

**“Is replicability necessary in the production of knowledge? Discuss with reference to two areas of knowledge.”**

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“Knowledge is a tool, and like all tools, its impact is in the hands of the user.” written by Dan Brown in his book, *The Lost Symbol*. As a method and tool, replication, referring to the ability to precisely copy or recreate anything, examines knowledge production from two perspectives which are expanding the scope of original knowledge and generating new ideals. As knowledge in general is defined as justified true belief, that is what we believe is true and justified with supporting evidence. We have evidence to justify it. In this way, replication is essential to ensure sufficient and consistent evidence to verify hypotheses in scientific knowledge, but it cannot drive for new scientific discovery. On the other hand, when producing knowledge such as ephemeral art, it can only be derived from replication of artwork. However, in most cases, replication might cause the loss of uniqueness or originality which denies the status of the replication being art so as knowledge being produced. This essay will evaluate the extent of the necessity of replication in the process of producing knowledge in both natural science and the arts. Knowledge in both natural science and the arts, and evaluate the extent of necessity of replication in the process of knowledge production.

In natural science, replication of trials is a non-replaceable step in the systematic procedure of scientific experiments, a primary tool in the production of scientific knowledge. Conducting multiple trials is necessary for scientists to verify the hypothesis through focusing on gaining the same results with the same input data, codes and computational methods (National Academy of Science, 2019). The results, once tested to be statistically significant, lead to generalized conclusions, which represent the scientific knowledge produced. For example, in my Biology Extended Essay I conducted an experiment on the effect of agar concentration on the yeast growth curve, with running more than 100 trials. After successfully passing the statistical tests, all the repeated trials ensure data validity, verifying the hypothesis of the negative relationship between independent and dependent variables. The impacts of errors and uncertainties in data are minimized through averaging repeated trial results, and the mean value is a representative of the variables’ relationship. In this case, the knowledge of the relationship

between agar concentration and yeast growth is produced, as sufficient evidence to support our belief in this relationship. At the same time, one data sample might be caused by randomness and error. Without replication, we are unable to conduct the statistical test and fail to draw a significant conclusion, because a single data point without replication of trials might be insufficient to represent anything. Without replication, we are unable to conduct statistical tests, eliminate uncertainties and errors, and verify our hypothesis as one data point alone does not hold validity. Therefore, in the case of producing scientific knowledge, replicability of trials is necessary as it allows scientists to obtain abundant evidence and draw valid and reliable conclusions that verifies the hypothesis..

However, scientific knowledge is mainly discovered through innovation and is only refined through replications when some elements and trends are overlooked at the start. Replication is only one component in the process of developing knowledge in natural science, as innovation is the driving force to expand the scope of existing scientific knowledge. Scientific discovery is the main source of knowledge production and is only made possible by innovation. Replication's function is to refine the produced knowledge, such as to uncover overlooked factors behind certain relationships, but it does not directly affect the process of knowledge production as the relationship itself is already discovered in the original study. One example is the investigation of whether replicability will impact the final results by Stephan Lewandowsky and Klaus Oberauer who conducted an analysis of 100 studies through the comparisons between the studies replicated before and after publication. Based on simulations, they show that scientists are selective in choosing which results to replicate. In this case, the replication functions as an insurance or an additional step to make the produced knowledge more complete. They also reveal that innovation has a more crucial role in leading scientific discovery, as the study indicates that “regardless of statistical power, the replication regime did not affect the success of scientific discovery.” Innovation is the primary element that leads to the production of scientific knowledge and results that “the community will end up benefiting from publication of findings that are of unclear replicability”. From the aspect of scientific discovery, replication can help to achieve more accuracy in the knowledge produced but is not the only tool to produce and expand knowledge out of the scope of the previous studies.

In the artistic aspect, there are scenarios when replication of the artwork is required to produce knowledge that will not be otherwise obtained. This is best illustrated by the example of drama performance, where every performance is considered as a replication of the original artwork. A main feature of drama performance is its specialty and uniqueness, as each performance will differ even with the same performers and stage design. Also, at the planning stage, no one can be perfectly sure about the final effects of stage design, including lights and sounds, until when they watch the actual performance. Thus, each replication of a drama performance is essential for performers to improve their knowledge and skills, which might also be applied to improve their next performance. Based on the duration of Victor Hugo's novel which is set among the deserving poor in 19th century France, the drama version of *Les Misérables* played by my school drama club really stands out as a poignant example as the abject poverty, prostitution, imprisonment, corruption, war and death are brought to the stage. Each stage has something different that influences the audience's emotions and watching experience. In the first stage performance, the cold light was casted at the scene of Jean Valjean, who is the main character, being inspired to learn to love and share but it was changed to a warm light next time I watched it. The change in light gave a more realistic feel which is both majestic and brutal through better actor's facial expressions and actions. This shows performers improve their art and produce new knowledge to apply in their next performance, while sparking new knowledge in the audience as well. For instance, I gained an understanding of France's history and culture. Without replication, there is no way to produce this artistic knowledge. Linked to the artistic area, replication of drama performance is necessary for performers in their knowledge production because it allows performers to enrich the characters to have a stronger impact on the audiences' feelings as a dissemination medium and carrier of art.

On the other hand, performance art needs uniqueness to allow artistic communication, affectional feedback, and its ethos, which cannot be replicated. A type of artistic knowledge production is when artwork provokes emotion and feelings in the audience and allows a unique artistic communication. Performance art is one type that produces this knowledge which can be defined as the artworks that are created spontaneously through creating an emotional bond with its audience, and also emphasizes its originality. For instance, A Japanese artist who recovered from depression, Sahiko Abe's paper cutting is a performance art and more like a calming

alternative to meditation. People felt calm and peaceful as if they went through Abe's life. The artistic performance is simply cutting papers into pieces but evokes the strongest subjective emotions. And, Abe is the first person to initiate this project. Even though everyone or machines can replicate the process of cutting paper into pieces, it is only a copy of the behavior but not art because they don't have Abe's experience or emotions to influence the audience. Because those who repeat the performance can't evoke the same emotions in the audience as the original artist does, knowledge can't be produced through simply replicating a different artist's performance. Besides, the uniqueness and originality in ephemeral art can evoke the strongest subjective feeling as a type of knowledge production in its audience. Hence, performance art cannot be fully and perfectly replicated. Knowledge produced in Abe's artwork invites us to contemplate the intensity of ideas that accumulate and disseminate in the transformation of a white sheet of paper into a medium of communication. Linked to artistic uniqueness and originality, replication of performance art is not necessary in knowledge production because it cannot achieve artistic knowledge where the inner communication from the artist's intention uses materials and techniques to convey feelings and meaning to the audience.

In conclusion, in both natural science and arts, there is no direct judgment on whether replication is necessary for knowledge production. Analysis suggests that replication does play an essential and crucial role in both natural science and art when it functions as a primary tool to produce knowledge and obtain a good result. The supportive evidence accepted by statistical approval in natural scientific systematic procedure cannot be acquired without replication of trials, and drama performance has to be improved through replication of performance in order to give the best watching experience for the audience. However, there are alternative ways to produce knowledge in both AOKs, where replication is not the decisive factor. In scientific discovery, which is innovation-oriented to expand the scope of original knowledge, replication is unnecessary as it functions to refine knowledge. In performance art, replication is considered a copy or even plagiarism that will destroy the originality and uniqueness, and weaken the bonds with the audience to convey certain messages to them.

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