

# Paint.NET reskinners: a case-study disproving the second law of thermodynamics\*

S. Chegg  
*University of Train Simulator*  
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Presented is a case-study on a ground-breaking example of a violation of the second law of thermodynamics. A simple instance of proof-by-contradiction is invoked to describe the apparent *un-baking* of locomotives within Train Simulator after the application of a new paint scheme.

## I. INTRODUCTION

### A. Second Law of Thermodynamics

It is well known that the first law of thermodynamics pertains to the definition of internal energy of a thermodynamic system. The second law of thermodynamics is instead concerned with the direction of natural processes. The second law asserts that *natural* processes may only occur in one direction, meaning that they are not reversible. A process that can be reversed is conventionally considered *fictive*, implying that such a phenomenon cannot occur in reality.

The most common statement of the second law of thermodynamics is from Clausius, who laid the foundation for the principle with his assertion:

Heat can never pass from a colder to a warmer body without some other change, connected therewith, occurring at the same time.

The meaning of this is that heat cannot spontaneously transfer from a colder body to a hotter body. The concept of entropy accounts for such one-way processes. The equation associated with the second law of thermodynamics for a closed system undergoing a natural process is:

$$dS > \frac{\delta Q}{T_s}, \quad (1)$$

where  $dS$  denotes an infinitesimal increment of entropy of the system,  $\delta Q$  is an infinitesimal transfer of heat and  $T_s$  is the temperature of the surroundings.

### B. Irreversibility of Baking

In the classical understanding, baking is an *irreversible* process, meaning that entropy increases once it has been performed, and that it will never spontaneously transform back to its original condition. Taking the example of a potato, the baking process is known as the gelatinization of the starch; with the case of a Train Simulator locomotive, the baking process is a phenomenon which

a locomotive technician undertakes in the 3D modelling software in which the locomotive was crafted. A similar principle applies to other rolling stock and buildings which can be found within the system.

It is the aim of this paper to provide a counter-example to the common formulation and understanding of irreversible processes, using the example of a repaint - or *reskin* - of a Train Simulator locomotive.



FIG. 1. The original *baked* locomotive.

## II. CASE STUDY

Here we present an example of a process that seemingly violates the second law of thermodynamics. The simple action of reskinning a locomotive has spontaneously caused the locomotive to have become spontaneously unbaked, reducing its entropy and giving the first example of a natural (not fictive) irreversible process being reversed.

Figure 1 shows the locomotive in its post-development condition, after having been baked. In stark contrast, Figure 2 shows the locomotive after an attempted reskin into a different colour. Notice the clear absence of a bake, indicating that the second law has indeed been violated.

Such a remarkable discovery is unprecedented. Upon further research, it seems that many people have independently discovered this phenomenon, leading to swathes of locomotives having been de-baked and placed back in Train Simulator with different colour schemes. The de-baking process continues to baffle physicists, as such a ground breaking example of a violation of such a ubiquitous law will surely rewrite the textbooks.

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\* An infinitesimal amount of trolling has been performed.



FIG. 2. The reskinned locomotive exhibiting spontaneous de-baking.

### III. CONCLUSION

It has been shown that a locomotive or other baked asset in Train Simulator can spontaneously undergo an irreversible process, decreasing its entropy, when someone tries to repaint it. Scientists continue to investigate such fascinating circumstances with great apprehension, as the principle violated here is the foundation of much of modern physics.

There are significant questions left unanswered. Further research is certainly required to fully unravel and explain this phenomenon, which was previously considered to be impossible. Laboratory testing will shortly begin to discover how we can harness this entropy-decreasing process for the betterment of mankind.