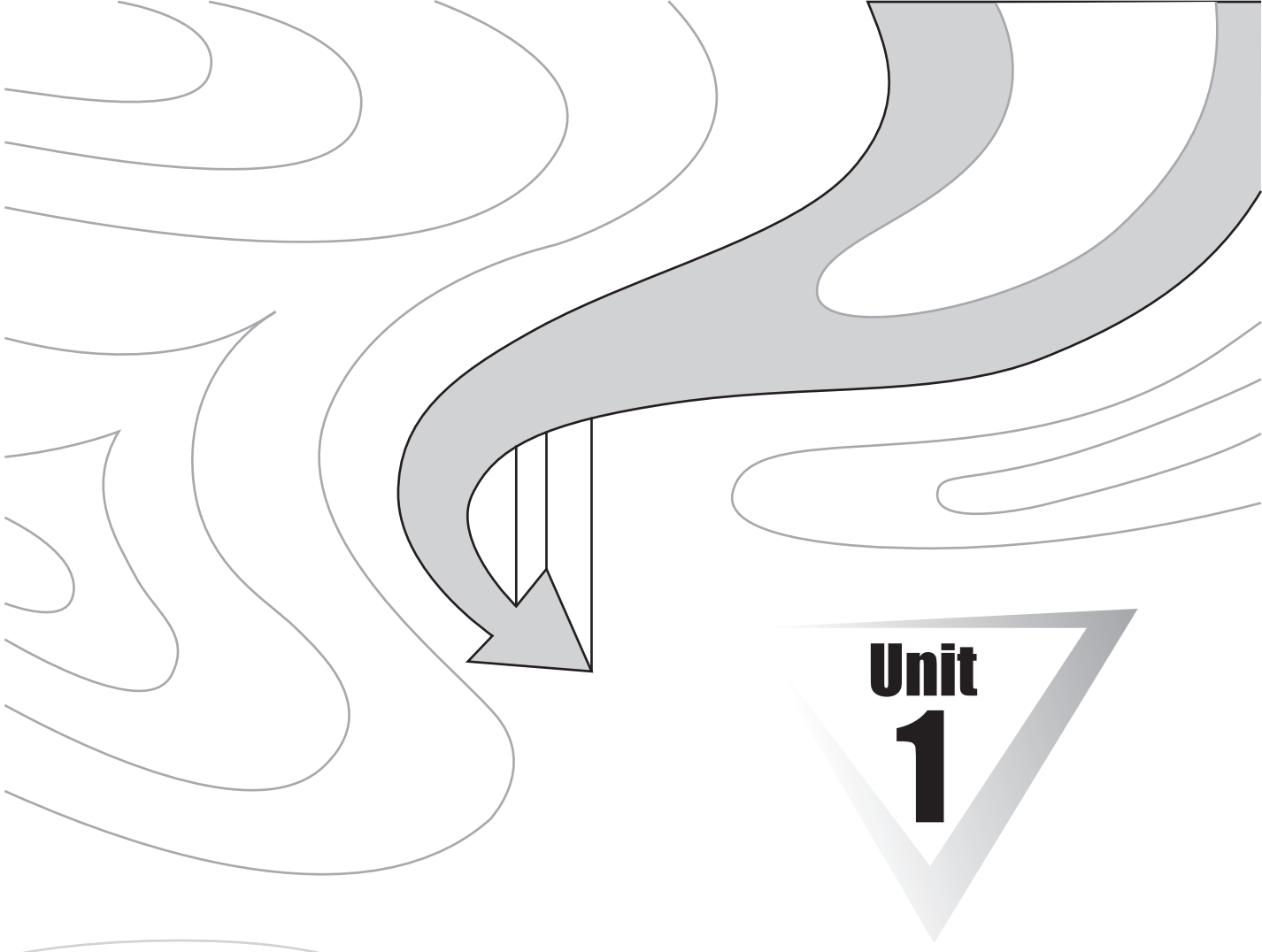

Unit
1

Science and Engineering

Reading

Text A

Survival Drives: How Mice Choose to Eat or Drink[1]

1 A new Stanford① study uses behavioral analysis, **neural** engineering, **electrophysiology**, and math to explore how mice decide whether to eat or drink when they are both hungry and thirsty.

2 An **interdisciplinary** team of researchers **delved into** the neurological **underpinnings** of choosing between basic needs. Their study focused on the brain activity of a hungry, thirsty mouse as it chose between food or water.

3 Making decisions is hard. Even when we know what we want, our choice often leaves something else on the table. For a hungry mouse, every **morsel** counts. But what if the decision is more consequential than choosing between crumbs and cheese?

4 Stanford researchers investigated how the mice resolve conflicts between basic needs in a study published in *Nature*② on November 8. They presented the mice that were both hungry and thirsty with equal access to food and water and watched to see what happened next.

5 The behavior of the mice surprised the scientists. Some gravitated first toward water, while others chose food. Then, with seemingly "random" periods of **indulgence**, they **switched back and forth**. In their study, Ph.D. candidate Ethan Richman, lead author of the paper, and colleague in the departments of Biology, Psychiatry and Behavioral Sciences, and Bioengineering explored why. This work **builds on** years of collaboration between co-senior authors Karl Deisseroth, the D. H. Chen Professor at Stanford Medicine, and Liqun Luo, the Ann and Bill Swindells Professor in the School of Humanities and Sciences, to understand how the brain keeps the body alive.

Buridan's what?

6 "There's this old philosophical **quandary** called Buridan's Ass③," explained Richman, "where you have a donkey that is equally hungry and thirsty and equally far from food and water." The concept was posited by philosophers Aristotle, Jean Buridan, and Baruch Spinoza, in different forms. The question was whether the donkey would choose one need over the other or remain stubbornly in the middle.

7 But animals are constantly making choices. We must satisfy our needs to maintain

1 Dohrn, G. 2023. Survival drives: How mice choose to eat or drink. Retrieved April 28, 2025, from the Stanford website.

homeostasis. Richman and colleagues wanted to know how the brain directs traffic through conflicting signals to flout Buridan. They call their behavioral experiment "Buridan's **Assay**".

8 If hunger or thirst directly motivated a mouse to eat or drink, it would switch as soon as one need outweighed the other. When needs were equal, the mouse would be stuck. This is not what the researchers observed. "Our data indicate that thirst and hunger don't act as direct forces on behavior," said Richman. "Instead, they **modulate** behavior more indirectly. They're influencing what we think of as the current goal of the mouse."

A mouse's goal

9 We often think of choices as a decisive moment. The researchers wanted to understand when and where choices between food and water originate in the brain. Using recent advances in recording technology, they monitored activity from individual **neurons** spread across the mouse brain.

10 To their surprise, neuron activity patterns throughout the brain predicted the mouse's choice, even before it was presented with options. "Instead of a single moment of choice, the mouse's brain is constantly **broadcasting** its current goal," said Richman. "Outcomes of the hardest choices you make—when options are closely balanced in importance, but the categories are fundamentally different—may have to do with the state your brain happened to be in, even before the choice was presented," said Deisseroth. "That's an interesting outcome and it helps us understand the aspects of human behavior better."

Exploring the random

11 The researchers found that hungry and thirsty mice often make the same choice repeatedly before suddenly switching. "In eating mode, the mouse will just eat and eat. In drinking mode, it will drink and drink," said Luo. "But there is an aspect of randomness that causes them to switch between these two. That way, in the long run, they fulfill both needs, even if at any given time they only choose one."

12 To test this apparent randomness, the researchers ran another experiment, this time with hungry mice. As the mice ate, scientists introduced thirst through a technique called **optogenetics**. With optogenetics, they used light to activate neurons causing thirst. Sometimes the mice switched to water, and sometimes they ignored it and kept eating. The level of thirst was the same each time, leading the researchers to conclude there is a key randomness influencing the mouse's goal.

13 The scientists were **perplexed** by the **interplay** between this randomness and the relative intensities of hunger and thirst. To better understand it, they turned to mathematical modeling. Inspired by a conceptual **resemblance** between their results and a distant field of physics, the researchers borrowed, tweaked, and **simulated** several **equations**.

14 "We were extremely surprised and excited to find that a few simple equations from a seemingly unrelated discipline could closely predict aspects of mouse behavior and brain activity," said Richman. The results of their modeling suggested that the brain activity relating to the mouse's goal is constantly **in motion**. It gets **trapped** by needs like hunger and thirst. To escape and **transition** from one goal to another, the mouse relies on **a** lucky **series of** random activity.

15 This work establishes the importance of the brain's shifting baseline state when it comes to decision-making. In the future, the researchers will explore what sets the tone and why decisions don't always **make sense**.

Beyond Buridan

16 "In terms of Buridan's Ass, we can say that **the donkey's mind** is **made up** before it is given a choice," says Richman, "and if it has to wait, then its choice may **spontaneously** switch." **Clinical** applications for this work in the human context are a bit more complex. "As a psychiatrist, I often think about how we make healthy (adaptive) or harmful (**maladaptive**) decisions," said Deisseroth. (Maladaptive behaviors impact people's ability to make decisions in their best interest and they are common in psychiatric disorders.) "It's very hard for family and friends to see loved ones act against their own survival drives. It may help to understand the choices made as reflecting the underlying dynamical landscape of the patient's brain, affected by the disorder more than by the patient's conscious **volition**."

17 Although this work might not explain human behavior, it begins to reveal an important **framework** for decision-making. "This is basic discovery science that depends on pretty advanced neuro-engineering, but at the core we address universal questions that people think about and experience all the time," said Deisseroth. "It's exciting to develop and apply modern tools to address these very old, deep, and personal questions."

Useful Words

neural	['njʊərəl]	*adj.*	connected to a nerve or the nervous system 神经的
electrophysiology	[ɪˌlektrəʊˌfɪzɪ'ɒlədʒi]	*n.*	the branch of physiology that deals with the electrical phenomena associated with nervous and other bodily activity 电生理学
interdisciplinary	[ˌɪntə'dɪsəplɪnəri]	*adj.*	involving different areas of knowledge or study 跨学科的
underpinning	[ˌʌndə'pɪnɪŋ]	*n.*	support, strength, or the basic structure of

			something 基础；基础材料
morsel	[ˈmɔːsl]	*n.*	a small amount or a piece of something, especially food 少量，一块（食物）
indulgence	[ɪnˈdʌldʒəns]	*n.*	the state or act of having or doing whatever you want 沉溺；放纵
quandary	[ˈkwɒndəri]	*n.*	a state of not being able to decide what to do in a difficult situation 困惑；进退两难
homeostasis	[ˌhəʊmiəˈsteɪsɪs]	*n.*	the process by which the body reacts to changes in order to keep conditions inside the body, for example, temperature 体内稳态
assay	[əˈseɪ]	*n.*	the testing of metals and chemicals for quality, often to see how pure they are 含量测定；化验
modulate	[ˈmɒdjuleɪt]	*v.*	to adjust or alter the level or intensity of something 调节；调整
neuron	[ˈnjʊərɒn]	*n.*	a cell that carries information within the brain and between the brain and other parts of the body 神经元
broadcast	[ˈbrɔːdkɑːst]	*v.*	to transmit information or content widely 广播；传播
optogenetics	[ˌɒptədʒəˈnetɪks]	*n.*	a biological technique that involves the use of light to control cells within living tissue 光遗传学
perplex	[pəˈpleks]	*v.*	to cause (someone) to feel completely baffled or puzzled 使困惑；使迷惑
interplay	[ˈɪntpleɪ]	*n.*	the way in which two or more things have an effect on each other 相互作用；相互影响
resemblance	[rɪˈzembləns]	*n.*	the state of being alike or similar 相似；相貌相似
simulate	[ˈsɪmjuleɪt]	*v.*	to imitate the appearance or character of something 模拟；模仿
equation	[ɪˈkweɪʒn]	*n.*	a mathematical statement that asserts the equality of two expressions 方程；等式
trap	[træp]	*v.*	to catch or hold something so it cannot escape 陷入；困住
transition	[trænˈzɪʃn]	*v.*	to change from one state or condition to another 过渡；转变

spontaneously	[spɒn'teɪniəsli]	*adv.*	occurring naturally, without being planned or engineered 自发地；自然地
clinical	['klɪnɪkl]	*adj.*	relating to the observation and treatment of patients rather than theoretical or laboratory studies 临床的；诊所的
maladaptive	[ˌmælə'dæptɪv]	*adj.*	not providing adequate or appropriate adjustment to the environment or situation 适应不良的
volition	[və'lɪʃn]	*n.*	the power of using one's will 意志；决断力
framework	['freɪmwɜːk]	*n.*	a basic structure underlying a system or concept 框架；结构

Phrases

delve into	to search in order to find a thing or information 深入探究
switch back and forth	to move between two different options or objects 来回切换
build on	to develop something that was started in the past or created by someone else 建立在……；以……为基础
in motion	the act or process of moving, or a particular action or movement 在运转中
a series of	a number of similar or related events or things, one following another 一组；一系列
make sense	to be clear and easy to understand 容易理解
make up one's mind	to decide 某人下定决心

Notes

① **Stanford:** Stanford University, also known as Leland Stanford Junior University, is a private research university located in Stanford, California, United States. It is situated near Silicon Valley and is one of the 12 founding members of the Association of American Universities. Due to its academic reputation and entrepreneurial atmosphere, it has been recognized as one of the most prestigious higher education institutions in the world.

② ***Nature*:** It is a British weekly scientific journal founded and based in London, England. As a multidisciplinary publication, *Nature* features peer-reviewed research from a variety of

academic disciplines, mainly in science and technology.

③ **Buridan's Ass:** It is an illustration of a paradox in philosophy in the conception of free will, which refers to a hypothetical situation wherein an ass (donkey) that is equally hungry and thirsty is placed precisely midway between a stack of hay and a pail of water. Since the paradox assumes the donkey will always go to whichever is closer, it dies of both hunger and thirst since it cannot make any rational decision between the hay and the water.

Exercises

Comprehension

Answer the following questions according to the information given in Text A.

1. What did the Stanford study aim to explore in mice?
2. What surprising behavior did the mice exhibit when presented with both food and water?
3. What philosophical concept is referenced in the study, and what does it represent?
4. How do the researchers describe the mouse's brain activity in relation to decision-making?
5. What aspect of randomness did the researchers discover in the mice's behavior?
6. What technique did the researchers use to introduce thirst in the mice during their experiment?
7. How did mathematical modeling contribute to the study's findings?
8. What do the researchers plan to explore in the future based on their current findings?

Vocabulary

I. Choose one word from the word bank to replace the underlined word or expression in each sentence. Change the form where necessary.

neural	indulgence	trap
electrophysiology	neuron	framework
morsel	perplexed	clinical
quandary	interplay	advance
assay	stimulate	spontaneously

1. The innovative teaching approach aimed to <u>spark</u> the curiosity of students. ( )

2. She felt confused by the complex directions. (　　)
3. The initiative was based on a well-structured foundation of preparation. (　　)
4. The researchers concentrated on the nerve connections in the brain. (　　)
5. His excessive enjoyment of candy resulted in putting on weight. (　　)
6. He possessed just a small piece of knowledge about the subject. (　　)
7. The business achieved considerable progress in the field of technology. (　　)
8. The researcher conducted an analysis to examine the chemical substance. (　　)
9. He felt like he was in a in a situation from which there was no way out. (　　)
10. She was in a difficult situation, unsure of which decision to make. (　　)

II. Choose the best answer to complete each sentence.

1. The mathematical _____ provided a clear solution to the problem.
   A. theory　　B. function
   C. equation　　D. assumption
2. The _____ of light through a medium can change its speed.
   A. reflection　　B. modulation
   C. refraction　　D. absorption
3. _____ study involves the intersection of different academic disciplines.
   A. Specialized　　B. Focused
   C. Interdisciplinary　　D. Generalized
4. The _____ of modern technology has greatly improved our quality of life.
   A. evolution　　B. transition
   C. decline　　D. reduction
5. The body's ability to maintain a stable internal environment is called _____.
   A. digestion　　B. equilibrium
   C. homeostasis　　D. metabolism
6. Scientists developed a(n) _____ method to control neural activity using light.
   A. electrical　　B. optogenetic
   C. chemical　　D. radiological
7. The patient experienced a _____ adaptation to the new environment, which caused stress.
   A. positive　　B. productive
   C. harmonious　　D. maladaptive
8. The therapist emphasized the importance of _____ in making decisions and taking

responsibility for one's actions.

A. freedom B. control

C. responsibility D. volition

9. The television station decided to _____ the educational program nationwide.

A. publish B. record

C. broadcast D. postpone

10. The doctor explained that the treatment would be based on a(n) _____ approach, combining both medical and psychological therapies.

A. traditional B. clinical

C. spiritual D. experimental

Cloze

Read the following passage and choose the best answer from the word bank for each numbered blank. Each word can be used only once.

A. allow	B. instance	C. blank	D. industrial	E. frustrating
F. items	G. indicating	H. highlight	I. user	J. complicated
K. white	L. encouraging	M. successful	N. articles	O. simple

It seems you always forget your reading glasses when you are rushing to work, your coat when you are going to the cleaners, your credit card when you are shopping...

Such absent-mindedness may be ___1___ to you; now British and German scientists are developing memory glasses that record everything the ___2___ sees.

The glasses can play back memories later to help the wearer remember things they have forgotten such as where they left their keys. And the glasses also ___3___ the user to "label" items so that information can be used later on. The wearer could walk around an office or a factory identifying certain ___4___ by pointing at them. Objects indicated are then given a ___5___ label on a screen inside the glasses that the user then fills in.

It could be used in ___6___ plants by mechanics looking to identify machine parts or by electricians wiring a(n) ___7___ device.

A spokesman for the project said, "A car mechanic for ___8___ could find at a glance where a part on a certain car model is so that it can be identified and repaired. For the motorist the system could ___9___ accident black spots or dangers on the road."

In other cases, the glasses could be worn by people going on a guided tour, ___10___ points of interest or by people looking at panoramas where all the sites could be identified.

Translation

I. Translate the following paragraphs into Chinese.

Using machine learning, Stanford researchers have found that children's drawings contain valuable information about how they think. This large-scale work adds robust support to previous findings that as children grow up, their abilities to both recognize and draw animals and objects increase. The fact that the analysis assessed such a sizable set of drawings allowed the researchers to infer more nuanced conclusions than the past studies, where far fewer drawings were analyzed by humans.

Although the recognizability of the drawings increased with age, the researchers found that the increase wasn't completely explained by improvements in motor control. Even trademark features that children learn to recognize and include in their drawings over time, such as eight legs on a spider, but it did not fully explain the increase. This suggests that children's improvement over time reflects not just what they directly observe or are able to produce, but also a change in how they think about objects.

II. Translate the following paragraph into English.

汽车保有量持续上升与城市停车场建设不足间的矛盾引发了严重的停车问题，同时泊车位数量不足、泊车空间狭小等问题严重阻碍了车辆出行任务的完成。自动泊车因其较低的车速以及在特定场景下的高度自动驾驶，成为最先落地的自动驾驶产品。在过去的十年里，中国的自动泊车技术取得了显著进步。各大汽车制造商纷纷加大对自动泊车系统的投资，推出了配备该系统的车型。相关统计数据显示，2018 年至 2022 年 5 月，国内新车搭载自动泊车系统数量显著提升，其中 2021 年全年新车搭载数量达到 243. 7 万辆，同比增长了 17.8%。

Text B

China's Breakthroughs in Science and Technology[1]

1 The year of dragon inspires our imagination with advancements in energy, space **exploration** and surprisingly, a new possibility of energy from space. Continuing a 30-year-long tradition, members of the Chinese Academy of Sciences (CAS)① and the Chinese Academy of Engineering (CAE)② have selected some breakthroughs by domestic researchers

1 He, Z. 2024. China's breakthroughs in Science and Technology. *National Science Review*, *11*(5): 084.