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复杂与简单

Complexity and Simplicity

物理学家传统上寻求自然界的简单本质和统一规律。这种追求简单性的原则促进了物理的创新和突破。人们将一个复杂的体系分解成非常小而简单的一些基本组分，并寻找支配这些基本组分的物理规律。例如将物质分解成分子、原子，并由此来解释复杂的自然现象。这样的研究方法被称为还原论。

Physicists traditionally seek the simple nature and unified laws of the natural world. This pursuit of simplicity has driven innovation and breakthroughs in physics. Complex systems are broken down into very small and simple basic components, and physical laws governing these basic components are sought. For example, matter is broken down into molecules and atoms, and complex natural phenomena are explained by this approach. This research method is called reductionism.

还原论在物理学发展中取得了巨大成功。但随着对世界认识深入，人们发现许多时候还原论并不能解释复杂现象。例如仅利用牛顿力学，并不能解决由大量分子组成的气体特性。为此发展出来统计力学是以统计假设为基础，而统计已经不是单个分子或原子特性了。即便如此，我们现在仍旧没有找到非常好的方法来研究非平衡态热力学体系。

Reductionism has been highly successful in the development of physics. However, as our understanding of the world has deepened, it has been found that reductionism cannot always explain complex phenomena. For example, the use of only Newtonian mechanics cannot explain the characteristics of gases composed of a large number of molecules. For this reason, statistical mechanics has been developed, which is based on statistical assumptions and is no longer the properties of individual molecules or atoms. Even so, we still do not have very good methods to study non-equilibrium thermodynamic systems.

20 世纪 70 年代，著名物理学家安德森提出，当所研究的个体由少变多，体系从简单到复杂后，将会演生出新物理规律来，且不能用还原论方式得到。这就产生了针对复杂体系的新科学方法论——演生论。复杂体系研究获得 2021 年诺贝尔物理奖，标志着人类对世界探索从简单性转变为与复杂性并重新阶段。

In the 1970s, the renowned physicist Anderson proposed that as the number of individuals being studied increases and the system moves from simplicity to complexity, new physical laws will emerge that cannot be obtained through reductionism. He called it “more is different”. This is the new scientific methodology for studying complex systems known as emergence. The study of complex systems was awarded the Nobel Prize in Physics in 2021, marking a shift in human exploration of the world from simplicity to complexity.

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从艺术角度看，复杂性和简单性也是重要的审美特征和创作原则。一般来说，复杂性可以使作品丰富多彩，展示生活和人性多面性和深刻性；简单性可以使作品清晰明了，并留空间激发想象力。人们在追求对称、平衡、整齐等简单优雅形式美同时，也在探索非对称、失衡、混乱等复杂富有张力形式美。

From an artistic perspective, complexity and simplicity are also important aesthetic features and creative principles. Generally, complexity can make a work rich and colorful, showing the diversity and profundity of life and humanity; simplicity can make a work clear and leave room for imagination. People are pursuing simple and elegant forms of beauty such as symmetry, balance, and neatness, while also exploring complex and tense forms of beauty such as asymmetry, imbalance, and chaos.

复杂性和简单性并不是孤立或对立的概念，而是相互依存相互转化的关系。一方面，在任何一个复杂系统中都存在着某种程度上可以归纳为简单规律或模式的成分；另一方面，在任何一个看似简单的系统中，也可能隐藏着无法用传统方法还原为更基本元素或关系的复杂成分。因此，在认识世界时需要平衡两种思维方式，根据情况灵活变通，并在实践中不断地检验和改进对事物本质和规律的理解。这在科学和艺术中都得到了很好的体现，使得我们对于世界的本源的认识更加深刻，也使得我们更充分地表达自己对世界的认识和感受。

Complexity and simplicity are not isolated or opposing concepts, but rather interdependent and transformable relationships. On the one hand, there are components in any complex system that can be generalized as simple rules or patterns to some extent; on the other hand, any seemingly simple system may also hide complex components that cannot be reduced to more basic elements or relationships using traditional methods. Therefore, when understanding the world, it is necessary to balance these two ways of thinking, be flexible according to the situation, and continuously test and improve our understanding of the essence and laws of things in practice. This is well reflected in both science and art, deepening our understanding of the origin of the world and allowing us to fully express our understanding and feelings towards the world.

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