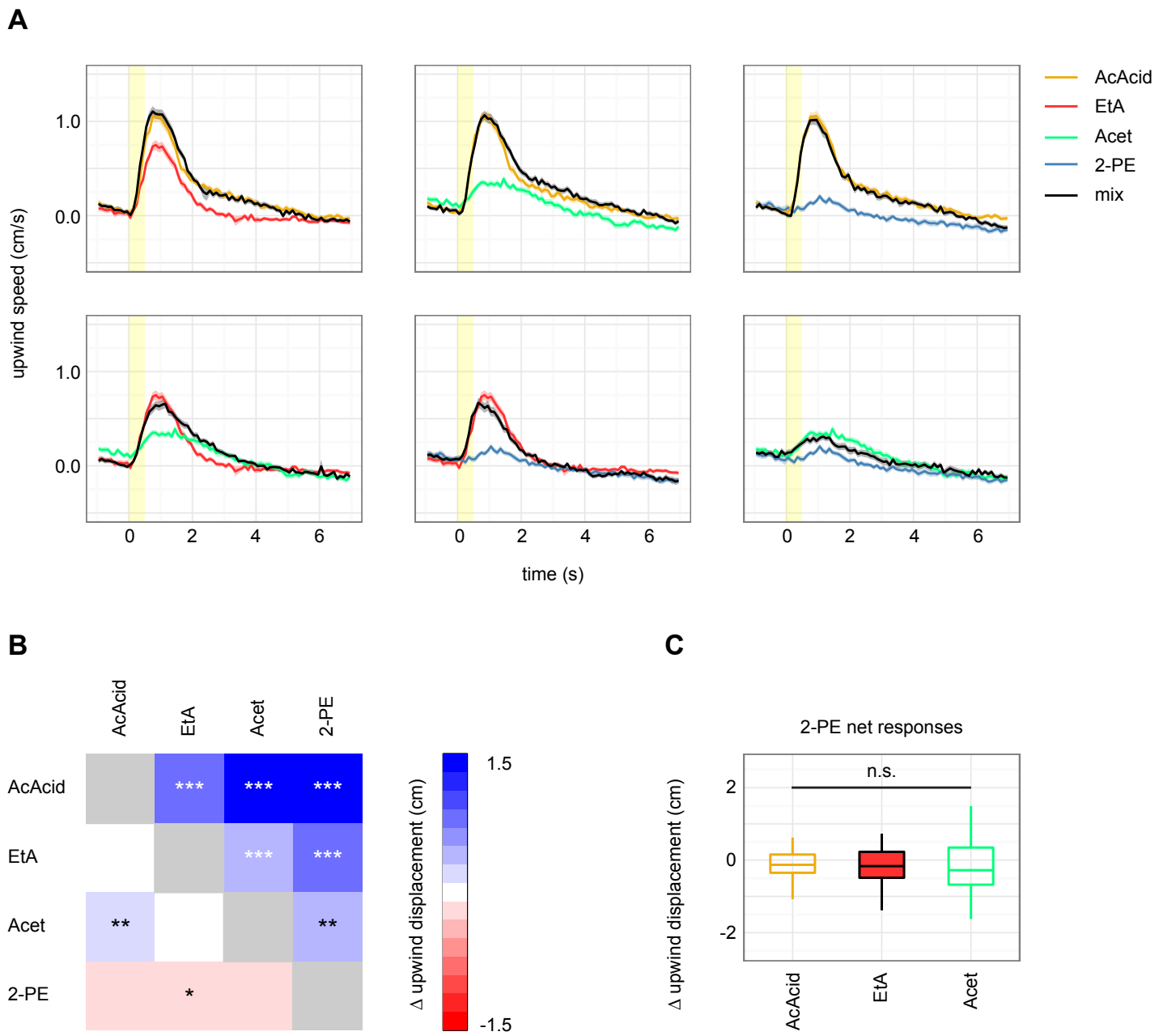

Fig. S5. Binary mixtures of vinegar volatiles. Analysis of mixtures of odors identified in balsamic vinegar (Becher et al. 2010); AcAcid: acetic acid (8% v/v), EtA: ethyl acetate 10^{-5}, Acet: acetoin 10^{-5}, 2-PE: 2-phenylethanol 10^{-5}, all dilutions prepared in distilled water. (A) Response time courses to single compounds and corresponding binary mixtures (mean ± s.e.m., n=60 flies). Note, that in addition to acetic acid, ethyl acetate and acetoin are also attractive in the *Flywalk* paradigm. (B) Color-coded differences between mixture responses and the compounds indicated as column names, analog to Fig. 2A. Asterisks indicate statistically significant differences between mixture and single compound responses (*: $p<0.05$; **: $p<0.01$; ***: $p<0.001$; Wilcoxon signed rank test, n=60 flies). (C) Net responses for 2-PE in mixtures with other vinegar compounds (analog to Fig. 3C). Filled box indicates significant difference from 0 (AcAcid: $p=0.067$; EtA $p=0.046$; Acet: $p=0.086$; one-sample Wilcoxon signed rank test). Note, that net responses from mixtures with different attractants are not statistically different from each other (Kruskal-Wallis rank sum test).

Table S1. Overview of mixture experiments

Odor 1	Odor 2	Odor 3	Odor 4	Mixtures tested
EtA -3	EtB -3	IAA -3	-	EtA&EtB (1); EtA&IAA (1); EtB&IAA (1)
EtA -3	EtB -3	BEDN -3	-	EtA&EtB (2); EtA&BEDN (1); EtB&BEDN (1)
EtA -3	EtB -3	yBtl -3	-	EtA&EtB **(3)**; EtA&yBtl (1); EtB&yBtl (1)
EtA -3	IAA -3	BEDN -3	-	EtA&IAA (2); EtA&BEDN (2); IAA&BEDN (1)
EtA -3	IAA -3	yBtl -3	-	EtA&IAA **(3)**; EtA&yBtl (2); IAA&yBtl (1)
EtA -3	BEDN -3	yBtl -3	-	EtA&BEDN **(3)**; EtA&yBtl **(3)**; BEDN&yBtl (1)
EtB -3	IAA -3	BEDN -3	-	EtB&IAA (2); EtB&BEDN (2); IAA&BEDN (2)
EtB -3	IAA -3	yBtl -3	-	EtB&IAA **(3)**; EtB&yBtl (2); IAA&yBtl (2)
EtB -3	BEDN -3	yBtl -3	-	EtB&BEDN **(3)**; EtB&yBtl **(3)**; BEDN&yBtl (2)
IAA -3	BEDN -3	yBtl -3	-	IAA&BEDN **(3)**; IAA&yBtl **(3)**; BEDN&yBtl **(3)**
EtA -3	EtB -3	IAA -3	BEA -1	EtA&BEA (1); EtB&BEA (1); IAA&BEA (1)
EtA -3	EtB -3	BEDN -3	BEA -1	EtA&BEA (2); EtB&BEA (2); BEDN&BEA (1)
EtA -3	IAA -3	BEDN -3	BEA -1	EtA&BEA **(3)**; IAA&BEA (2); BEDN&BEA (2)
EtB -3	IAA -3	BEDN -3	BEA -1	EtB&BEA **(3)**; IAA&BEA **(3)**; BEDN&BEA **(3)**
EtA -3	EtB -3	IAA -3	MeSa -3	EtA&MeSa (1); EtB&MeSa (1); IAA&MeSa (1)
EtA -3	EtB -3	BEDN -3	MeSa -3	EtA&MeSa (2); EtB&MeSa (2); BEDN&MeSa (1)
EtA -3	IAA -3	BEDN -3	MeSa -3	EtA&MeSa **(3)**; IAA&MeSa (2); BEDN&MeSa (2)
EtB -3	IAA -3	BEDN -3	MeSa -3	EtB&MeSa **(3)**; IAA&MeSa **(3)**; BEDN&MeSa **(3)**
EtA -3	EtB -3	IAA -3	1Oct -3	EtA&1Oct (1); EtB&1Oct (1); IAA&1Oct (1)
EtA -3	EtB -3	BEDN -3	1Oct -3	EtA&1Oct (2); EtB&1Oct (2); BEDN&1Oct (1)
EtA -3	IAA -3	BEDN -3	1Oct -3	EtA&1Oct **(3)**; IAA&1Oct(2); BEDN&1Oct (2)
EtB -3	IAA -3	BEDN -3	1Oct -3	EtB&1Oct **(3)**; IAA&1Oct **(3)**; BEDN&1Oct **(3)**
EtA -3	EtB -3	IAA -3	Oct3ol -3	EtA&Oct3ol (1); EtB&Oct3ol (1); IAA&Oct3ol (1)
EtA -3	EtB -3	BEDN -3	Oct3ol -3	EtA&Oct3ol (2); EtB&Oct3ol (2); BEDN&Oct3ol (1)
EtA -3	IAA -3	BEDN -3	Oct3ol -3	EtA&Oct3ol **(3)**; IAA&Oct3ol(2); BEDN&Oct3ol (2)
EtB -3	IAA -3	BEDN -3	Oct3ol -3	EtB&Oct3ol **(3)**; IAA&Oct3ol **(3)**; BEDN&Oct3ol **(3)**
BEA -1	MeSa -3	1Oct -3	-	BEA&MeSa (1); BEA&1Oct (1); MeSa&1Oct (1)
BEA -1	MeSa -3	Oct3ol -3	-	BEA&MeSa **(2)**; BEA&Oct3ol (1); MeSa&Oct3ol (1)
BEA -1	1Oct -3	Oct3ol -3	-	BEA&1Oct **(2)**; BEA&Oct3ol **(2)**; 1Oct&Oct3ol (1)
MeSa -3	1Oct -3	Oct3ol -3	-	MeSa&1Oct **(2)**; MeSa&Oct3ol **(2)**; 1Oct&Oct3ol **(2)**

Numbers in parentheses indicate cumulative number of experiments in which the given mixture was tested.

Table S2. Estimated gas phase concentrations of odors used in mixture experiments.

odor	abbreviation	CAS	vp (mmHg)	ppm
ethyl acetate	EtA	141-78-6	72.98[1]	1226.3[*]
ethyl butyrate	EtB	105-54-4	17.3[2]	66.0[t]
isopentyl acetate	IAA	123-92-2	5.62[1]	14.3[t]
2-3-butanedione	BEDN	431-03-8	52.2[1]	296.2[t]
gamma-butyrolactone	yBtl	96-48-0	1.5[1]	2.38[t]
benzaldehyde	BEA	100-52-7	1.27[3]	189.8[t]
methyl salicylate	MeSa	119-36-8	0.034[3]	0.013[t]
1-octanol	1Oct	111-87-5	0.14[1]	0.95[*]
1-octen-3-ol	Oct3ol	3391-86-4	0.46[2]	0.48[t]

Gas phase concentrations estimated after Cometto-Muñiz et al. (2003) and Pelz et al. (2006) using available vapor pressure information at temperatures of 20-25°C. Gas phase concentrations were divided by 8 to correct for further dilution in clean air in the stimulus device.

[1]: Material Safety Data Sheet (MSDS) provided by supplier.

[2]: Pelz et al. (2006)

[3]: EPISuite exp database (www.chemspider.com)

[*]: gas phase concentrations estimated using parameters provided in Cometto-Muñiz et al. (2003)

[t]: gas phase concentrations estimated after Pelz et al. (2006)