THE UNIVERSITY of EDINBURGH
School of Biological Sciences

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Edinburgh Medical School
Biomedical Sciences

IAD

MinecraftED:

Constructing immersive pedagogical experiences in Minecraft

Richard Fitzpatrick, Simon Parker, Melanie Stefan

Workshop Plan

1. MinecraftED: Student and Staff Reflections
2. Constructing Minecraft Worlds for Teaching
3. Breakout Rooms – Using Minecraft in your own teaching
4. Debrief

MinecraftED (August 2019)

Richard Fitzpatrick, Melanie Stefan, Okuk Takon, Chikku Rajagopalan, Simon Parker, Connor Schlemmer

Creatively engaging students with their own learning

PTAS title *"Building Biological Models in Minecraft"*

Exploratory – how do students use Minecraft when given two different tasks?

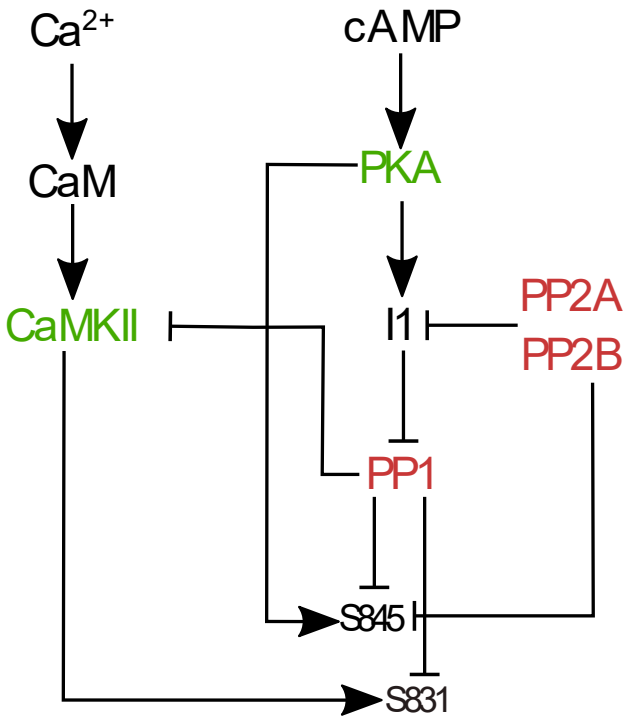
1) Unknown protein brief
2) Free model construction

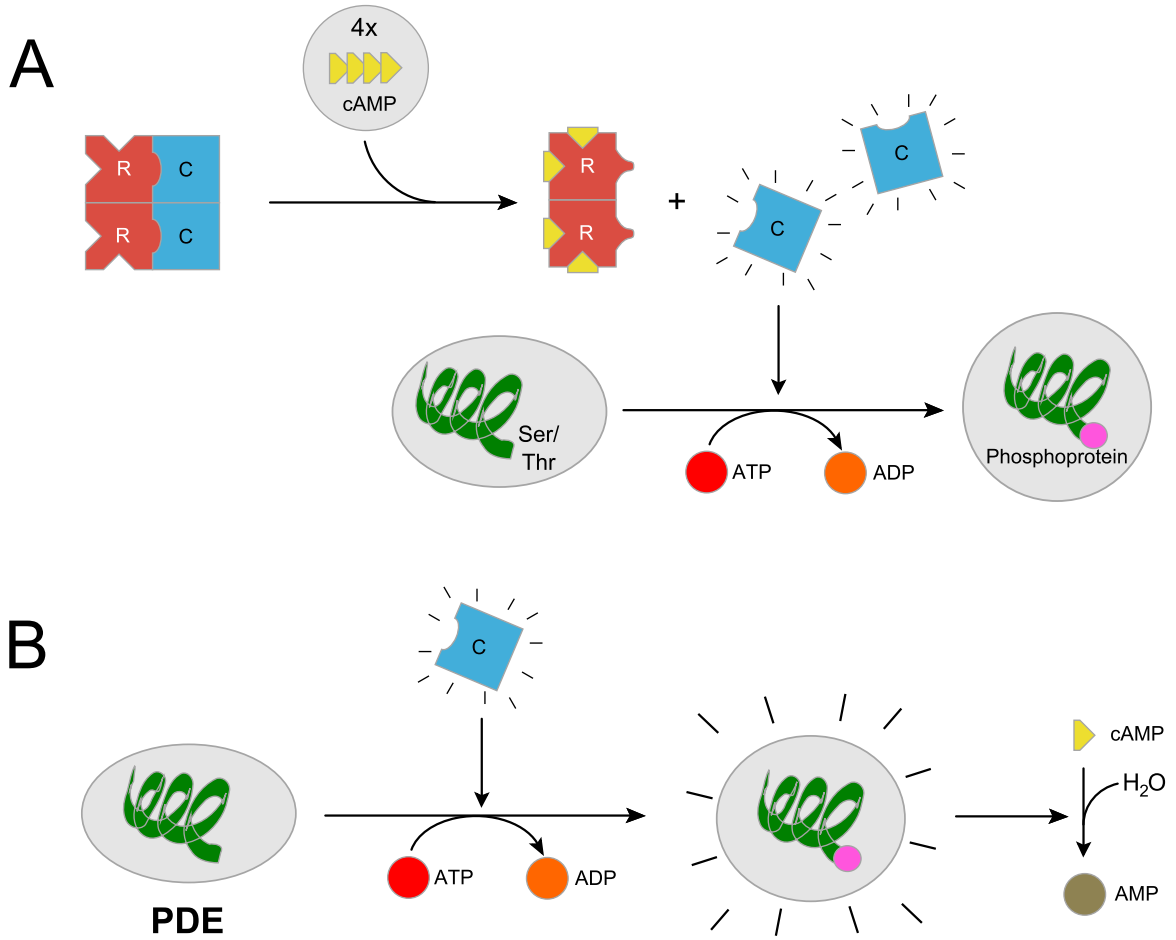
As broad a range of students as possible in a cohort of 4!

Follow-up reflective reports on the project

Why Minecraft?

Dutta-Roy, R., Rosenmund, C., Edelstein, S. J., & Le Novère, N. (2015). Ligand-dependent opening of the multiple ampa receptor conductance states: a concerted model. *PloS one*, *10*(1), e0116616.





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By Yikrazuul; chris 論 - File:Proteinkinase 1.svg, de:File:PKARII.png, Public Domain, https://commons.wikimedia.org/w/index.php?curid=8653327

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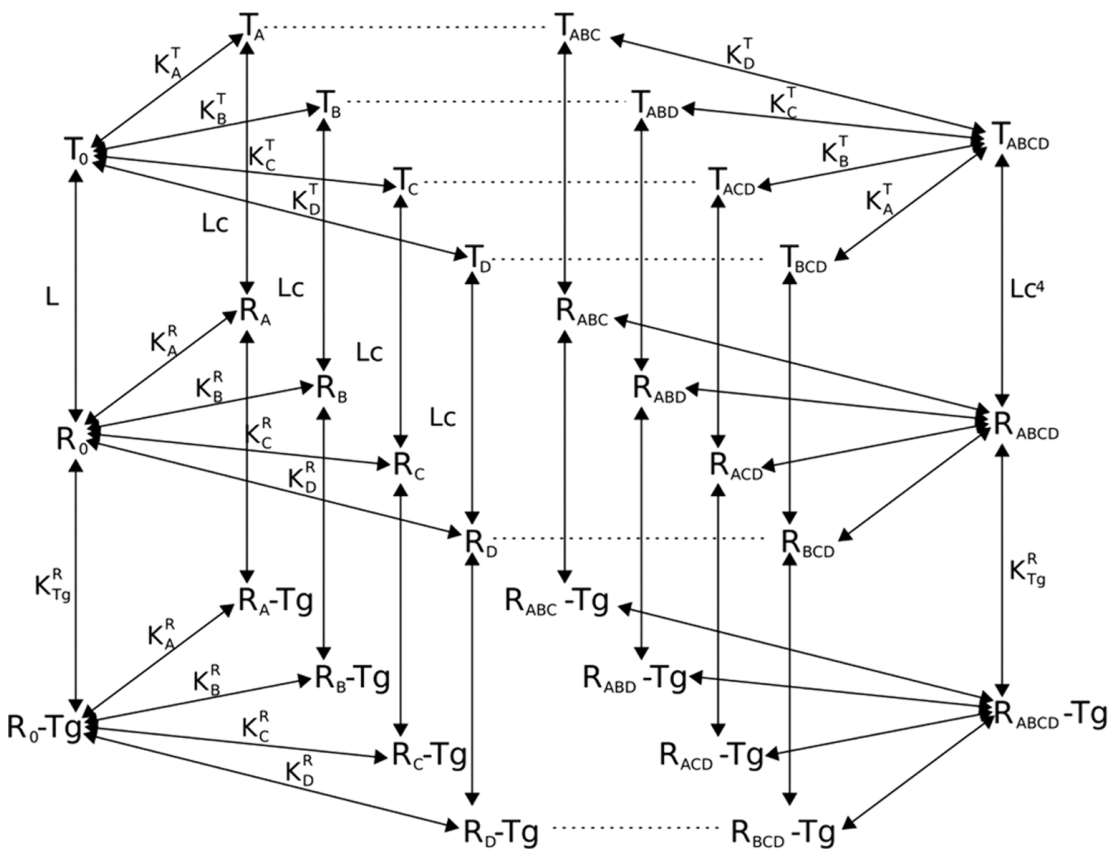

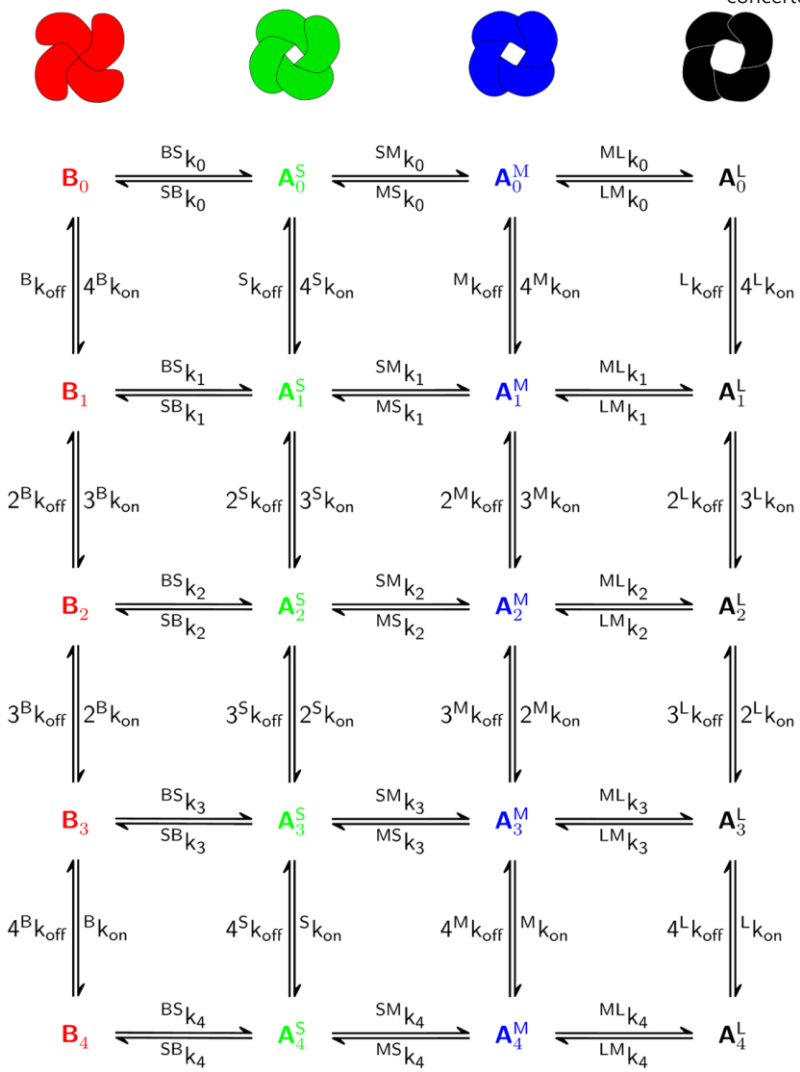

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Why Minecraft?

- Constructing concepts from the "bottom-up" to aid learning has a long history
- Lego can be used to explain many different concepts, both physically and as a framing device
- Minecraft works on the same principle, but has a much greater scalability and scope

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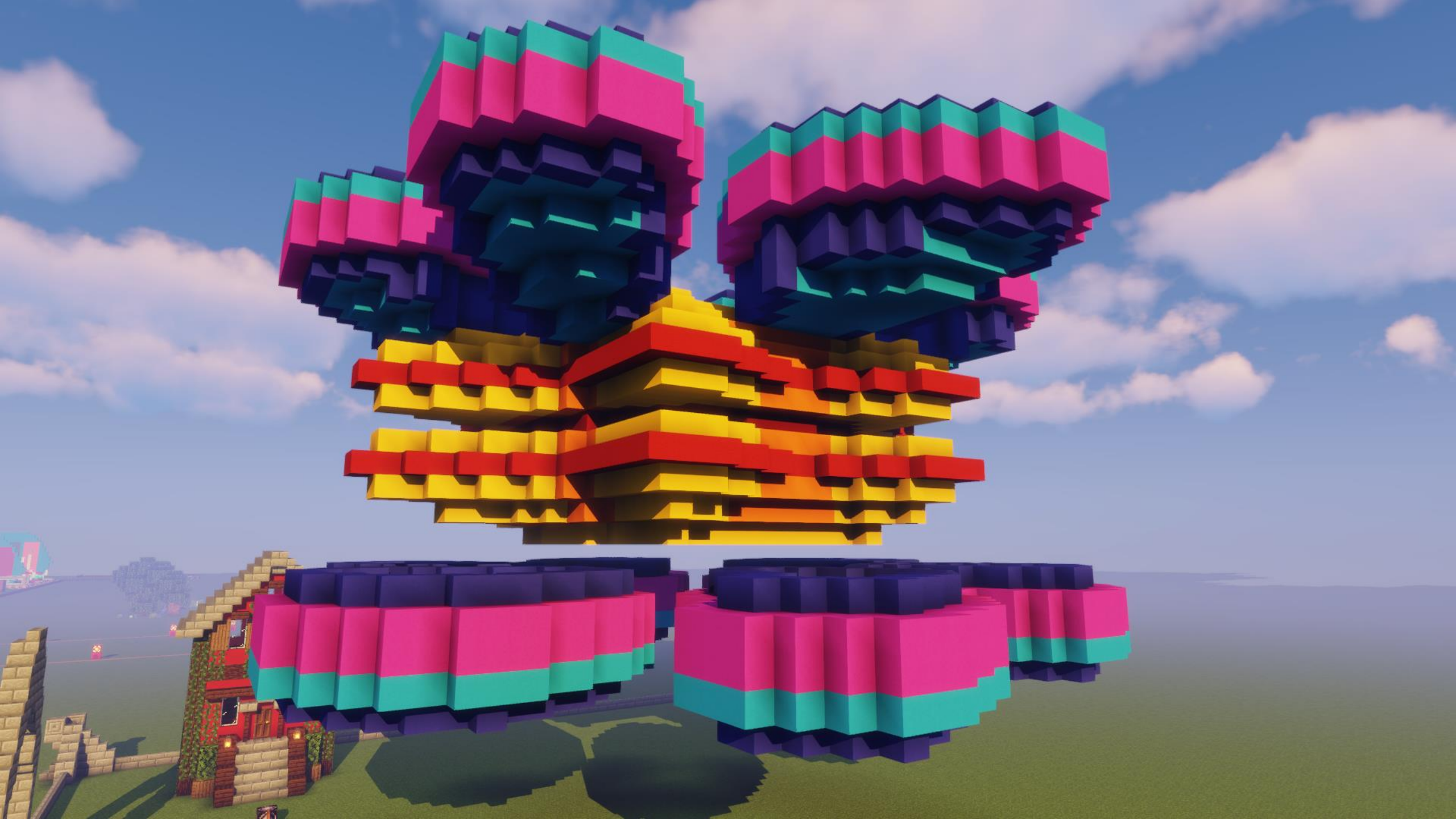
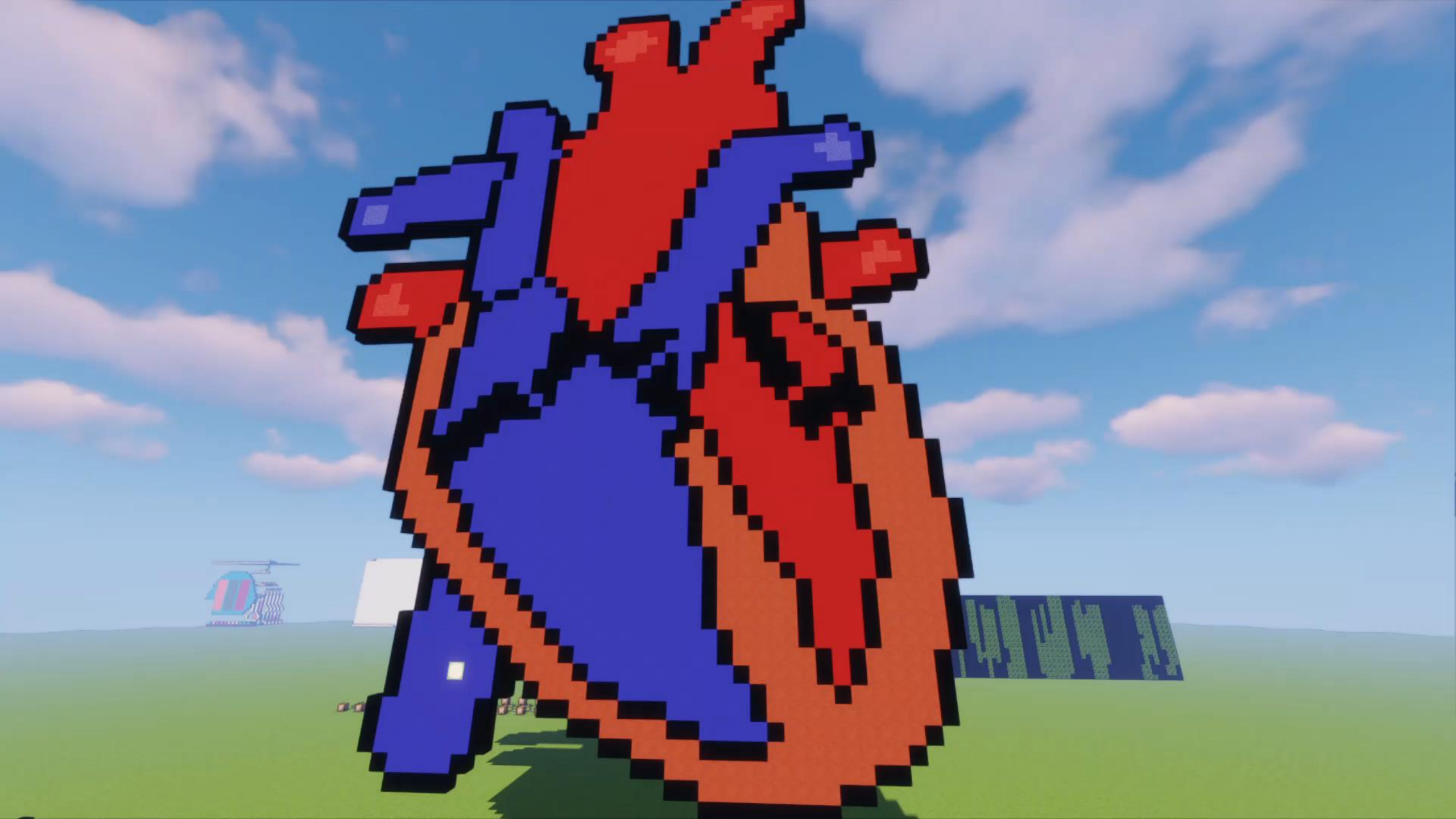
Questions we want[ed] to explore

- Does capturing the mechanistic properties of biology help with student understanding of complex concepts?
- Does making these concepts dynamic and interactive help?
- Can we recreate biological concepts easily and intuitively?
- Does this method work for all students, or just those with prior gaming experience?





Reflections on using Minecraft in Biology

Simon Parker

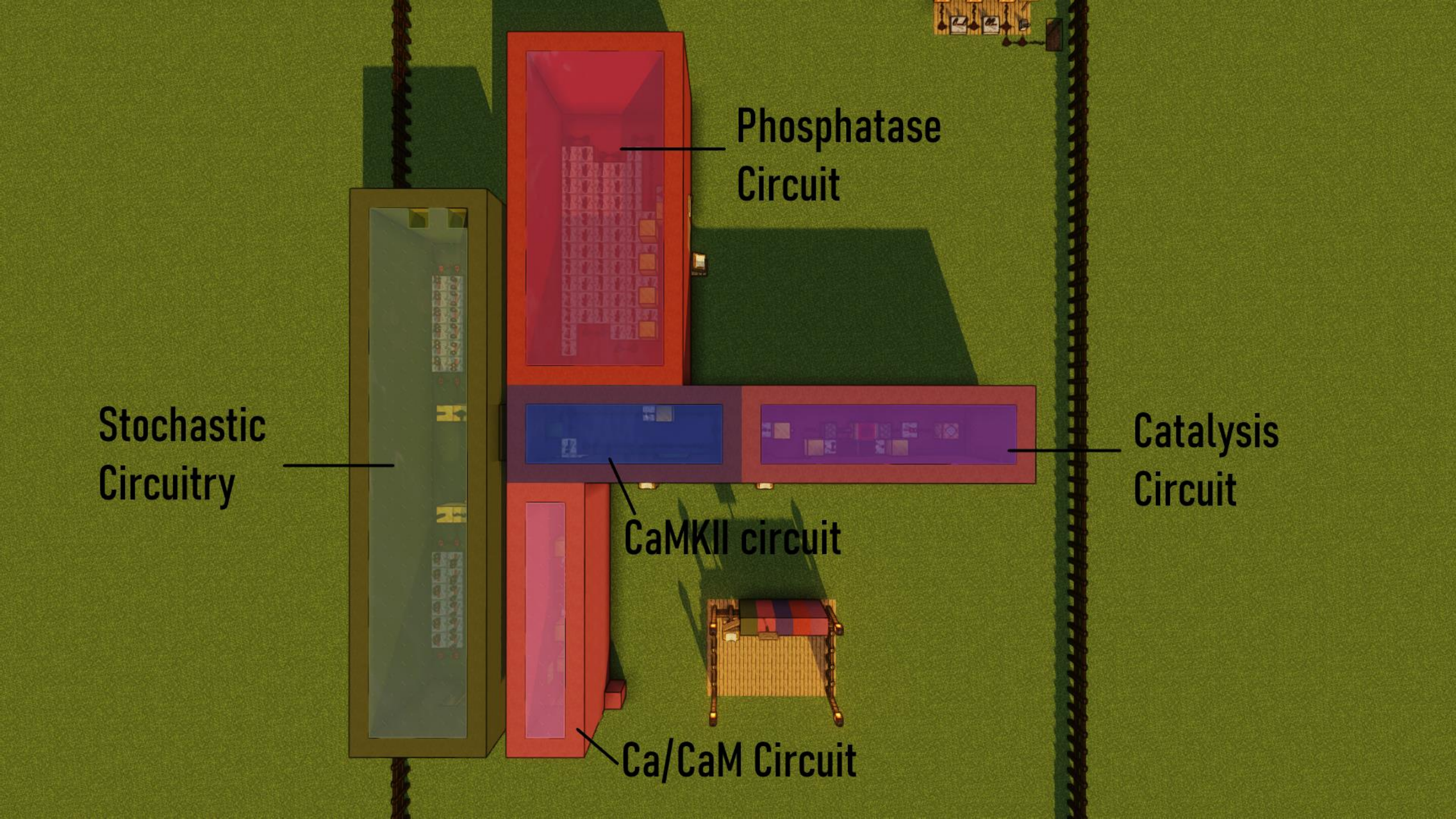
Challenge 1 – Unknown protein brief: Calmodulin kinase II

Two possible solutions:

1) Structural
2) Functional

Aims:

1) Divide CaMKII function into digestible parts
2) Represent each part as best as possible with redstone


Phosphatase Circuit
Stochastic Circuitry
Catalysis Circuit
CaMKII circuit
Ca/CaM Circuit

MinecraftED (August 2019)

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Challenge 1 – Unknown protein brief: Calmodulin kinase II

Findings:

1) Learned a lot about circuitry in Minecraft
2) Bit off a bit more than I could chew
3) Learned about CaMKII myself; but the model itself was difficult to learn from

MinecraftED (August 2019)

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Challenge 2 – Free model construction: DNA replication, transcription and translation

Two possible solutions:

1) Structural
2) Functional

Aims:

1) Convert components of these processes into accessible representations
2) Animate these components and in a understandable and (hopefully) appealing way

MinecraftED (August 2019)

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Challenge 2 – Free model construction: DNA replication, transcription and translation

Findings:

1) Learned **a lot** about command blocks and circuitry in Minecraft
2) Could flexibly determine the model's complexity
3) Extremely time consuming (and monotonous)
4) Reworking needed to make animations 'flow' and machines more responsive
5) Helpful for developing science communication skills

General takeaways

When asking students to build:

- Consider your students
  - Time needed to onboard students
  - Time required to build models – can creep up if not controlled
  - Avoid monotonous projects as much as possible

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  - Forces engagement with biological content
  - Develops sci-comm skills

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  - Provide guidance on these systems (e.g. redstone, command blocks, rails)
  - Provide examples of potential builds + 'best practices'

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When building for your students:

- Make it pretty
- Make it accessible
- Make it **fun!**

[Potential Streaming Point]

Using Minecraft for Honours Dissertations:

Reflections and Outputs

Siobhan Vickerstaff & Melanie Stefan

Honours Project (2020)

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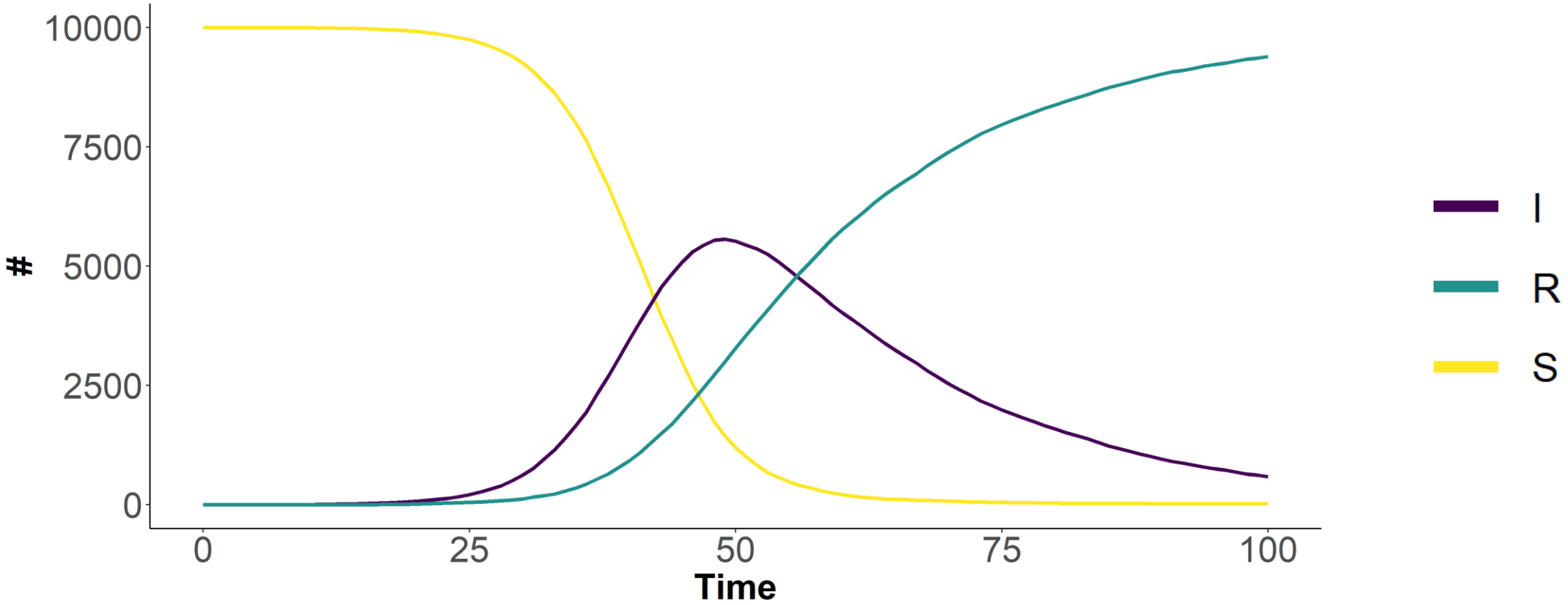

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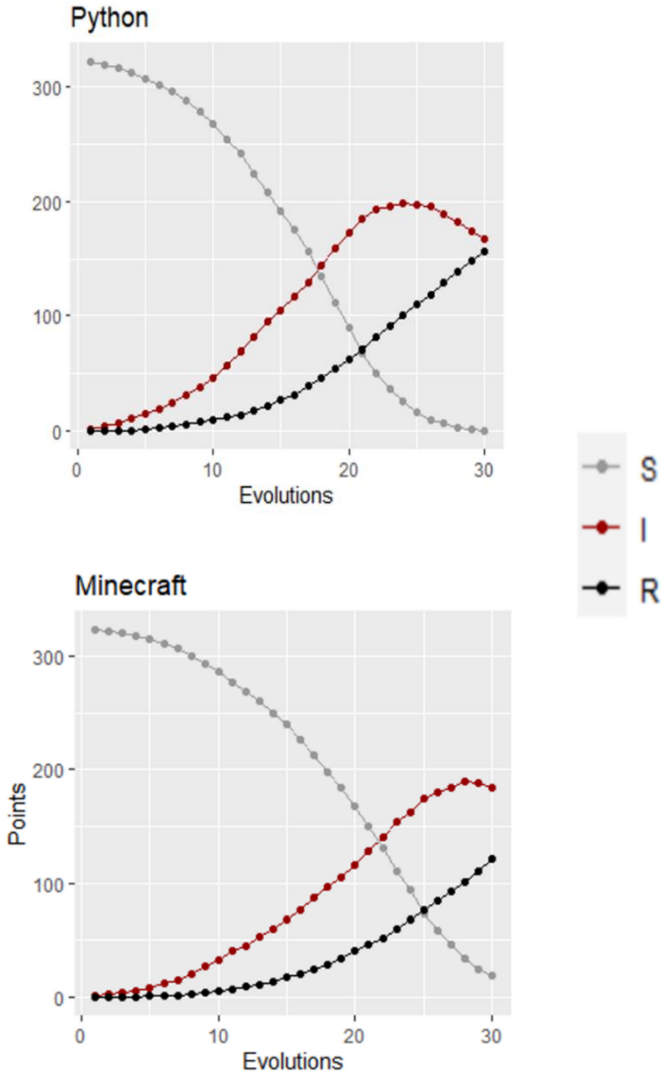

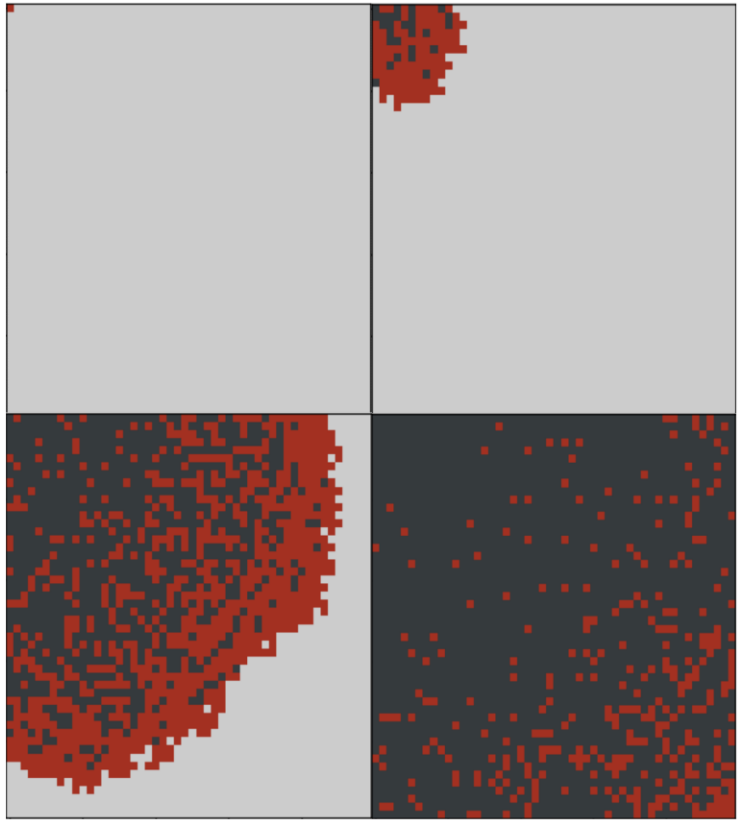

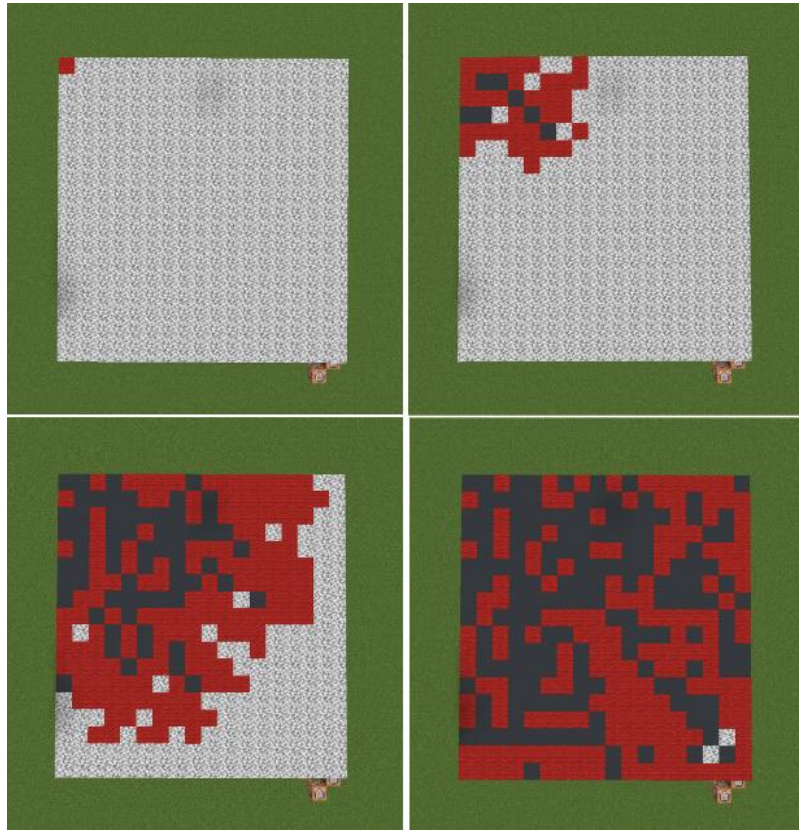

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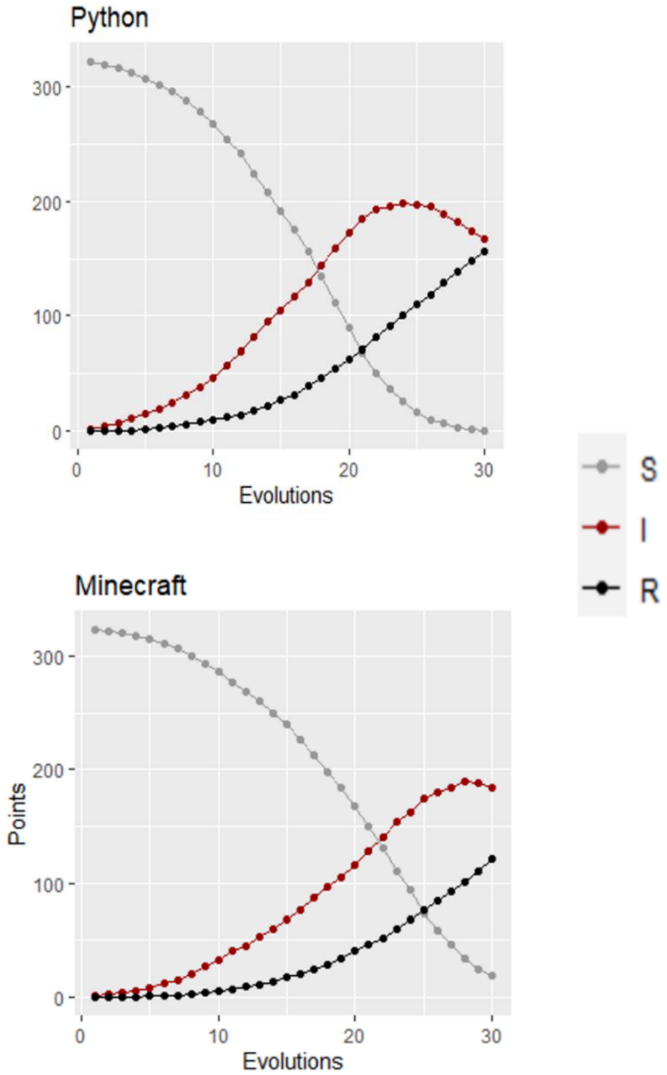

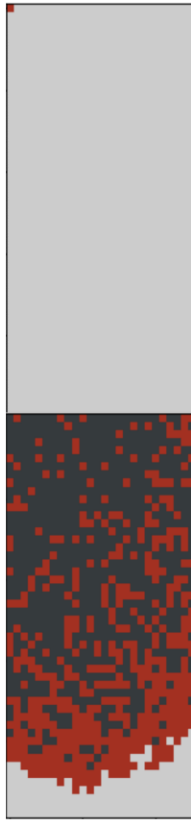

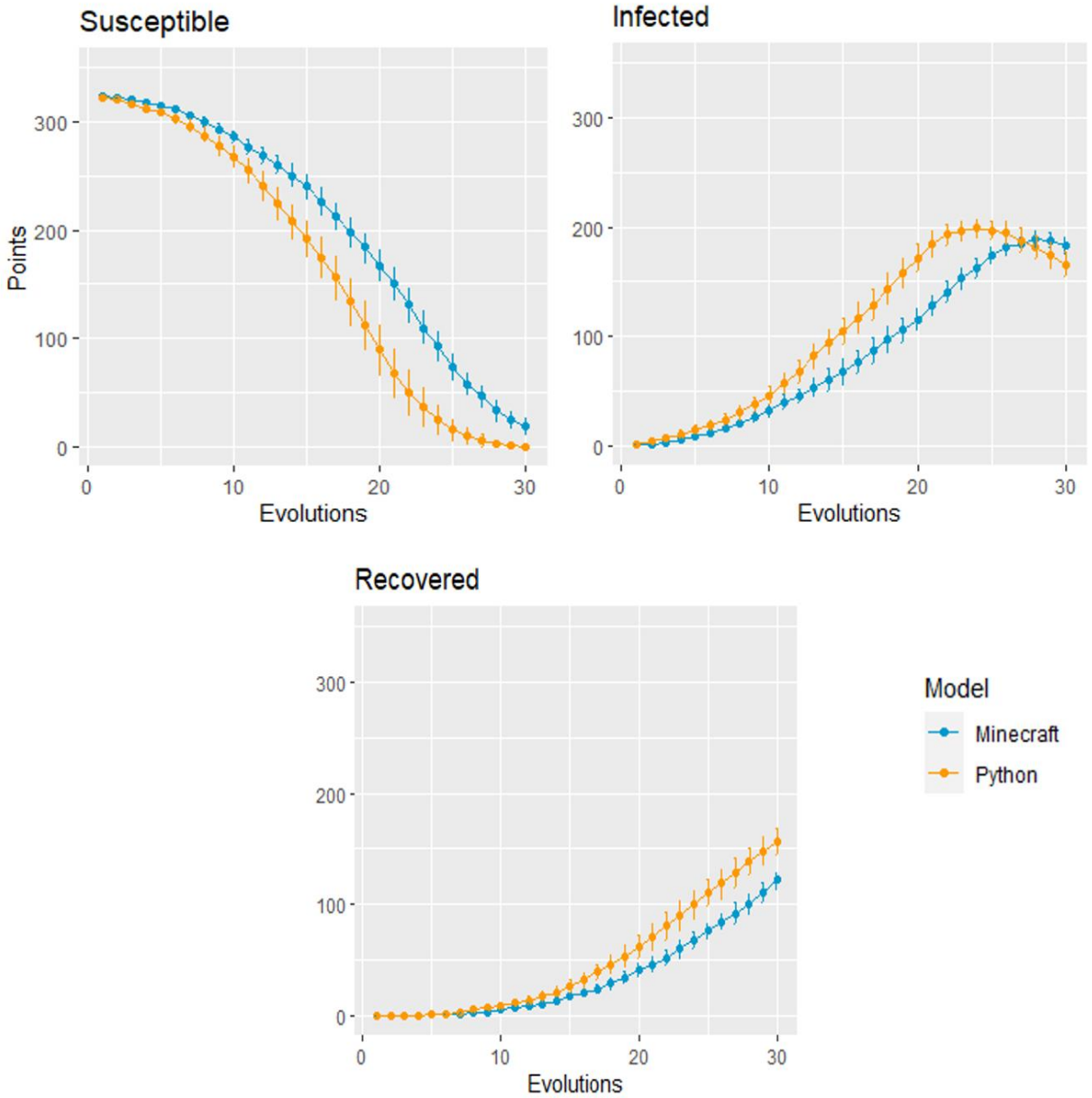

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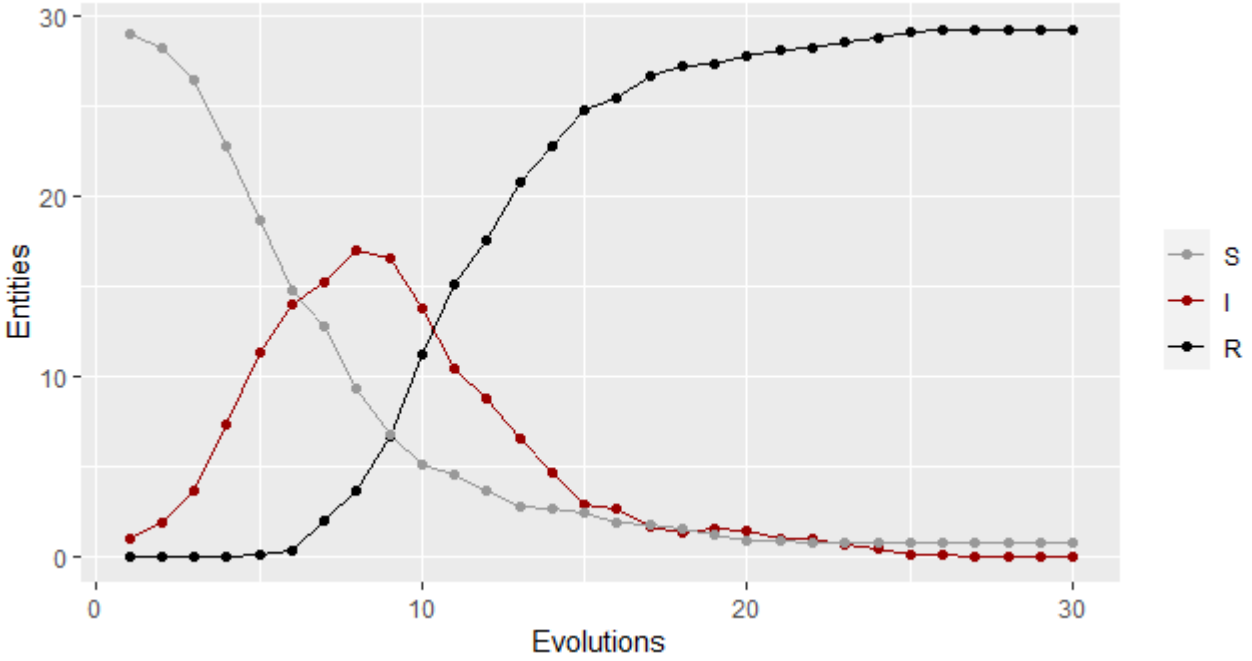

[Potential Streaming Point]

Any Questions?