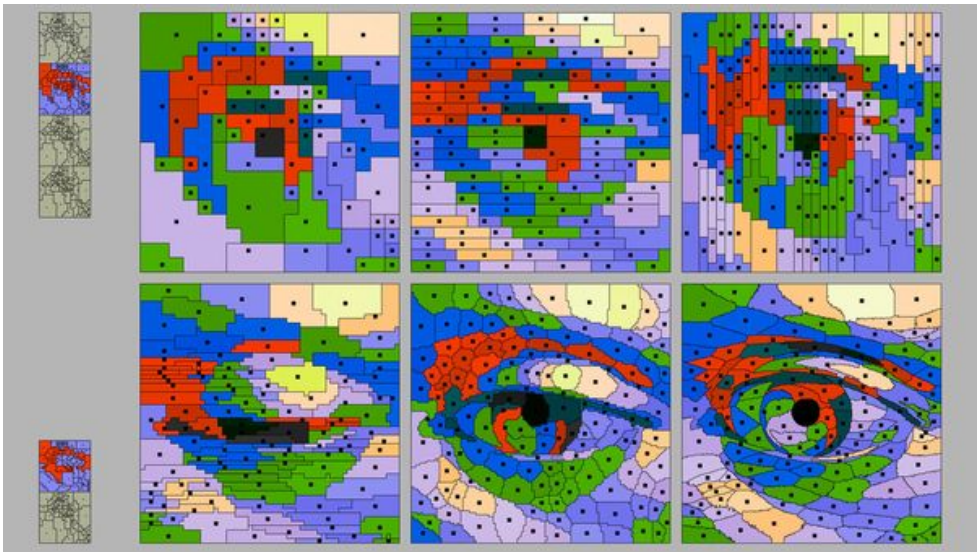
Could more brain-like chips provide a path to consciousness?

更像大脑的芯片，能走向意识吗？

Some experts believe computers will need biological aspects to become self-aware

一些专家认为，计算机要有自我意识，需要具备生物学方面的特征

The Economist · 2026-08-20



彩色网格从规则方块逐渐显出眼睛的形象，呼应人工系统与意识的主题；这是一幅概念插画。

难度 **64** / 100

建议55–75分钟；选做作文另计。

适用读者：能阅读一般英语新闻，希望读准长句、搭配与作者语气的学习者。

入门准备：能辨认基本主谓结构和常见从句，愿意结合语境查词。

About this lesson 本课导读

从存储与计算分离的普通电脑，到忆阻器、活神经元和类器官，文章依次介绍几条接近大脑的路径。关键是读清：工程机制、已有演示和关于意识的可能性判断，各自说明了什么。

- 分清三类近脑计算方案
- 读懂压缩修饰与多层强调结构
- 准确还原比较对象和代词
- 保留科学报道中的条件与不确定性

Before you read 读前思考

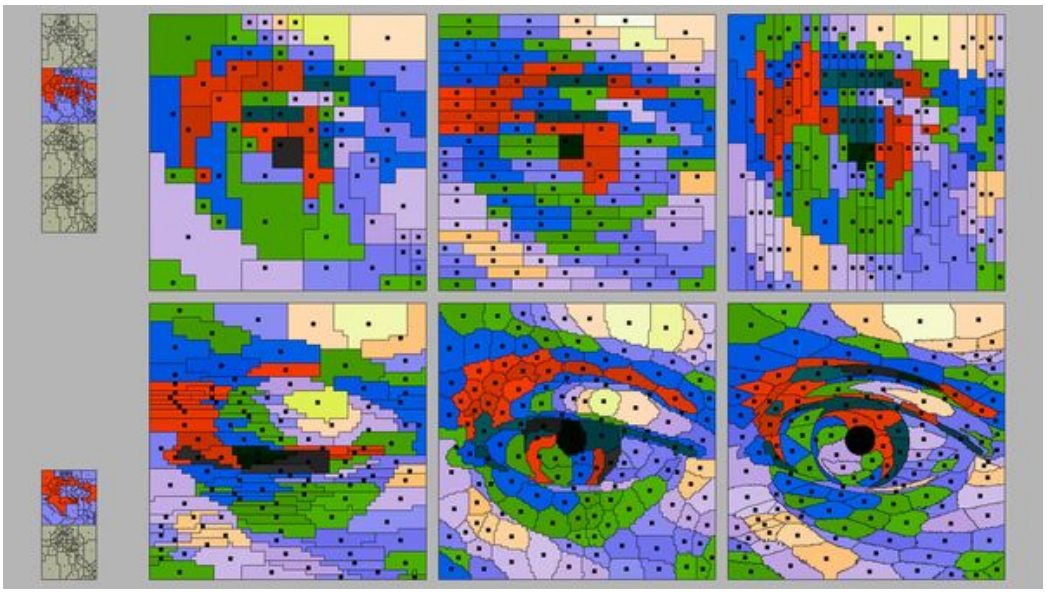
What might be similar between a machine and a brain, and what would similarity alone leave unproved?

拓展例句与练习情境用于说明用法。

书末答案 (p.13)

Text 课文

[P01] THE CURRENT crop of AI models looks to some scientists like a dead end when it comes to consciousness, regardless of how powerful they become.[V01V02V03K01] For some, this is because of their lack of wet, biological stuff; for others, because of their design structure. But they do not rule out the potential for consciousness in future versions of AI built either with living cells, or on different, more brain-like, computational architectures.[V04V05K02]



彩色网格从规则方块逐渐显出眼睛的形象，呼应人工系统与意识的主题；这是一幅概念插画。

[P02] Modern computers are based on a blueprint invented by John von Neumann, a Hungarian polymath, in 1945.[V06V07] They feature a processing unit (for making calculations) and a memory unit (for storing instructions and data).[V08] Information has to zoom back and forth between these units and, for AI applications, the energy requirements can mount up.[V09V10]

[P03] Brains do not work this way. Neurons process and store data in the same place, making networks of them much more energy-efficient at computations than their digital-computer equivalents.[V11V12] A typical brain consumes around 20 watts whereas an artificial neural network carrying out an equivalent number of parallel calculations would require a data centre that guzzles millions of watts.[V13K03]

[P04] "Neuromorphic" computing aims to be more efficient and brain-like, using devices called memristors to perform computations and store information in the same place.[V14V15] Apply a voltage to a memristor and its conducting properties change; remove that voltage and that change persists, acting as a memory.[V16V17V18K04] Such traits make computing far more efficient.[V19] But they are, separately, intriguing to some philosophers who believe that it is not computational prowess but the way in which computers "think" that will make it possible for them to become conscious.[V20V21K05]

[P05] Another idea is to use real brain cells. Cortical Labs, an Australian startup, has developed a computer using hundreds of thousands of human neurons (grown from donated stem cells)

mounted on silicon.[V22][V23] Their "biological computer" has been taught to play "Pong", a simple computer game, and, in later versions, "Doom", a first-person shooter game.

[P06] Further in the future are neural organoids, three-dimensional clusters of brain cells grown in labs.[V24][V25][K06] Though still a relatively new technology, used in labs to understand better how brains grow and behave, they could also one day be used to perform computations. The largest organoids grown in labs today contain more brain cells than there are in a honey bee.[K07] They are big enough to potentially develop consciousness, suggests Peter Godfrey-Smith, a philosopher at the University of Sydney who works on animal minds, but they are just not organised in the right way.[V26]

[P07] The common factor in all these ideas is that they are closer analogues with the human brain (in some cases because they are made of the same stuff) than the digital computers of today.[V27]

[P08] "How brain-like does AI have to be to move the needle on the credence that it might be conscious?" says Anil Seth, a neuroscientist at the University of Sussex.[V28][V29] He believes that silicon, no matter how cleverly it is constructed, probably will not achieve consciousness on its own.[V30] "If you start to build systems that share more and more properties with brains, given that we don't know which of those properties matters, then you're more likely to move the needle a bit."[K08]

New words and expressions 生词和短语

按原文出现顺序排列；⋆为优先练习表达。

V01 · P01 **crop**
/krɒp/ n. 同一时期的一批
the current crop of models把模型看成当前这一批，不是农作物。

V02 · P01 **dead end**⋆
/ˌded 'end/ n. 走不通的路；死胡同
这里限定when it comes to consciousness，不是说这些模型在所有任务上都没有价值。

V03 · P01 **regardless of**⋆
/rɪˈgɑːdləs əv/ prep. phr. 不管；不论
后接名词或how引导的成分，表示该差别不改变前面的判断。

V04 · P01 **rule out**⋆
/ruːl aʊt/ phr. v. 排除……的可能性
do not rule out保留可能，不等于预测必然实现。
The tests do not rule out a fault in the cable.
这些测试尚不能排除电缆发生故障的可能。

V05 · P01 **architecture**
/ˈɑːkɪtektʃə/ n. 系统架构
计算领域指组成部分如何连接与组织，不是外壳形状。

V06 · P02 **blueprint**
/ˈbluːprɪnt/ n. 设计蓝图；基本方案
此处是组织计算机的设计思路，不能理解成每台现代电脑的全部细节都相同。

V07 · P02 **polymath**
/ˈpɒlɪmæθ/ n. 博学家；多领域学者
a Hungarian polymath同位说明John von Neumann的身份。

V08 · P02 **feature**⋆
/ˈfiːtʃə/ v. 具有；以……为组成部分
They feature ...中作及物动词；同词也能作"特征"名词。
The new library features a quiet study room.
新图书馆设有一间安静的自习室。

V09 · P02 **back and forth**⋆
/ˌbæk ən ˈfɔːθ/ adv. phr. 来回地
between these units限定来回传递的两个端点。

V10 · P02 **mount up**⋆
/maʊnt ʌp/ phr. v. 逐渐增多；累积
常写成本、债务或任务累积；这里主语是energy requirements。

Small delays can mount up over a long project.
小延误在长期项目中可能不断累积。

V11 · P03 **neuron**
/ˈnjʊərɒn/ n. 神经元
活细胞与人工神经网络中的计算单元不能只因同名就视为同一种东西。

V12 · P03 **equivalent**
/ɪˈkwɪvələnt/ n.; adj. 对应物；等量的
P3先用复数名词equivalents指对应系统，后用形容词修饰number。

V13 · P03 **guzzle**
/ˈgʌzəl/ v. 大量消耗；猛喝
用形象动词形容耗电大；并非在描述喝液体的实际动作。

V14 · P04 **neuromorphic**
/ˌnjʊərəʊˈmɔːfɪk/ adj. 神经形态的；仿神经结构的
强调模仿神经系统某些组织或运算特性，不自动意味着器件里有活细胞。

V15 · P04 **memristor**
/mɛmˈrɪstə/ n. 忆阻器
本文抓住导电状态可改变并保留的特性；memory与resistor两部分有助于记词。

V16 · P04 **voltage**
/ˈvəʊltɪdʒ/ n. 电压
apply a voltage施加电压；remove that voltage撤去刚才施加的电压。

V17 · P04 **conducting**
/kənˈdʌktɪŋ/ adj. 导电的
conducting properties指导电特性；conduct还可表示组织活动、指挥或行为表现。

V18 · P04 **persist**⋆
/pəˈsɪst/ v. 继续存在；持续
主语是that change，保留下来的是变化后的状态，不是被撤去的电压。

The smell persisted after the window was opened.
窗户打开后，那股气味仍然没有消散。

V19 · P04 **trait**
/treɪt/ n. 特征；特性
Such traits回指前面的器件特征，不能突然改解为科学家的个性。

V20 · P04 **intriguing**
/ɪnˈtriːgɪŋ/ adj. 引人兴趣的；耐人寻味的
to some philosophers标明谁觉得有趣，未宣布意识已经被发现。

V21 · P04 **prowess**
/ˈpraʊəs/ n. 高超本领；能力
computational prowess与计算方式对照，强调能力表现和组织过程的区别。

V22 · P05 **stem cell**
/ˈstem sel/ n. 干细胞
grown from ...说明神经元的培养来源，不是说把一整个现成大脑放到芯片上。

V23 · P05 **mount**
/maʊnt/ v. 安装；安置
mounted on silicon说明神经元所在载体；与P2的mount up语义不同。

V24 · P06 **organoid**
/ˈɔːgənɔɪd/ n. 类器官
本文是实验室培养的三维脑细胞团；organ与organoid不表示相同完整程度。

V25 · P06 **cluster**
/ˈklʌstə/ n. 团；簇；聚集体
clusters of brain cells在这里解释类器官，不能把三维细胞团直接叫完整人脑。

V26 · P06 **potentially**⋆
/pəˈtenʃəli/ adv. 有可能地；潜在地
保留尚未确认的可能性；big enough与potentially并用尤其不能删掉后者。

V27 · P07 **analogue**
/ˈænəlɒg/ n. 对应物；类似物
这里按相似关系说对应物，与analogue signal“模拟信号”的用法不同。

V28 · P08 **move the needle**⋆
/muːv ðə ˈniːdəl/ idiom 使指标或判断有所改变
原为仪表指针移动的形象；本文改变的是对意识可能性的判断。

One favourable review barely moved the needle on sales.
一条好评几乎没有使销量发生变化。

V29 · P08 **credence**
/ˈkriːdəns/ n. 相信程度；可信程度
the credence that ...围绕相信某主张的程度，不能译成意识本身的强弱。

V30 · P08 **on its own**
/ɒn ɪts ˈəʊn/ adv. phr. 独自；仅凭自身
其对象是silicon；这里讲材料自身是否足够，不是计算机有没有联网。

Notes on the text 课文注释

1 三条路径，先看它们分别改变什么 [P01 / P02 / P03 / P04 / P05 / P06 / P07]

P1并列提出两类疑虑：缺生物材料，以及组织结构不对。下文据此展开：忆阻器方案改变存算组织；活神经元方案把真实细胞与电子系统连接；类器官进一步讨论三维细胞团。三者都与大脑有相似之处，但“相似”并不抹掉各自差别。

P4先说高效，再用separately引出哲学兴趣：一种结构即使节能，也仍需另行说明它与主观体验有什么关系。文章没有给出“功耗低于某数就有意识”的判据，P7的共同点也只是更接近人脑。

2 瓦特是在比较什么 [P02 / P03]

处理与存储分开的示意中，计算要不断取用指令和数据，信息搬运也涉及能耗。P3把大脑在同处处理、存储的方式拿来对照，making ...把这种安排与节能结果连在一起。这里可先画两个盒子和来回箭头，再与文中同处处理存储的表述比较。

瓦特表示功率，也就是耗能的速率。P3的约20瓦与数百万瓦给出量级对照，但没有交代相同任务、速度、精度以及是否包括散热和外围设备等统一口径。因此不能直接用两个数字相除，就宣称得到了固定、实测的人脑能效倍数。报道中的equivalent number只明说并行计算数量相当，不自动补齐这些条件。

3 撤去电压之后，究竟留下什么 [P04]

P4按两步解释：施加电压→导电特性改变；撤去该电压→改变后的状态仍可保留。第二个that change接回第一步的properties change，acting as a memory说明这个保留状态可承担记忆功能。不要把persist的主语错读成已被撤掉的电压。

可以把它想成能改写的导电档位。信息对应某个档位，写入使档位变化，之后读取这个状态。这个比喻帮助理解存储作用，不意味着所有器件永久保持不变，更不意味着整个系统运行时不需要电。

4 有活细胞，不等于搬入了完整大脑 [P05 / P06]

P5的using ... neurons指计算机用什么；grown from donated stem cells指神经元怎样培养；mounted on silicon再补神经元安置在哪里。分清“设备—神经元—培养来源—载体”，就不会误把stem cells当作整句唯一计算主体。

P6的three-dimensional clusters紧跟organoids作解释。细胞数量与组织方式是不同条件：作者先转述数量已足够大的看法，随后用but说明排列组织仍有问题。potentially和suggests仍在限制结论，不能把这段概括成“类器官已被证实有意识”。

P6的Though still a relatively new technology可补出Though they are ...，they接回类器官；used in labs ...补充这项技术目前的用途。主句they could ... be used再写未来可能用途，不能把used当成另一个独立主句的谓语。

5 结尾移动的是判断，不是意识开关 [P01 / P06 / P08]

not rule out仅表示未排除；could one day是未来可能；probably will not不是绝对不可能；more likely提高的是概率判断。P8用credence明确讨论我们有多相信系统可能有意识，而不是给意识本身计量。

Seth提出一个带前提的研究方向：既然不知道大脑哪些特征关键，增加共有特征可能使判断有所移动。a bit又收窄了移动幅度。这个论证没有指定必要且充分的材料清单，也没有说只要模仿更多特征就必然成功。

Special difficulties 难点辨析

1 生物神经元与人工神经网络 **[P03 / P04 / P05 / P06]**

neuron在P3与P5指生物细胞，artificial neural network则指人工网络。neuromorphic重在某些结构或运算方式像神经系统，biological computer在本篇强调实际采用活细胞。名称里都带“神经”，并不足以认定它们材料相同或已具体验。

同样，organoid译作类器官是要保留“类似”的程度。P6给的说明是三维细胞团，后面仍讨论组织方式不足；译成完整大脑会提前抹去作者要讨论的困难。

2 同一个mount，两种关系 **[P02 / P05]**

P2的energy requirements can mount up是需求逐渐累积，up属于短语。P5的neurons ... mounted on silicon是神经元被安置在硅上，mounted为过去分词，on引出载体。不能看到mount就统一译成增加。

Repair bills mounted up, so the team mounted a sensor on the pump.

维修账单不断累积，于是团队在泵上安装了一个传感器。

Background 背景与延伸

1 从器件状态回到忆阻器的“记忆” **[P04]**

J. Joshua Yang等人在2008年的忆阻型器件研究中，描述了金属 / 氧化物结构内导电状态的非易失切换：施加电场可改变导电通道。这个例子帮助理解P4中“改变后保留”的基本意思；具体材料、保持时间和运行条件仍须看具体器件，不能推广为所有忆阻器都无限期保存状态。

2 游戏表现怎样与神经元相连 **[P05]**

Brett J. Kagan等人的2022年实验把人类或啮齿动物来源的神经元培养物，经多电极阵列接入简化的Pong游戏环境：软件把游戏信息变成刺激，再把神经活动映射成操作，形成带反馈的闭环。研究关注这种条件下的学习表现；不能把“神经元玩游戏”理解成细胞自己包含并执行全部游戏软件。

Cortical Labs随后也发布了CL1参与Doom的官方演示。Pong实验论文与公司演示属于不同形式的材料；无论哪一种，都不能仅凭任务表现就断言测到了主观痛苦或完整自我意识。这里回到全文的核心区别：会完成任务，与具有体验，需要分别论证。

Key structures 关键句型

K01 · P01 looks to some ... like ...，regardless of how ...

THE CURRENT crop of AI models looks to some scientists like a dead end when it comes to consciousness, regardless of how powerful they become.

在一些科学家看来，谈到意识，目前这一批人工智能模型似乎走进了死胡同，不论它们变得多么强大。

主干为the current crop ... looks ... like a dead end。to some scientists标明判断者，when it comes to consciousness限定讨论领域；look like表示在他们看来似乎如此，不能删去看法归属。

regardless of后接how powerful they become，how修饰powerful，they指models。这个成分说模型变得多强都不改变前述疑虑，不是在问模型具体有多强，也没有宣布它们在所有任务中都走不通。

The proposal looks to some residents like a dead end when it comes to transport, regardless of how attractive the buildings become.

在一些居民看来，说到交通，这个方案似乎走不通，无论楼房变得多么好看。

K02 · P01 built either with … or on …：并列结构保留各自介词

But they do not rule out the potential for consciousness in future versions of AI built either with living cells, or on different, more brain-like, computational architectures.

但他们并不排除未来版本的人工智能拥有意识的可能性，这些版本或由活细胞构建，或采用不同的、更接近大脑的计算架构。

主句they do not rule out the potential；for consciousness说明什么可能性，in future versions of AI说明可能出现在哪里。built …是压缩的被动修饰，可以展开为versions of AI that are built …，不是另外一个主句。这里they指前面持这些看法的科学家，与首句指模型的they不同。

either with living cells与or on … architectures并列连接两种构建思路，with重在所用材料，on重在架构基础。并列不要求把两个介词硬改成同一个；更不能把not rule out改写成guarantee。

The team does not rule out future designs built either with recycled parts or on a modular platform.

团队不排除未来采用回收零件构建或基于模块化平台构建的设计。

K03 · P03 whereas … carrying out … would require … that …

A typical brain consumes around 20 watts whereas an artificial neural network carrying out an equivalent number of parallel calculations would require a data centre that guzzles millions of watts.

一个典型的大脑消耗约20瓦功率，而执行相同数量并行计算的人工神经网络，则需要一个耗电数百万瓦的数据中心。

whereas把两种功率描述并列对照。前半主语a typical brain，谓语consumes；后半主语an artificial neural network，谓语would require，carrying out …修饰network并说明在怎样的计算情形下比较。

that guzzles …修饰最近的data centre。equivalent number比较数量，不保证速度、精度和整机边界都等同。whereas是对照，不必译成时间先后的“然后”；would也保留了所设比较情形。

A small fan uses little power whereas a cooling system serving the whole building would require equipment that consumes much more.

小风扇耗电不多，而为整座楼服务的制冷系统则会需要耗电大得多的设备。

K04 · P04 Apply … and …；remove … and …：操作与结果

Apply a voltage to a memristor and its conducting properties change; remove that voltage and that change persists, acting as a memory.

给忆阻器施加电压，它的导电特性就会改变；撤去该电压，这一变化仍会保留，发挥记忆的作用。

Apply与remove都是省去you的祈使句，各自后面的and引出结果。可理解为If you apply …，its properties change；if you remove …，that change persists。分号两侧的两组结构相互平行，and在这里不只是罗列无关事件。

its指memristor；that voltage指刚施加的电压；that change指导电特性的变化。acting as a memory解释持续的状态所起的作用，不要把它挂到执行操作的人身上。

Press the switch and the lamp lights up; release the switch and the light remains on, acting as a signal.

按下开关，灯就亮起来；松开开关，灯仍然亮着，充当信号。

K05 · P04 it is not … but … that …，make it possible for … to …

But they are, separately, intriguing to some philosophers who believe that it is not computational prowess but the way in which computers "think" that will make it possible for them to become conscious.

但另一个方面是，它们也让一些哲学家感到兴趣；这些人相信，使计算机有可能获得意识的，将不是计算本领，而是计算机"思考"的方式。

先找到they are … intriguing to some philosophers，they接回器件的这些特性；who believe …修饰philosophers并说明他们的看法。believe后的that引出相信的内容，里面还有强调框架it is … that …。

被强调的是not computational prowess but the way …，即不是计算本领而是思考方式。in which computers "think"修饰way，等于说明以怎样的方式思考。后一个that把强调部分接回will make …，不能与believe后的that混成同一种关系。

make it possible for them to become conscious中的it是形式宾语，用来先占位置；真正要说可能的是computers become conscious这件事。them指computers。外层强调用的it与内层占位用的it作用不同。

The teachers believe that it is not the length of the lesson but the way in which pupils practise that will make it possible for them to remember more.

教师们相信，使学生有可能记住更多内容的，将不是课时长短，而是学生练习的方式。

K06 · P06 Further in the future are …：先地点式范围，后主语

Further in the future are neural organoids, three-dimensional clusters of brain cells grown in labs.

更遥远的未来方向是神经类器官，即在实验室培养的三维脑细胞团。

还原常见语序为Neural organoids are further in the future。作者把时间上的位置放在前面，再用are引出新的复数主语neural organoids。这是整组谓语位于主语前，不是疑问句倒装。

逗号后的three-dimensional clusters …同位解释organoids，grown in labs则修饰这些细胞团。further把它与前面方案的时间距离比较，表明更遥远的方向，不等于马上可用。

Further down the road are two repair shops, small businesses run by local families.

沿路再往前是两家修理铺，都是当地家庭经营的小生意。

K07 · P06 more … than there are …：比较从句中的存在结构

The largest organoids grown in labs today contain more brain cells than there are in a honey bee.

如今在实验室培养出的最大类器官，所含脑细胞比一只蜜蜂拥有的还多。

主语是The largest organoids，grown in labs today作被动修饰，主句谓语contain。more brain cells比较细胞数量，than there are in a honey bee可补成than there are brain cells in a honey bee。

there are说明蜜蜂中存在多少脑细胞，并非there指代实验室。largest也限定了比较对象，不是所有大小类器官都超过蜜蜂；这句话单独比较数量，不证明组织方式或意识相同。

The new archive contains more letters than there are in the local museum.

新档案库收藏的信件比当地博物馆里的还多。

K08 · P08 If …，given that …，then …：条件中的理由插入

"If you start to build systems that share more and more properties with brains, given that we don't know which of those properties matters, then you're more likely to move the needle a bit."

"如果你开始构建与大脑共有越来越多特征的系统，考虑到我们并不知道这些特征中哪些起作用，你就更有可能让这种判断向前移动一点。"

If引出开始构建这样的系统这一条件；that share …修饰systems，with brains引出共享特征的比较对象。主句是you're more likely to move the needle a bit，then只是明示接下来的条件结果。

given that相当于considering that，插入"考虑到我们不知道"的理由。which of those properties matters是know的嵌入问句，which选择特征，语序是主语在前、动词在后，不加疑问句的does。

you在此泛指从事构建的人；those properties指系统与大脑共有的特征。more likely与a bit保留概率和幅度，不宜概括成"增加相似度就保证有意识"。

If you collect evidence from several teams, given that we do not know which local factor matters, then you are more likely to improve the estimate a little.

如果从几个团队收集证据，考虑到我们还不知道哪个当地因素起作用，你就更有可能让估计略微改善。

Exercises 练习与写作

Comprehension 理解

依据文章回答，保留判断归属与限定。

02 What two objections to current AI are introduced in P1?

03 Why does the article discuss movement between memory and processing units?

04 What persists after the voltage is removed in the memristor example?

05 Why is the word separately useful in P4?

06 What qualification follows the claim about the largest organoids?

07 What does Seth suggest might move, and by how much?

Words in use 词汇

用词库填空，每项一次。

词库：rule out / features / mounted up / persisted / move the needle

08 The evidence is too limited to ____ another explanation.

09 The renovated station ____ a larger waiting room.

10 Unexpected expenses ____ during the repairs.

11 The difficulty ____ even after extra staff arrived.

12 One small discount may not ____ on total demand.

Key structures 句型

还原指代与修饰，并迁移到新情境。

13 In P1, whose judgment is expressed by looks … like a dead end, and what limits its scope?

14 In P1's final sentence, what does built modify?

15 In P3, which noun does carrying out an equivalent number of parallel calculations modify?

16 Use a command followed by and: "If you press this button, the timer starts."

17 What is contrasted inside the emphatic it is … that … structure in P4?

18 Put the subject first: "Further down the road are two repair shops."

19 Restore the omitted noun phrase after there are in P6's comparison.

20 What does given that introduce in the final sentence?

Listening 听读

用配套录音完成两遍听读；第二遍可对照全文，不要求记忆数值。

21 First identify the computing routes. Then listen for expressions that limit claims about consciousness.

Summary writing 摘要

用80–100词概括方案与限制；不必抄数字。

22 Write an 80–100-word summary.

Composition 作文（选做）

选做：用90–110词，以一个具体情境说明为什么比较需要统一口径。

23 Explain why a useful comparison needs a clearly defined task and measurement boundary.

Reference translation 参考译文

P01 在一些科学家看来，谈到意识，目前这一批人工智能模型似乎走进了死胡同，不论它们变得多么强大。对一些人而言，这是因为它们缺少湿润的生物物质；对另一些人而言，则是因为它们的设计结构。但他们并不排除未来版本的人工智能拥有意识的可能性，这些版本或由活细胞构建，或采用不同的、更接近大脑的计算架构。

P02 现代计算机基于匈牙利博学家约翰·冯·诺依曼于1945年提出的一个设计蓝图。它们有一个处理单元，用来进行计算，还有一个存储单元，用来存放指令和数据。信息必须在这两个单元之间快速来回传递，而在人工智能应用中，能源需求可能累积起来。

P03 大脑并非这样工作。神经元在同一位置处理和存储数据，使它们构成的网络在计算时比相应的数字计算机系统节能得多。一个典型的大脑消耗约20瓦功率，而执行相同数量并行计算的人工神经网络，则需要一个耗电数百万瓦的数据中心。

P04 “神经形态”计算旨在更加高效，也更加接近大脑：它使用称为忆阻器的器件，在同一位置执行计算并存储信息。给忆阻器施加电压，它的导电特性就会改变；撤去该电压，这一变化仍会保留，发挥记忆的作用。这些特征使计算高效得多。但另一个方面是，它们也让一些哲学家感到兴趣；这些人相信，使计算机有可能获得意识的，将不是计算本领，而是计算机“思考”的方式。

P05 另一个想法是使用真正的脑细胞。澳大利亚初创企业Cortical Labs已经开发出一种计算机，它使用数十万个安装在硅上的人类神经元，这些神经元由捐赠的干细胞培养而来。他们的“生物计算机”已经学会玩简单的电脑游戏《Pong》，后来的版本还学会了玩第一人称射击游戏《Doom》。

P06 更遥远的未来方向是神经类器官，即在实验室培养的三维脑细胞团。虽然这仍是一项相对较新的技术，目前用于实验室中更好地了解大脑如何生长和活动，但有朝一日它们也可能被用于计算。如今在实验室培养出的最大类器官，所含脑细胞比一只蜜蜂拥有的还多。悉尼大学研究动物心智的哲学家彼得·戈弗雷 - 史密斯认为，它们已大到有可能发展出意识，但只是尚未以恰当方式组织起来。

P07 所有这些想法的共同点，是它们比今天的数字计算机更接近人脑的对应物；在某些情况下，这是因为它们由与人脑相同的物质构成。

P08 萨塞克斯大学神经科学家阿尼尔·塞思问：“人工智能要像大脑到什么程度，才能让我们对它可能具有意识的相信程度有所提升？”他认为，硅无论被多么巧妙地构造，很可能都无法仅凭自身实现意识。“如果你开始构建与大脑共有越来越多特征的系统，考虑到我们并不知道这些特征中哪些起作用，你就更有可能让这种判断向前移动一点。”

Reference answers 参考答案与解析

开放题不要求与参考答案逐字一致；先检查信息和意思，再修改表达。

Before you read 读前思考

01 读前思考

They might share a processing arrangement, certain behaviours or, in some systems, living cells. Similarity alone would not establish that the machine has subjective experience.
给出具体相似点，再说该相似点还没有回答什么；不要只说像或不像。

Comprehension 理解

02

Some scientists point to a lack of biological material; others point to the design structure.
两项关注不同，不能都写成电脑不够快。

03

To explain one source of energy demand and set up the contrast with processing and storing information in the same place.
把信息搬运与下段存算方式对照联系起来。

04

The changed conducting state or properties, which can serve as a memory.
不是电压继续存在；也不是保证所有状态永远不变。

05

It separates the engineering advantage of efficiency from philosophical interest in how the computing process might relate to consciousness.
节能与意识可能性是两项讨论，前者不直接证明后者。

06

Godfrey-Smith suggests that they may be large enough potentially to develop consciousness, but says they are not organised in the right way.
必须保留说话者、potentially和组织方式限制。

07

Our degree of belief that a system might be conscious could shift a little as systems share more brain properties; the relevant properties remain uncertain.
不要把credence误作意识强度，a bit也不能删成确定成功。

Words in use 词汇

08

rule out
to后用原形；否认能排除，不等于另一解释已被证实。

09

features
单数主语station，动词第三人称单数。

10
mounted up
过去发生的费用累积，不是在设备上安装零件。

11
persisted
表示困难继续存在，even after建立出乎预期的延续。

12
move the needle
may后用原形，讨论总需求是否有明显变化。

Key structures 句型

13
Some scientists' judgment; when it comes to consciousness limits the subject under discussion.
不能泛化成作者断言所有AI用途都走不通。

14
Future versions of AI.
不是修饰scientists，也不是另起一个过去时主句。

15
An artificial neural network.
后面的that guzzles修饰data centre，两层修饰不同。

16
Press this button and the timer starts.
可接受表达：

- Press this button and the timer will start.

祈使句写操作，and后写结果；will start也适合未来结果。

17
Computational prowess and the way in which computers think.
不是所有哲学家与所有计算机对照；强调内容处在believe的补语中。

18
Two repair shops are further down the road.
原句前置位置成分，这里恢复主语—谓语—位置顺序。

19
Brain cells.
比较的是细胞数，不是实验室数或蜜蜂数。

20
A reason or consideration: we do not know which shared brain properties matter.
given that不是指别人递给你东西，也不把条件句变成确定结论。

Listening 听读

21

The routes include neuromorphic devices, computers using living neurons and neural organoids. Relevant limits include do not rule out, could also one day, potentially, probably will not, more likely and a bit.

先记录路线，再比较可能性词语；漏听可回看对应段落，不能把听到的未来设想改成已经实现。

Summary writing 摘要

22

Some scientists doubt that current AI can become conscious because of its material or architecture, but leave open other possibilities. Conventional computers separate processing from memory, whereas more brain-like approaches seek closer integration. The article describes memristors, computers using living neurons and future neural organoids. Efficiency and game performance do not themselves settle the consciousness question. Cell numbers also leave questions about organisation. Seth suggests that sharing more brain properties might slightly increase confidence in possible consciousness, while admitting uncertainty about which properties matter.

应包含当前疑虑、三条方案以及结尾有限判断；可省数字和专名。不要把可能性改成三种方案均已成功。

Composition 作文

23

A school compares two projectors and finds that the smaller one uses less power. Before calling it more efficient, the staff should ask whether both produce the same brightness and image quality for the same length of time. They should also decide whether to include speakers and other equipment. If one machine performs a much smaller task, its lower power use does not establish superior efficiency for the school's needs. Clear boundaries do not make comparison impossible. They make the result easier to interpret and help the school choose equipment for the work it actually requires.

原创情境；交代任务、表现与边界，再说明结果能支持什么。不要只要求数字越精确越好，却不说两台设备是否完成同样工作。