SCENE 1 - SCIENCE HALL - EXT. MORNING

[Opening shot of the NARRATOR looking into the camera in front of the building. A dramatic music score plays in the background as the narrator begins to walk forwards.]

NARRATOR
Biologist Theodosius Dobzhansky once wrote that "nothing in biology makes sense except in the light of evolution." It's one of the most profound insights into the natural world. It explains how life on Earth developed from simple, single-celled organisms into the rich tapestry of species we see today. For centuries, scientists have sought to unravel the secrets of evolution, piecing together clues from fossils, genetics, and other aspects of life around us. The impacts of evolution aren't just relegated to museums. If you look closely, you may find that they show up in places you'd never expect.

[Insert short clip from Geher Interview from 8:03]

[Cut to a classroom of students looking bored and disinterested as a teacher lectures from a textbook.]

NARRATOR
But in classrooms around the world, students are taught about evolution through textbooks and lectures. For many, the subject can seem dry and abstract, a collection of facts and figures that fail to capture the wonder and complexity of the natural world. What if there was a better way? What if there was a way to bring the excitement of evolution to life?

[Cut to footage of the Spore video game.]

NARRATOR
Enter the world of life simulation games, or "life sims" for short. These games allow players to create and evolve their own organisms, experimenting with genetics, behaviors, and the environment. But

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can these games really teach us about evolution? And if so, which of these games would be the most effective?

[Cut to a montage of various organisms evolving in different life simulation games.]

NARRATOR
Join us as we explore the teaching potential of life sims. Through interviews with scientists, educators, and game designers, we'll delve into the pros and cons of different gameplay styles, weigh scientific accuracy against playability, and try to discover what the ideal educational evolution video game could be; a game that could revolutionize the way we learn about how life came to be.

[Final shot of the animated organism from the opening shot, now thriving in its environment.]

NARRATOR
The world of evolution awaits. Let's explore it together.

[Title Sequence]

SCENE 2 - THE QUAD - EXT. MORNING

[Opening shot of Glenn walking on campus.]

NARRATOR
To understand the potential of life sims for teaching evolution, we must first understand the core mechanisms of evolution itself. This is Professor Glenn Geher. He is a professor of psychology, as well as the founding director of the Evolutionary Studies department here at the State University of New York at New Paltz. He coedited “Darwin’s Roadmap to the Curriculum,” a guide for teaching evolution in higher education.

[Cut to a shot of Professor Geher in his office, surrounded by books and papers.]

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PROFESSOR GEHER
Evolution is nothing more than a “statistical bias in the rate of perpetuation of alternatives.” This was a statement written by George Williams in 1966. He was a renowned evolutionary biologist at Stony Brook. When someone asks me if I think that evolution is “true,” I point to this quote by George Williams. If there’s two things and they’re different from each other, and one of them is more likely to be retained for any reason at all, and more likely to replicate for any reason at all in the future, the one that is retained and that replicates more effectively will mathematically, by definition, be more likely to exist in the future compared with alternatives that do not have the same capacity to retain their features and to replicate across generations. That’s what evolution is. (2:39)

NARRATOR
At its most basic level, evolution is driven by three factors: Replication, Variation, and Selection. In order to evolve, individuals in the population must be able to copy themselves. This goes for individual organisms, to the cells that make them up, even down to the non-living pieces like molecules. There must also be variation. If all the members of a population are exactly the same, nothing will change. Replication isn’t perfect, so variations arise in the form of mutations. Different variations may be less or more effective at perpetuating themselves, depending on what they do and the environment around them. That’s where selection comes in. In essence, evolution is the non-random selection of random mutations. Once it’s all laid out like that, the core concept seems pretty simple. So why is this subject so hard to teach?

[Cut back to Professor Geher]

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PROFESSOR GEHER
David Sloan Wilson talks about three specific hurdles to evolution education. Evolution is often disregarded by a lot of Americans because America has a science problem. It’s hard to get Americans excited about science. People are afraid of and uninterested in those fields. (5:15) People don’t generally think that evolution is relevant to their everyday lives. (6:00) Finally, there have been very bad efforts to try to apply evolution in large-scale social contexts by people who don’t really understand evolution. (6:45)

SCENE 3 - OFFICE - INT. EVENING

NARRATOR
Now that we understand the importance of teaching evolution, let's dive into the question of how to effectively teach it. Can interactive class activities help students understand the complex mechanisms of evolution? To answer this question, I reached out to Tyler Rhodes, the artist behind a drawing-based activity designed to demonstrate natural selection.

[Cut to an interview with Tyler Rhodes]

INTERVIEWER
Can you tell us a bit about the activity you created and how it works?"

TYLER RHODES
Sure. It's a hands-on drawing-based activity that walks students through the process of natural selection. Essentially, students start with a blank sheet of paper and are asked to draw a creature using only a limited number of crayons. Then, they exchange their drawings with a partner and the partner is asked to color in the drawing using only the same limited number of crayons. Finally, the class votes on which drawing is the

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'fittest' based on how well it blends into its environment."

INTERVIEWER
What inspired you to create this activity?

TYLER RHODES
I was frustrated with the lack of engaging activities available for teaching evolution. I wanted to create an activity that was hands-on and interactive, something that would get students excited about learning the complex mechanisms of evolution.

INTERVIEWER
And did you find that this activity was effective in helping students understand evolution?

TYLER RHODES
Absolutely. In fact, the activity was part of a larger study that found that students who participated in the activity had a significantly better understanding of natural selection than those who did not. It's a simple activity, but it really gets students thinking about how the process of natural selection works.

INTERVIEWER
That's fascinating. So, it sounds like interactive class activities can be an effective way to teach evolution."

TYLER RHODES
Definitely. I think any time you can get students actively engaging with the material, it's going to be more effective than just lecturing to them. And when it comes to evolution, there are a lot of misconceptions out there that can be difficult to overcome. Interactive activities like this can help students see the process in action and better understand how it works.

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NARRATOR
Tyler's activity is just one example of the many creative ways educators are finding to help students understand evolution. But what about using video games to teach evolution? Could life simulation games be the key to unlocking a deeper understanding of the complex mechanisms of evolution?

[Cut to footage of various life simulation games.]

NARRATION
Tyler's activity is a proof-of-concept for how interactivity can help students learn about evolution. Life sims could offer a unique opportunity for students to see evolution in action, experimenting in more detail with genetics, behaviors, and the environment. By seeing how their organisms evolve and adapt over time, students can gain a deeper understanding of the processes that drive evolution. So far this is all speculation, so how could we put the teaching ability of life sims to the test?

PROFESSOR GEHER
I think it’s a brilliant idea, and I think that if you can come up with good examples I would like to see data on how effective different video games are. Can you, for instance, create a measure of evolution literacy? Are there some games that correspond to better evolution literacy outcomes relative to other games? [10:04]

SCENE 4 - COLLEGE HALL - EXT. MORNING

NARRATOR
Now that we've explored the effectiveness of interactive class activities, let's take a closer look at the game Spore. Developed by game designer Will Wright and his team at Maxis, Spore was released in 2008 and quickly became a sensation. It allowed players to create their own creatures

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and guide them through various stages of evolution, from single-celled organisms to space-faring civilizations. But how scientifically accurate is Spore, and what compromises were made during its development?

Interview with Soren Johnson:

SOREN JOHNSON
When we were working on Spore's civilization stage, we wanted to create a game that was accessible and fun for players of all ages. We knew we had to simplify some aspects of civilization building, like trade and diplomacy, to make it more engaging. We also had to make sacrifices in terms of scientific accuracy.

NARRATOR
One of the main criticisms of Spore was its lack of realism in the later stages of the game, where players could travel between planets and engage in interstellar warfare.

Interview with Chaim Gingold:

CHAIM GINGOLD
We had to balance the game's scientific accuracy with its accessibility and fun factor. For example, in the creature creator, we had to simplify certain traits and abilities to make it easier for players to create their creatures. But we still tried to incorporate some real-world evolutionary concepts, like sexual selection and adaptation to different environments.

NARRATOR
Despite the changes made to the game’s ultimate goal, or perhaps because of them, Spore was a huge commercial success, now having sold over 2 million copies worldwide. However, some critics argue that the game's marketing campaign focused too much on

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the creature creator and not enough on the game's educational potential.

Interview with Jason Shankel:

JASON SHANKEL
I think there was definitely a missed opportunity with Spore in terms of its educational potential. We had a lot of interesting ideas for how to incorporate real-world scientific concepts into the game, but ultimately those ideas had to be simplified or cut for the sake of marketability. It's a shame, because I think Spore could have been a really valuable educational tool if we had been able to push the boundaries a bit more.

SCENE 5 - SPORTS FIELD - EXT. MORNING

NARRATOR
Despite the compromises made during its development, Spore remains a popular and beloved game that has inspired countless players to think about the wonders of evolution and the possibilities of life in the universe. Spore was a groundbreaking game that introduced players to the mechanics of evolution. However, it also faced criticism for sacrificing scientific accuracy in the name of marketability. Now, we turn our attention to a game that seeks to remedy this: Thrive.

OLIVER LUGG
Thrive is a free, open-source game that aims to teach players about the mechanics of evolution and the emergence of complex life. It's a game that emphasizes scientific accuracy and complexity, and we believe that it has the potential to be an excellent educational tool.

BRIAN ZITO
One of the most significant differences between Spore and Thrive is that Thrive places a greater emphasis on the player's ability to

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understand and interact with the game's underlying mechanics. The game features a more realistic simulation of evolution, including the need for organisms to acquire energy and resources to survive, as well as the ability to reproduce and mutate over time.

BUCKLY MURPHY
Thrive also features a detailed tech tree that allows players to upgrade and improve their organisms over time. This feature encourages players to think about the long-term implications of their decisions, rather than simply trying to survive in the short term.

NARRATOR
Despite its many strengths, Thrive also faces its own set of challenges. For example, the game's complexity may be overwhelming for some players, and it requires a significant investment of time and effort to truly understand and appreciate all of its mechanics.

OLIVER LUGG
Additionally, because Thrive is an open-source project that is still in development, it may not be as polished or user-friendly as some other games on the market. However, we believe that the game's educational potential makes it more than worth the effort to learn.

NARRATOR
There are two major design flaws when it comes to portraying evolution accurately with these games. The first is that evolution is portrayed as a linear process, with humans at the top of the chain. In reality, evolution is a branching process, with all species constantly evolving and adapting to their own niche within their environments. The other problem is that both of these games contribute to the “Naive Species Selection Fallacy.”

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[Cut back to Professor Geher]

PROFESSOR GEHER
If you take the idea that evolution selects attributes “for the species,” that’d be like saying that things lions evolved weren't for the benefit of getting their own genes into the future compared to other lions, but it was so lions could beat dandelions in the race for who takes over the planet. It’s crazy, but it’s also the most common erroneous concept regarding evolution that’s out there. It’s called the “Naive Species Selection Fallacy.” (4:30)

SCENE 6 - ASHOKAN COMMON AREA - INT. MORNING

NARRATOR
While Spore and Thrive are popular choices for teaching evolution through simulation, they both require players to be actively engaged in their virtual worlds. But what if there was a game that allowed for real-time genetic and behavioral evolution without requiring any player input? Enter The Bibites, a zero-player game that simulates the evolution of autonomous, simulated organisms.

[Cut to interview with Léo Caussan, the sole developer of The Bibites.]

LÉO CAUSSAN
The Bibites is a game that's not really a game in the traditional sense. It's a zero-player game, which means that once you start it, it runs by itself without any player input. The game simulates the evolution of a population of organisms, the Bibites, and the genetic and behavioral changes that occur over time.

NARRATOR
The Bibites is a unique take on the life simulation genre, focusing on the scientific accuracy of evolution rather than the playability of a

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traditional game. However, there are limitations to a zero-player game when it comes to its potential as an educational tool.

[Cut to interview with Glenn Geher, author of "Darwin's Roadmap to the Curriculum: Evolutionary Studies in Higher Education."]

GLENN GEHER
While a zero-player game like The Bibites can accurately simulate the mechanisms of evolution, it lacks the interactivity that is crucial for effective learning. Students need to be engaged and actively participating in the learning process.

NARRATOR
The Bibites is an interesting case study for educators, as it demonstrates the potential for accurate simulation of evolution in a zero-player game. However, it falls short in terms of interactivity and engagement, making it less effective as a teaching tool compared to more interactive games like Spore and Thrive.

[Cut to interview with Léo Caussan.]

LÉO CAUSSAN
While The Bibites may not be as engaging as some other life simulation games, I believe that its focus on scientific accuracy makes it a valuable tool for educators. By simulating the complex processes of evolution in real-time, students can better understand the fundamental mechanisms that drive the diversity of life on Earth.

NARRATOR
While The Bibites may not be the most engaging life simulation game on the market, it offers a unique perspective on the potential for zero-player games as an educational tool. By accurately simulating the mechanisms of

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evolution, it provides an important teaching tool for educators looking to demonstrate the power of evolution through simulation.

SCENE 7 - MULTIPLAYER

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MULTIPLAYER game speculation:

{Soren mentions games like WOW influence player character creation in a way that more accurately represents evolution, Buckly made a mini-multiplayer version of Thrive, This connects back to the in-person activity that was the basis for the thesis in the first place}

Review Section and Conclusions

- Zero-player games are the least interactive, but are the most scientifically accurate

- One-player games, no matter how scientifically accurate they try to be, can bias the player by the nature of their medium. Nature doesn't plan ahead.

- Multiplayer games could be the best compromise, but they would be the most costly and complicated to implement.

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SCENE 8 - CONCLUSION

NARRATOR
As we've seen, both single-player and zero-player games have their strengths and limitations as teaching tools. However, there is a possibility of a third way, a multiplayer life simulation game that could combine the best aspects of both types of games. A multiplayer game could create an environment where students could collaborate and compete, learn about the scientific concepts of evolution, and engage with an interactive, evolving system.
One of the benefits of a multiplayer game is the ability to introduce social learning, where players can

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learn from each other and collaborate in a competitive environment. According to Professor Glenn Geher, social learning is a key aspect of how humans have evolved to understand the world around them. By creating a game that emphasizes social learning, students could engage with a more immersive and dynamic learning environment.

To further explore the potential of a multiplayer life simulation game, we interviewed some of the developers and experts we spoke with earlier. Soren Johnson, who worked on Spore's Civilization stage, explained that the multiplayer environment could be used to simulate different populations of creatures, each with their own environments and resources. This would allow students to experience the effects of natural selection and the evolution of species in real-time.

Oliver Lugg, the lead developer of Thrive, suggested that a multiplayer game could incorporate elements of social cooperation, such as group migration or predator-prey relationships. Buckly Murphy, a programmer on Thrive, added that a multiplayer game could also allow players to experiment with different strategies for survival and reproduction, adding an element of competition that could enhance the educational experience.

However, there are also practical limitations to developing a multiplayer game for educational purposes. Brian Zito, another developer on Thrive, explained that the development costs of a multiplayer game would be much higher than those of a single-player game, and that the complexity of creating an online environment that could support a large number of players could pose significant challenges.

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Despite these challenges, the potential benefits of a multiplayer life simulation game for teaching evolution make it a promising area for further research and development. By combining elements of social learning, collaboration, and competition, a multiplayer game could provide students with an immersive and dynamic environment to explore the complex and fascinating mechanisms of evolution.

Life simulation games offer a unique and engaging way to learn about evolution. From the single-player experience of Spore and Thrive, to the zero-player simulation of The Bibites, to the as of yet untapped multiplayer concept, we have explored the benefits and drawbacks of each game design.

Single-player life sims can offer a detailed and interactive experience, allowing players to see the effects of evolution firsthand. Zero-player games like The Bibites can provide a more accurate depiction of evolution, but may lack the interactivity that some learners need to truly engage with the concept. Multiplayer games could offer the best of both worlds, with a more interactive and engaging experience while still maintaining scientific accuracy, but designing a cost-effective multiplayer life sim would require resources as well as creative planning.

While these games can be a valuable addition to traditional education methods, they cannot replace the importance of in-person classroom instruction. However, they can be an effective way to supplement and enhance traditional teaching methods. As we look to the future, it is exciting to think about the potential for further advancements in life simulation games and how they can continue to improve the way we teach

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and learn about evolution. Who knows what new discoveries we may uncover or what new technologies may arise to help us better understand the intricacies of the natural world.

In the end, one thing is certain: the study of evolution will continue to be a fundamental component of scientific education, and the possibilities for innovative and engaging teaching methods are endless.

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