

Supplemental Information

Supplementary Tables

Supplementary Table 1. Statistical results of behavioral experiments

Conditioning (3-way ANOVA)	SS	MS	F (DFn, DFd)	P value
Sessions	39952	5707	F (7, 182) = 26.74	P<0.0001****
(CTRL vs hM4d)	2512	2512	F (1, 26) = 0.7170	P=0.4048
(A vs B)	12.16	12.16	F (1, 26) = 0.02112	P=0.8856
Sessions x (CTRL vs hM4d)	6981	997.3	F (7, 182) = 4.672	P<0.0001****
Sessions x (A vs B)	874.0	124.9	F (7, 182) = 1.353	P=0.2279
(CTRL vs hM4d) x (A vs B)	9.810	9.810	F (1, 26) = 0.01703	P=0.8972
Sessions x (CTRL vs hM4d) x (A vs B)	517.3	73.90	F (7, 182) = 0.8008	P=0.5876
CTA (3-way ANOVA)	SS	MS	F (DFn, DFd)	P value
Sessions	37224	18612	F (2, 52) = 64.18	P<0.0001****
(CTRL vs hM4d)	1344	1344	F (1, 26) = 2.912	P=0.0998
(ND vs D)	53832	53832	F (1, 26) = 127.1	P<0.0001****
Sessions x (CTRL vs hM4d)	39.38	19.69	F (2, 52) = 0.06789	P=0.9344
Sessions x (ND vs D)	41521	20761	F (2, 52) = 83.36	P<0.0001****
(CTRL vs hM4d) x (ND vs D)	155.6	155.6	F (1, 26) = 0.3675	P=0.5497
Sessions x (CTRL vs hM4d) x (ND vs D)	32.92	16.46	F (2, 52) = 0.06609	P=0.9361
PROBE – whole session (2-way ANOVA)	SS	MS	F (DFn, DFd)	P value
(CTRL vs hM4d)	806.6	806.6	F (1, 26) = 4.340	P=0.0472*
(A vs B)	143.3	143.3	F (1, 26) = 1.743	P=0.1983
(CTRL vs hM4d) x (A vs B)	658.8	658.8	F (1, 26) = 8.013	P=0.0088**
PROBE – trials (3-way ANOVA)	SS	MS	F (DFn, DFd)	P value
Trials	14489	2070	F (7, 182) = 4.142	P=0.0003***
(CTRL vs hM4d)	2207	2207	F (1, 26) = 3.121	P=0.0890
(A vs B)	1860	1860	F (1, 26) = 1.148	P=0.2938
Trials x (CTRL vs hM4d)	959.7	137.1	F (7, 182) = 0.2743	P=0.9633
Trials x (A vs B)	2840	405.8	F (7, 182) = 0.6098	P=0.7474
(CTRL vs hM4d) x (A vs B)	7711	7711	F (1, 26) = 8.013	P=0.0384*
Trials x (CTRL vs hM4d) x (A vs B)	2778	396.8	F (7, 182) = 0.5963	P=0.7584

Supplementary Table 2. Comparisons of fitted parameters for the control and hM4d groups with the two tested reinforcement learning models. Data are represented as mean \pm SEM.

<i>Ha: Precision deficit model parameters</i>	Control	hM4d	P value
<i>Imprecision term - χ</i>	0.64 \pm 0.138	1.031 \pm 0.099	P=0.027*
<i>Model-based value observation rate - η^{mb}</i>	2.669 \pm 1.964	5.062 \pm 2.626	P=0.169
<i>Model-based transition observation rate - η^{tm}</i>	11 \pm 4.657	22.41 \pm 4.477	P=0.067
<i>Strength of devaluation - NegRew</i>	-50.82 \pm 5.092	-60.21 \pm 4.81	P=0.185
<i>Value adjustment - $\nabla_{pell2cue}$</i>	0.718 \pm 0.069	0.512 \pm 0.066	P=0.04*
<i>Hb: MB vs MF model parameters</i>			
<i>Model-free observation rate - η^{mf}</i>	3.71 \pm 2.778	15.21 \pm 4.758	P=0.007**
<i>Model-based observation rate - η^{mb}</i>	12.8 \pm 4.51	15.77 \pm 4.82	P=0.575
<i>Contribution of model-free system - w^{mf}</i>	0.553 \pm 0.106	0.703 \pm 0.081	P=0.513
<i>Strength of devaluation - NegRew</i>	-52.09 \pm 5.85	-54.78 \pm 5.243	P=0.821
<i>Value adjustment - $\nabla_{pell2cue}$</i>	0.761 \pm 0.069	0.501 \pm 0.059	P=0.012*
<i>Conditioning to probe forgetting - ∇_{cp}</i>	0.603 \pm 0.079	0.385 \pm 0.083	P=0.071