# Dramatic Velocity Changes Under Temperature Differentials in Ephaptic Tracts

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**Abstract**

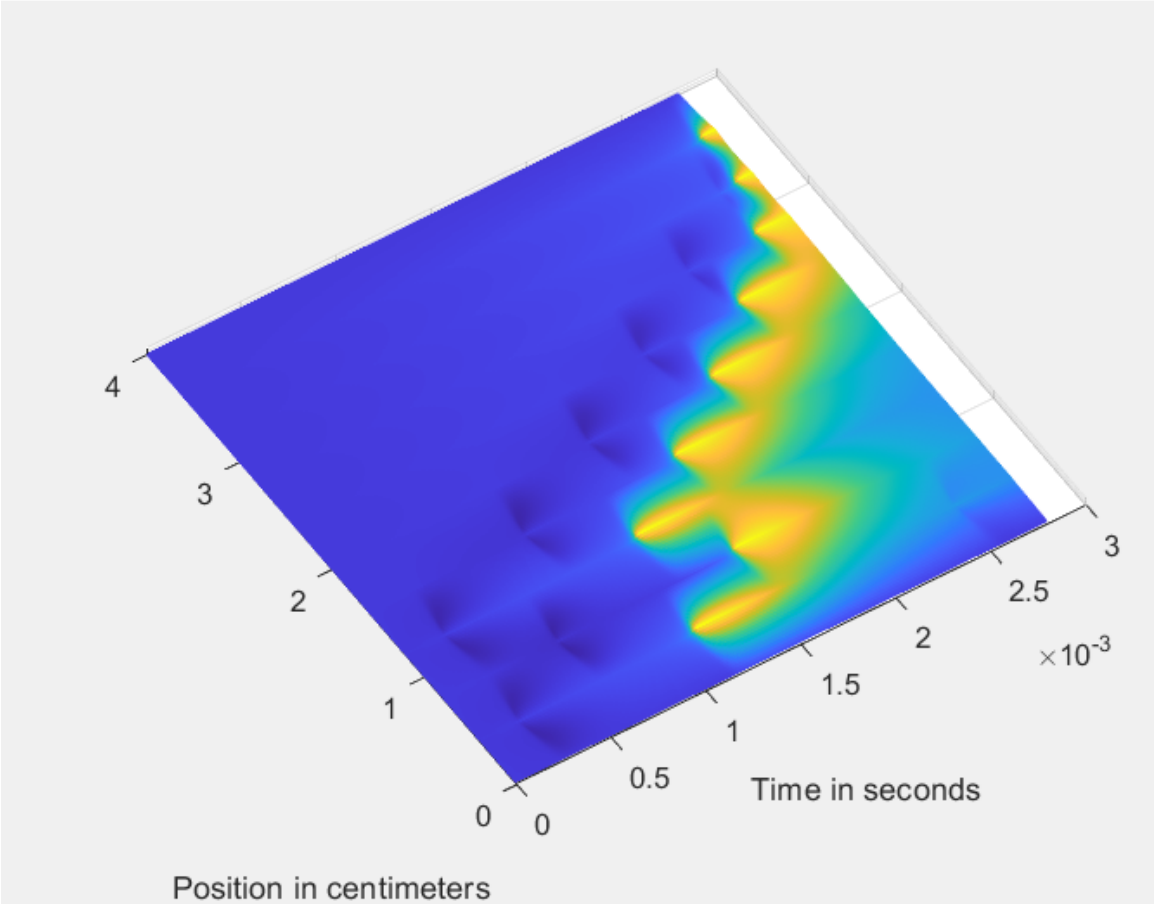
In this note, the authors present the output of in-silico investigations that demonstrate the dependence of ephaptic conduction profiles on the presence of slight temperature variations amongst the axons in a tract. The results show that spurious spikes and altered conduction velocities are created when a temperature gradient is applied. This has implications for our understanding of nerve conduction in non-homeostatic conditions of altered body temperature.

The present work is based on [1, 2]. The first set of three figures show the space-time evolution of action potential trains on the three axons when axon $i$ has the temperature $(base - temperature + 0.1 * i)$. The second set of three figures show the space-time evolution of action potential trains in the absence of these encoded differences. It is notable that in the first set, some of the trains are highly speeded up after a few hops, as compared to their usual velocity. This implies in conditions such as fever which create such small temperature differentials across tracts, wherever ephaptic coupling is present, the conduction of nerve signals is not at the normal rate and can be faster as well. This may explain altered proprioception during diseased conditions which are concomitant with fever. There may be implications for multiple sclerosis as well.

## References

[1] Aman Chawla, Salvatore Morgera, and Arthur Snider. On axon interaction and its role in neurological networks. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, 2019.

[2] Aman Chawla, Salvatore D. Morgera, and Arthur D. Snider. Fields, geometry, and their impact on axon interaction. *Journal of Applied Mathematics and Physics*, 9(4):751–778, 2021.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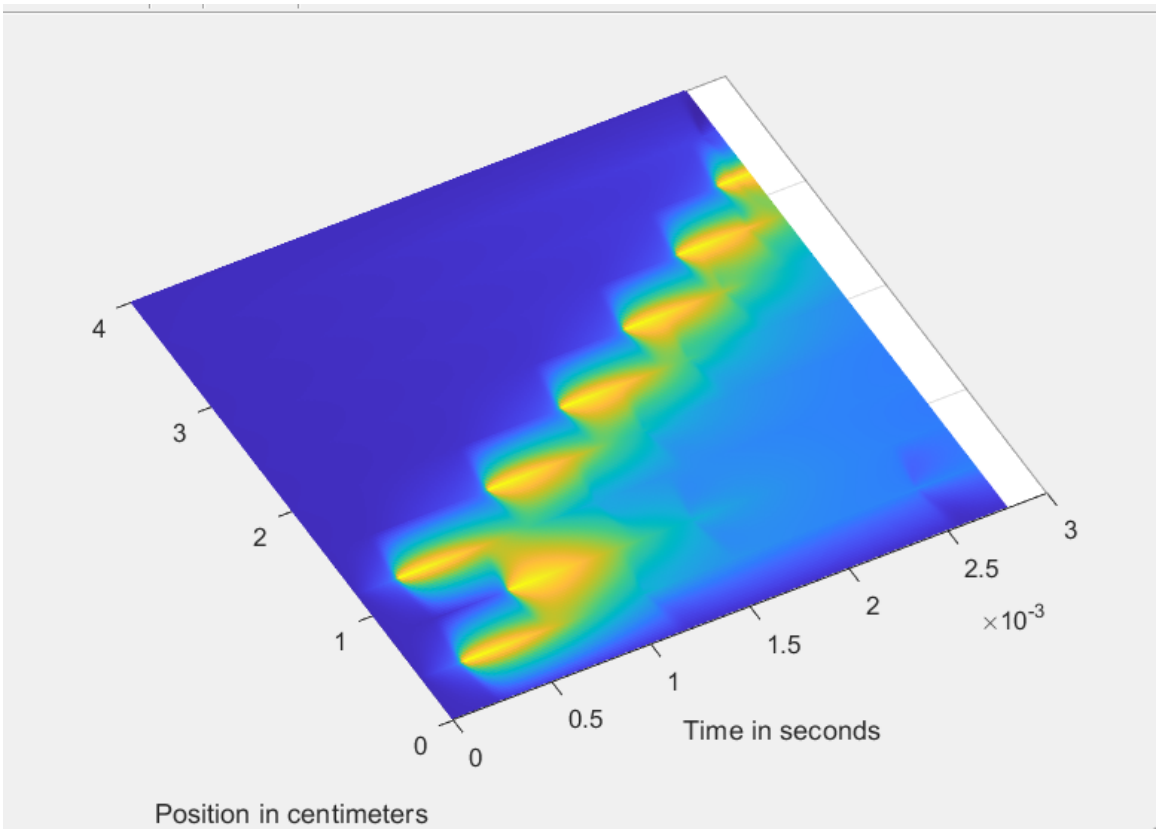
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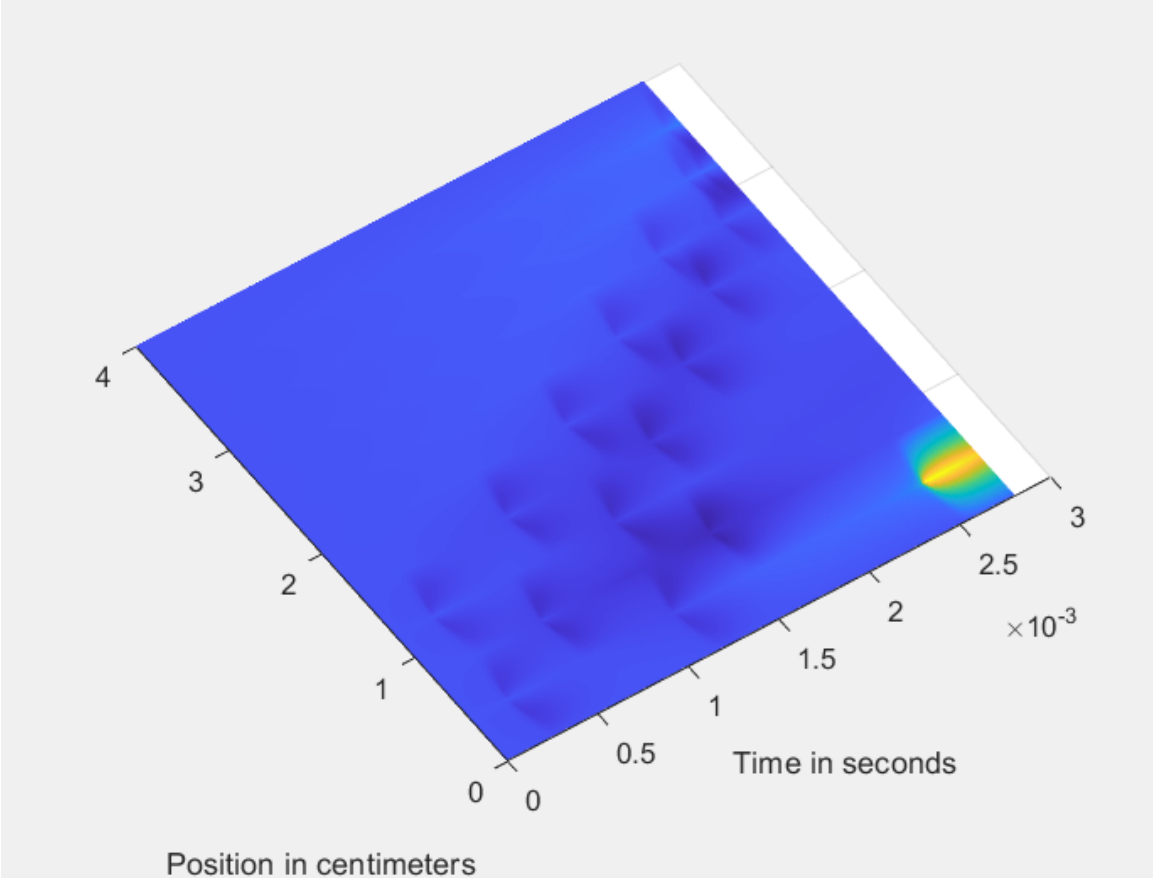
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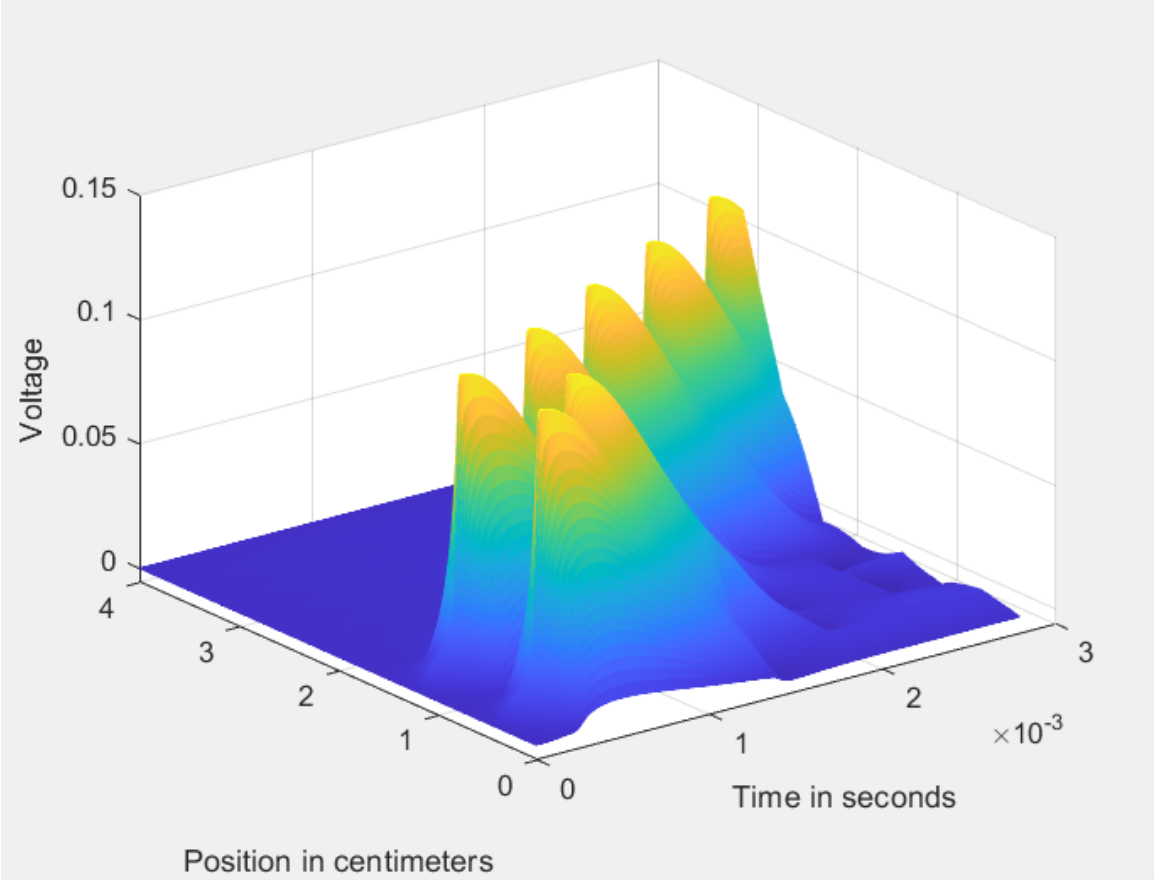
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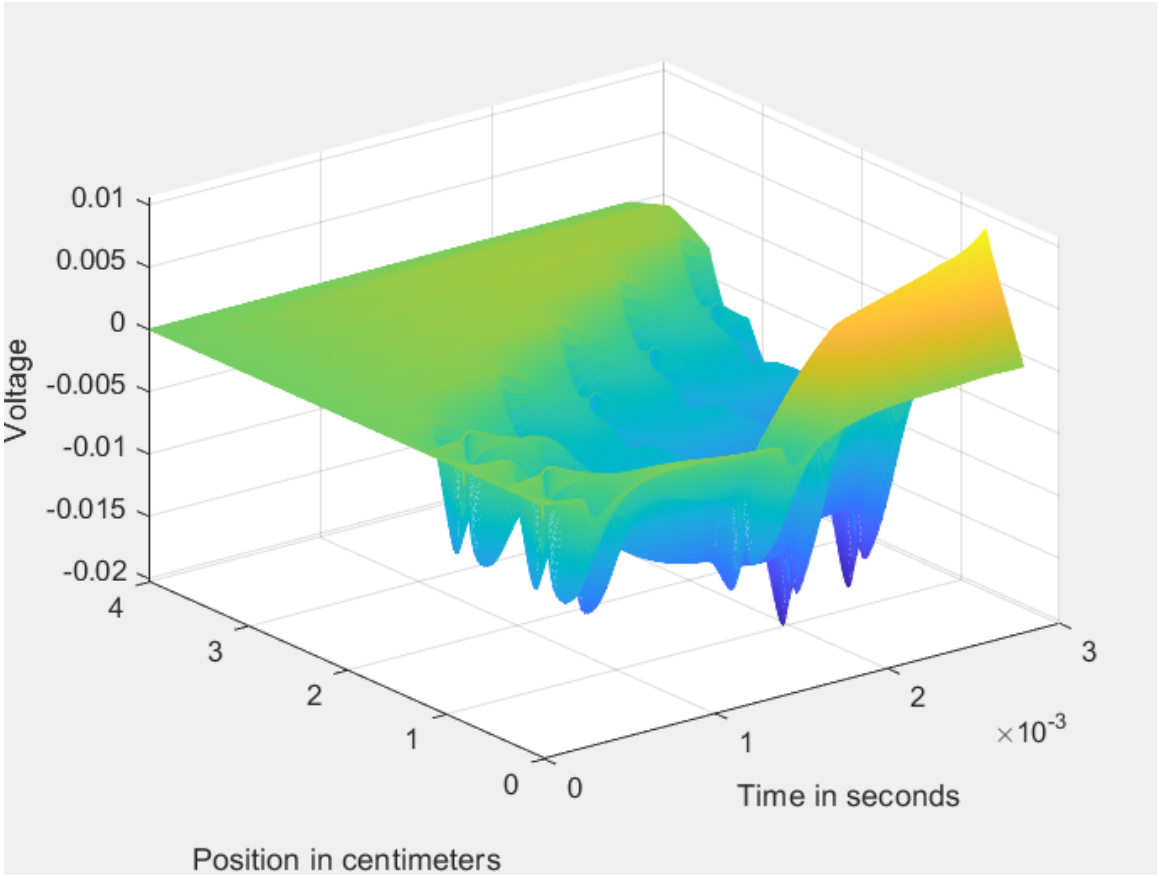
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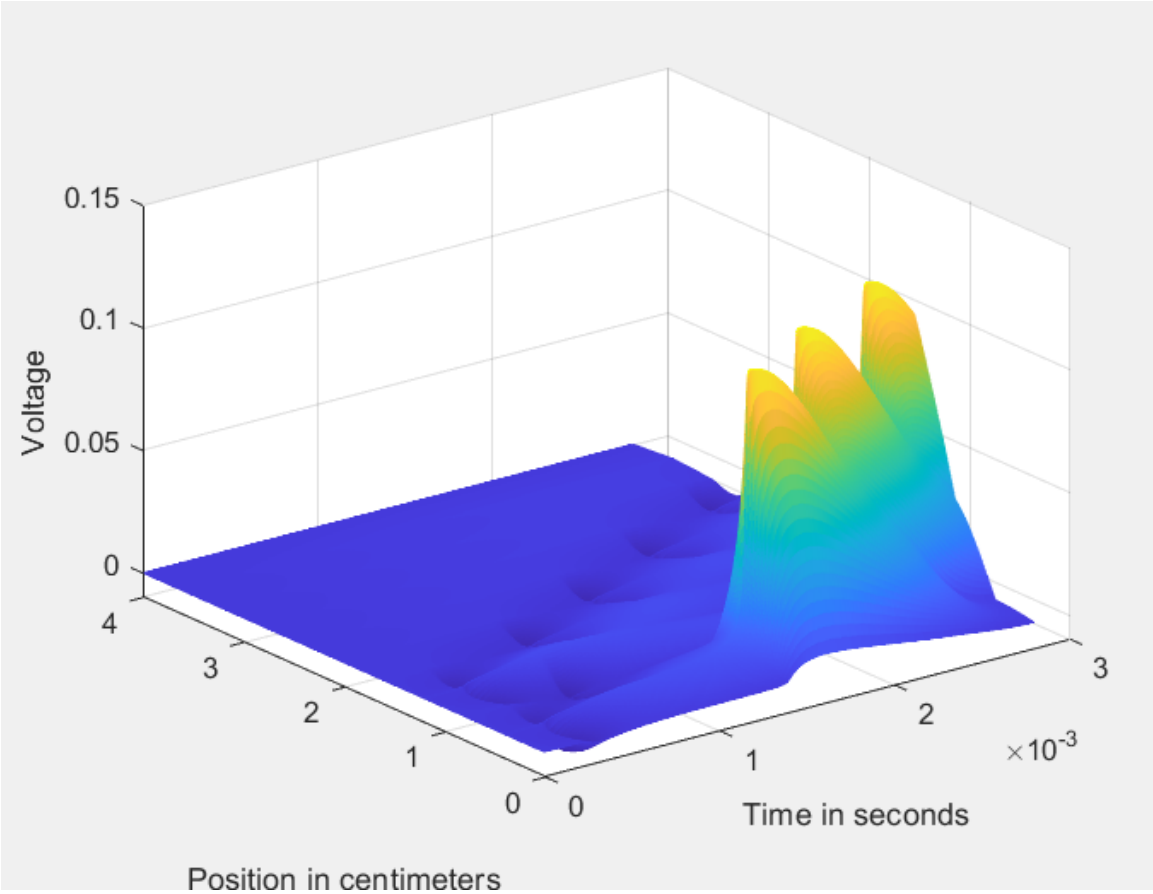
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