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　　如果说人类起源于同一位非洲大草原母亲，那么这既经历了人类进化的漫长岁月并在其中起着决定性作用的非洲草原景观，必埋藏着有关人类空间和景观认知的秘密。

　　图片从人与环境感知的角度逐渐展开——近景处的连绵草地让人联想到安全的处境，获得安详和宁静之感；几处位于中景的茂密灌木丛往往是狮子等捕食者埋伏的场所，传递出危险的信号；远景中奔跑的角马是肥美的猎物，唤起了狮群追捕的欲望，令人亢奋；远方的两颗扇形孤树则象征着安全与家，是茫茫草原上的避难之所。为了生存和繁衍，人类必须穿越危机四伏的中间地带，到达远方有着丰美食物和安全居所——这样的景观也因此变得激越且生动，既能触发可探索的刺激之感，又具有清晰的空间结构，进而唤起人们内心深处的美感。

The African savannah, where human species born in legends, played a decisive role in human evolution over thousands of hundreds of years, holding the secret of spatial and landscape cognition of human beings.

　　According to the studies of environmental perception, the photo shows that the continuous grassland in the foreground renders a sense of protection, serenity, and tranquility; Several lush shrubberies in middle ground are often an ambush spot for predators such as lions, symbolizing great danger; The running wildebeests in distance arouse the strong appetite for predators; and the two fan-shaped trees in the background signify shelters in the vast savannah. To ensure their evolution, humans have to traverse the dangerous land and reach the distant safe, calm shelters with abundant food, forming thrilling, vivid landscapes of clear spatial structure and with an exciting charm and a profound sense of beauty.

从黏菌到Meta
From Slime Mold to Meta

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摘要

近期，有关黏菌空间感知和决策能力与Facebook改名为"Meta"的新闻引发了笔者对于人类空间认知的思考。与人类所采用的试错方法相比，黏菌拥有足以媲美人类个体的空间感知与设计的能力。黏菌在体现生存本能的过程中形成了美丽的菌体形态；与之相似，人类对空间的设计既是一种对自身生存欲望和本能的表达，也是一种对平衡关系的追求。借由黏菌实验的启发，笔者对Facebook描绘的元宇宙中的人类活动表示忧虑：如果人类文化失去了地域性、空间性和时间性，那么基于虚拟时空的元宇宙也将丧失城市意象；而在没有地域限制的元宇宙中，人类的活动是否还存在意义，将成为城市和景观设计面临新的挑战。

关键词

黏菌；空间认知；城市和景观设计；景观美学；人类文化；场所感；元宇宙

ABSTRACT

Stirred by the latest research findings on spatial sense and decision-making machinery of slime molds and the rename of Facebook to Meta, the author discusses human's ability of spatial cognition. Compared with human's indifferent trial-and-error approaches, slime molds are not inferior to humans in ability of spatial perception and design. Similarly, both slime molds and human beings pursue a balanced beauty under their desire and instinct for survival, in forms of colony shapes and spatial design, respectively. Inspired by the slime mold experiment, the author concerns that in the virtual reality of Metaverse promoted by Facebook, human culture depending on the place, space, and time may disappear, and city image will be erased as well; If geographical constraints no longer exist, do human activities still have meaning? This now is a new challenge to urban and landscape design.

KEYWORDS

Slime Mold; Spatial Cognition; Urban and Landscape Design; Landscape Aesthetics; Human Culture; Sense of Place; Metaverse

最近的两则新闻令我脑洞大开，一则是来自《哈佛大学校刊》（*Harvard Magazine*）有关黏菌（Slime Mold）空间感知和决策智慧的最新研究成果[1]，另一则是脸书创始人马克·扎克伯格发布的将Facebook改名为Meta的消息。这两件事情虽风马牛不相及，却都挑战了我们对于人类空间认知、决策和设计的许多固有观念。

黏菌是一种没有大脑和神经系统的单细胞生物，在中国古代文献中被称作"鬼屎"，最早记载于唐代陈藏器所著的《本草拾遗》[2]。21世纪初，日本科学家发现它们具有超乎人类的空间感知能力——能够迅速设计最短取食路线，走出迷宫：首先，黏菌伸展自己的菌体以覆盖整个迷宫平面，一旦发现食物，就会缩回除最短路径之外的其余部分[3]-[5]。通过这种方法，黏菌能绘制出堪比东京地铁线路图般复杂且最优的联系网络。如果这可以理解为最原始的刺激—反应过程的话，那么《哈佛大学校刊》报道的这项实验发现则令人匪夷所思：黏菌居然能隔空感知远方物体的质量，并以此决定菌体延展的方向，这表现出这种低等生物的空间感知、决策和设计能力，也就是一种尽量在避免无效消耗菌体物质与能量的条件下，提前设计行动路线的能力。同时，黏菌能够在这一过程中形成异常优美的菌体形态——从人类对于任何艺术的审美标准（诸如色彩、形态的对比与平衡关系）来讲都可谓美不胜收。这让我产生了多个联想：

第一个联想是前不久媒体曝光某快递公司用了类似的刺激—反应方法，通过奖励发现更短路线的快递员，制造"内卷"，不断压缩投递时间，试图通过牺牲快递员的个人利益实现公司整体收益的增长。这是一种听起来有些残酷的试错机制，但这也是一种基于大数据的方法，在这方面，黏菌的决策能力一点不比人类差。

第二个联想是黏菌的空间感知和决策过程如同中国围棋这类空间游戏。2016年的围棋人机大战证明，人类在游戏空间的认知方面完全败给了机器——可能有人会认为，人类在空间认知方面似乎既不如最低等的单细胞生物，也不如没有生命的、只能识别0或1的机器。

第三个联想，从进化论——也是认知心理学和景观认知的基本出发点——的角度来看，人类的空间认知能力及审美与动物一样，源于觅食或繁殖的本能。所以，正如黏菌用美丽的菌体形态来注解对生存的欲望及本能，人类通过其在空间中的运动轨迹和美的环境的设计，表达自身的生存欲望和本能。在这层意义上，人类与黏菌在本质上并无区别。

第四个联想，基于对食物和生存欲望的空间感知，黏菌在实验中表现出了物理上的高效性和平衡关系，进而让人感受到美，这似乎为人类的空间和景观审美找到了依据，这也解释了为什么围棋的空间布局也同样具有美的逻辑。

正是基于这几点联想，第二则新闻就变得意味深长了。Facebook提倡的元宇宙（Metaverse）是一个虚拟时空集合[6]，由一系列的增强现实、虚拟现实和物联网技术所组成，当然还要借助智慧眼镜等工具来实现[7]。尽管不可回避的是，元宇宙起源于娱乐和游戏，但它将不同时空的人联系在一起，使

人类活动摆脱了时间和物理空间的约束：时空环境不再是人类活动场景的预设，而可以是某些奇幻浪漫的设计，诸如在热带雨林里或月球上约会、在海底或火山口聚餐、在云上开董事会，等等。作为城市空间认知的鼻祖，凯文·林奇在20世纪60年代探讨了城市意象：如何增加城市的可辨识性，以帮助人们认路并形成空间认知地图[8]。这一研究对当代城市空间的设计产生了巨大影响。而在元宇宙中，城市意象似乎失去了意义，人们也无需凭借脑中的认知地图去寻找车站、餐厅、约会的酒吧，或造访名胜景点，一切空间营造和景观尽在指间以及智慧工具之中。城市空间和景观设计的原则将面临新的挑战。

　　接下来的问题是，随着元宇宙——即后宇宙、超宇宙——时代的到来，失去时间感和地域感的人类活动是否仍具有意义？失去以地域、空间和时间为载体的人类文化后，人与黏菌还有什么区别！地理学和景观认知领域均强调空间的可辨识性、可探索性及可参与性；地理认知领域所强调的场所性和场所感取决于地域特色和认同感，以及空间的定位和方向感[9]。场所精神（Genius Loci）作为建筑与景观设计的核心概念，取决于给定的天时及地利条件，即天地之间的立锥之地（The Given）[10]。失去了地域性和场所性，如何让元宇宙中的人类活动具有意义？这似乎成为了一个新的设计问题。**LAF**

Recently, I am inspired by two pieces of news: one is the latest findings about the spatial sense and decision-making machinery of slime molds reported by *Harvard Magazine*[1]; and the other is Mark Zuckerberg's announcement that Facebook is renaming to Meta. Although the two pieces of news seem share nothing in common, they both challenge the public's awareness about human's ability of spatial cognition, decision, and design.

Slime mold, a single-cell organism without brain or nervous system, was described as "鬼屎" (Demon's droppings) in ancient Chinese literature and earliest recorded in *Materia Medica Supplements* by Chen Zangqi in the Tang Dynasty[2]. In the early 21st Century, Japanese scientists found that slime molds have an extraordinary ability of spatial sense, even better than humans': they can quickly work out the minimum-length solutions to food and maze solving. After changing their shapes to cover the entire maze, slime molds can retract other cytoplasm except that on the shortest path to the food.[3]–[5] In this way, slime molds can come up with optimal connections as sophisticated as the Tokyo subway network. If we take slime molds' behavior as a primal stimulus–response process, the discovery reported in the *Harvard Magazine* is stunning: slime molds can perceive the mass of distant objects across space, and then decide the direction for extension. All these behaviors demonstrate this unicellular eukaryote's ability to spatially perceive, decide, and design—in other words, slime molds are able to design an optimal route in advance without extra consumption of material or energy. Meanwhile, during the process, the colony shapes are exceptionally beautiful, in respect of any aesthetic standards of human art (e.g., the contrast and balance of colors and forms).

This news arouses my profound reflections. First, a similar stimulus–response approach was employed in a Chinese express company which encourages expressmen to shorten delivery times by rewarding the ones who discovered shorter delivery routes. This might increase the company's profits, but would lead to unhealthy competition and compromise expressmen's benefits. This seemingly cruel trial-and-error technique, however, is a big data method. Accordingly, slime molds are not inferior to humans in ability of decision making.

Second, slime molds' spatial sense and decision-making process is similar to the playing of Chinese Go. The 2016 match between AlphaGo and Lee Sedol evidenced that machines surpass humans in the cognition of game spaces. One might argue that, in terms of spatial cognition, human beings' ability seems to be inferior to both single-cell organisms and inanimate machines that are programed with 0 and 1.

Moreover, from the perspective of Evolutionism—also the basis of Cognitive Psychology and Landscape Cognition—human's spatial cognition and aesthetics come from their instinct for food or reproduction, as other animals. As slime molds' behaviors for survival by changing colony shapes, humans' desires for survival are projected in their spatial trajectories of movement and designs of beautiful environment. In this sense, there is no essential difference between human beings and slime molds.

Lastly, in previous experiment, the spatial sense of slime molds, for food and survival, also represents their physical efficiency and balance, whose beauty is further appreciated by humans. This could serve as a basis for human aesthetics on spatial layout and landscapes, which also explains the beauty logic of Go board layouts.

The reflections above expand my thoughts on the second piece of news. Facebook's Metaverse is a virtual set of space–time[6], supported by artificial reality, virtual reality, and Internet of Things, via the aid of tools such as smart glasses[7]. Developed from entertainment and game applications though, Metaverse connects people by breaking down temporal and physical constraints on human accessibility. The space–time scenarios for human activities can be extremely romantic, for example, dating in the rainforest or on the moon, dining together with an undersea or volcanic scenery, having a board meeting over the clouds, etc. Kevin Lynch, the founder of urban spatial cognition, discussed city image in the 1960s: how to enhance the imageability of cities so as to facilitate people in way-finding and form spatial cognitive maps[8]. This theory has significantly influenced contemporary urban spatial design. Unfortunately, in the Metaverse, the city image would become meaningless: stations, restaurants, bars or scenic spots would be erased from people's cognitive maps. All spatial and landscape planning can be realized by fingers and with smart tools. Against this backdrop, urban and landscape design is facing new challenges.

In the age of Metaverse—the post-universe or super-universe—will human activities be as meaningful as before when the sense of time and place is lost? There will be no difference between human beings and slime molds if human culture that roots in place, space, and time disappear! Both Geography and Landscape Cognition value making sense, explorability, and involvement of space. The placeness and the sense of place emphasized in Geography Cognition are defined by regional characteristics and identification, as well as spatial orientation[9]. As a core concept in Architecture and Landscape Design, Genius Loci relies on THE GIVEN temporal and geographical conditions[10]. Thus, a new questions for design is that when locality and placeness no longer matter in the Metaverse, how to make human activities still meaningful. **LAF**

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