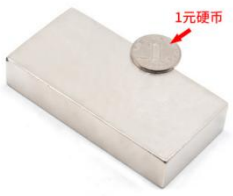
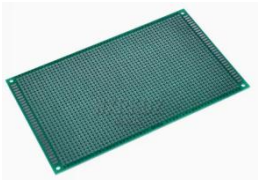
Supplementary information

Movie S1 Artificial prey performance testing
Movie S2 Predation task track recognition
Movie S3 Predation task at base difficulty (150 mm/s, original video)
Movie S4 Improve 50% difficulty of predation task (225 mm/s, original video)
Movie S5 Improve 100% difficulty of predation task (300 mm/s, original video)
Movie S6 Key point marking with DeepLabCut
Movie S7 Pause during predatory pursuit in mice

Hardware Module			
Item(model)	Image	Parameter	Link
Computer		Precision 5820 Tower Inter(R) Xeon(R) W-2155 CPU NVIDIA GeForce RTX 2080Ti	https://www.dell.com/zh-cn/shop/
Stm32		STM32F103ZET6 72 MHz clock	https://item.taobao.com/item.htm?spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP&id=523092580242&_u=t2dmg8j26111
Camera		HF868SS Pixel Size 3um*3um 480P:120 fps	https://detail.tmall.com/item.htm?_u=t2dmg8j26111&id=627225947424&spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP
Servo Motor Driver		0.1kw-5.5kw SVPWM 220VAC+10% ~-15% RS-485	www.fereme.cn
Slide rail		Length: 1000 mm Width: 1000 mm	https://item.taobao.com/item.htm?spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP&id=629115224689&_u=t2dmg8j26111
Square Magnetic Block		Length: 100 mm Width: 50 mm Thickness: 20 mm	https://item.taobao.com/item.htm?spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP&id=584042996591&_u=t2dmg8j26111

Round magnetic block		Diameter 40 mm thickness 10 mm	https://detail.tmall.com/item.htm?id=619864317122
Regulated power supply		Output voltage: 0-30 V Output current: 0-3 A	https://item.taobao.com/item.htm?spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP&id=610465415897&_u=t2dmg8j26111
circuit board		Length: 60 mm Width: 40 mm Hole spacing: 2.54 mm	https://detail.tmall.com/item.htm?abbucket=0&id=619035415749&ns=1&skuId=4368959501684&spm=a21n57.1.0.0.7237523chCxvsC
Square acrylic plate		Length: 800 mm Width: 800 mm Thickness：10 mm	https://detail.tmall.com/item.htm?_u=t2dmg8j26111&id=45653259177&spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP
Acrylic cylinder		Diameter 800 mm, height 300 mm, thickness 8 mm	https://item.taobao.com/item.htm?spm=a1z0k.7386009.0.0.46cf37de6uNgrP&id=668894324208&_u=t2dmg8j26111
Anti-vibration table		Length 1500 mm Width 1500 mm Height 750 mm	https://item.taobao.com/item.htm?spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP&id=1914089181 2&_u=t2dmg8j26111

Platform support frame		OB3030 Length 1600 mm height 900 mm width 800 mm	https://item.taobao.com/item.htm?spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP&id=598799357725&_u=t2dmg8j26111
Camera support frame		Maximum width 3300 mm, maximum height 2600 mm	https://detail.tmall.com/item.htm?_u=t2dmg8j26111&id=653440514110&spm=a1z0k.7386009.1997985097.d4918993.46cf37de6uNgrP&skuId=4710466984766
Circuit Components			
DuPont Line		/	https://detail.tmall.com/item.htm?abbucket=0&id=41254478179&ns=1&spm=a21n57.1.0.0.cfe4523cn15qaS&sku_properties=122216547:20213
2N2222A		NPN	https://detail.tmall.com/item.htm?_u=t2dmg8j26111&id=602012446142&spm=a1z0k.7385961.0.0.3dd337deMz7y0R&skuId=4209941168719

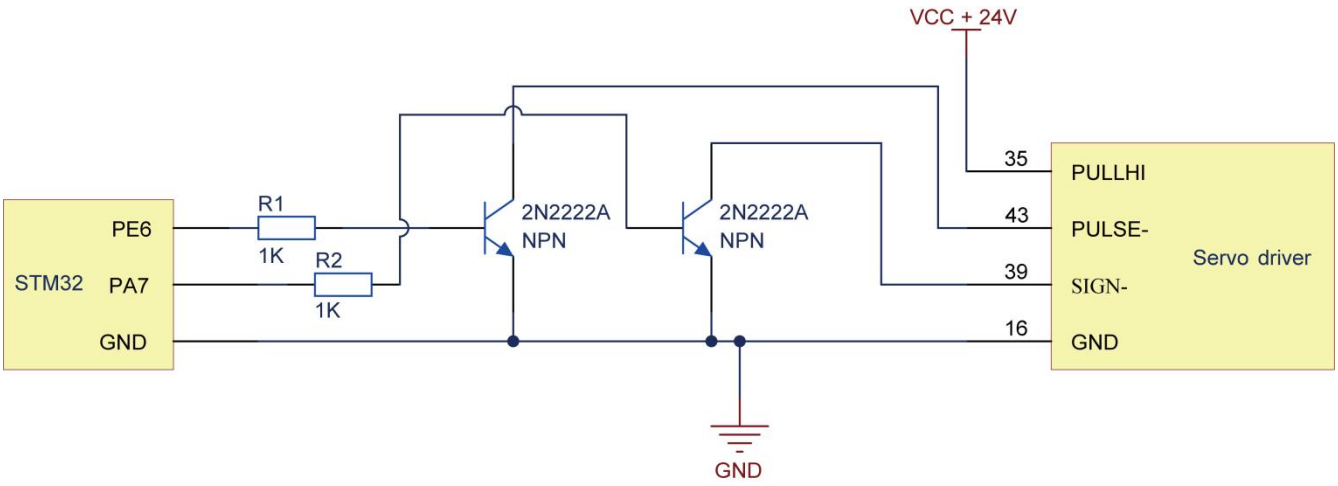


Fig. S1 Conversion Circuit Connection Diagram

Ports PE6 and PE7 in the STM32 give direction and speed signals, respectively, which are passed through an amplifier circuit to ports 43 and 39 of the servo motor controller.

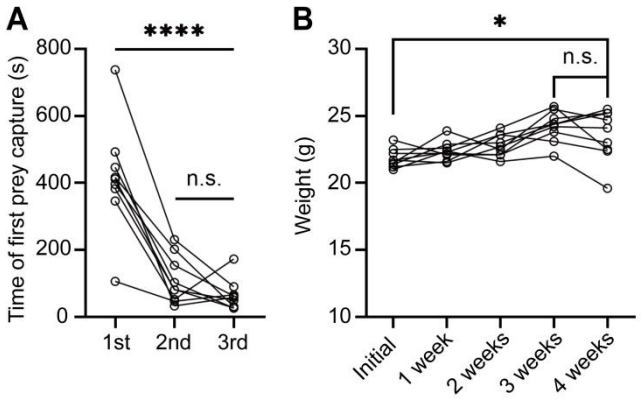


Fig. S2 Habilitation and body weight changes in mice

A The time to first food retrieval in mice during habituation. There was no significant difference in the time to first food retrieval in mice during the second and third habituation (n = 9. one-way ANOVA).

B Body weight changes in mice throughout the experiment. There was no significant weight loss in the mice (n = 9. Paired *t*-test).

n.s., $P > 0.05$; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; **** $P < 0.0001$.

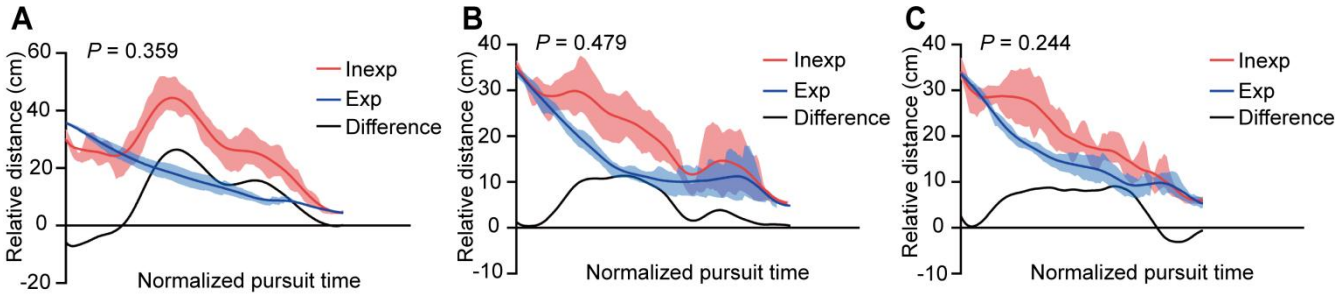


Fig. S3 Relative distances between mice and artificial prey during pursuit

A, B, C Relative distances to artificial prey for experienced and inexperienced mice at each difficulty level, with normalized results shown in Fig. All variations of the difference are not smooth (A: low difficulty; B: medium difficulty; C: high difficulty; mean ± SEM. Augmented Dickey-Fuller test, $P > 0.05$, non-smooth).

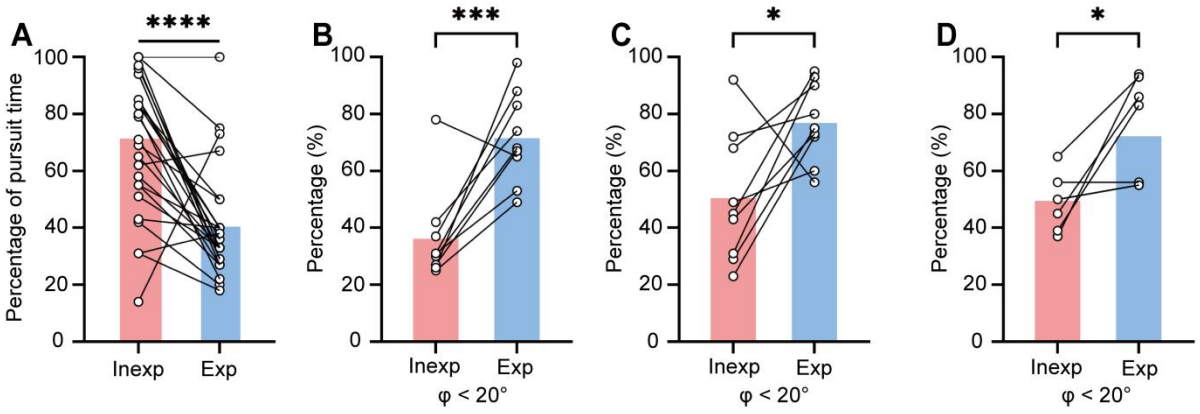


Fig. S4 Percentage of time

A Percentage of total time spent in pursuit for inexperienced and experienced mice. There was a significant reduction in the percentage of time spent in pursuit (n = 25. Paired *t*-test).

B, C, D Percentage of time that line of sight and heading were aligned between inexperienced and experienced mice during pursuit at each difficulty level. During the pursuit, the experienced mice maintained the angle φ near zero more than 70% of the time, which is more persistent than the inexperienced mice. (A: low difficulty, n = 9; B: medium difficulty, n = 9; C: high difficulty, n = 7. Paired *t*-test).

n.s., $P > 0.05$; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$; **** $P < 0.0001$.