Episode 28: This is Like That: The Importance of Analogies

Show Notes
In talking about a game, we almost always make references to past games in order to describe or teach the new game. What does cognitive psychology have to say about analogy use, in terms of how prevalent and useful it really is?

Game References
Aeon's End, Clank, Dominion, Paperback, Star Wars Jedi: Fallen Order

Research References
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Transcript
Hello! This is Episode 29 of the Cognitive Gamer podcast. I am your host, Dr. Stephen Blessing, professor of cognitive psychology at the University of Tampa. I use games to both explain and explore concepts in psychology. To get started with today's topic, I imagine there's been a number of times, both in relation to games and definitely also in your non-gaming life that you have tried to explain one thing by making reference to something else, or have found it useful to use previously learned knowledge to help you out with a current task. Indeed, it's hard to approach a new task without thinking it reminds you of something else you know, and trying to use that past knowledge in the current situation. This is the heart of what analogy use is all about, and it's an incredibly powerful cognitive tool that we have in order to help us learn a new skill, either in game playing or just in life more generally speaking.

Let's consider times in which you've used analogy in game playing. I've talked about this a couple of times very briefly in past episodes, but now it's time to hit this important topic head on. In video games, third person action-adventure gamers are common. The Nathan Drake series, The Last of Us, Assassin's Creed, Lara Croft and others of course differ in their stories and details, but share a lot in common in terms of how you play them. When Star Wars Jedi: Fallen Order came out, if you had a friend familiar with past action-adventure games, you could easily give them a pretty fair idea of what Fallen Order was all about, just by telling them it was an third-person action-adventure game set in the Star Wars universe. By using their knowledge of

the Nathan Drake series, or whichever other game you might have mentioned, they probably have a pretty good idea of what Fallen Order is going to be like. They probably figured it was primarily meant to be single-player, you'll have one big goal you are trying to accomplish across the game, you'll probably have the option to meet other objectives along the way, perhaps move around in an open world, among other aspects that are common to the genre. You also will have a pretty good idea how to move your character, with twin-stick controls on a console or keyboard and mouse on a PC. All of that previous knowledge can be subsumed into your quote unquote "new" knowledge about Fallen Order. You won't have to spend a lot of time on much of these basic issues.

The same is true with board games as well, of course. For example, deck builders are a type of game that started with a game called Dominion in 2008. It's not very often that a game creates a whole new genre. When I first learned to play Dominion, it was different than anything else I had played, and it took a bit to figure it out. While deck building isn't all that complicated, you do have to get your head around what it means to add cards to your deck, how those cards get recycled through, and other issues particular to deck building. But, now that I've played Dominion a number of times, I can more easily pick up new deck building games. I have Tim Fower's Paperback, which is a combination deck builder and word game. Most of the cards are letters, and you use them to make words as you deal your hand for that round. When I played it for the first time, I could much more readily figure out how it all works, due to my previous experience with Dominion. Most of that knowledge about building decks could be ported over, saving me time in learning the new game. That was the same when I learned other deck builders, like Clank and Aeon's End. I could analogize from the prior knowledge I had learned from playing Dominion and others to the new deck builder, concentrating on just the differences they offered.

As an aside, this reminds me of Robert Altman's 1992 movie *The Player*, which is about making deals in Hollywood. Whenever a new movie was pitched, it was always described in relation to past movies. I resisted the urge to describe Paperback as Dominion meets Scrabble, but there's some truth to that, and it would help you picture the game. Memorable mash-ups from The Player was a movie described as Ghost meets The Manchurian Candidate and another which was The Graduate meets Psycho, where Benjamin and Elaine take care of an ailing Mrs. Robinson. I'm sure you have heard of other movies or games or maybe something else in another domain described as like this thing plus this other thing. Whenever that happens, you are relying on analogy to help describe the new thing.

So, when telling someone about a new game or when teaching a new game, analogies can be quite useful. If you catch yourself, you will notice that you and those around you use analogies quite a bit throughout the day. This occurs at all levels of development. Young kids use analogies to help them learn to read and to make sense of the world. I imagine when you first heard about atoms with their nucleus and electrons, the person explaining might have made an analogy between that and something you probably already knew, planets rotating around the sun. At the upper level, Kevin Dunbar and Isabelle Blanchette did an interesting study where they embedded themselves into research labs doing work on immunology and molecular biology. They recorded these meetings, and then coded the discussions. One of the things they were most interested in

was the analogy use during the lab discussions. These scientists doing cutting-edge research often used analogy.

Given that analogy use is so prevalent and important across many different contexts, let's discuss how cognitive psychologists think about how people do analogy. It's been studied quite a bit in the problem solving literature, where we are interested in how people will use a past problem, a worked example say, to help them solve their current problem. One of the ground-breaking studies was done by Mary Gick and Keith Holyoak back in the early 1980s. They laid out analogy as having three main steps to it: noticing, mapping and applying. That is, you must first notice the similarity between what you are currently trying to figure out and a past piece of knowledge. Once you believe you have noticed that a past problem might be similar to the current problem, you have to map the pieces of the original problem to the current problem you are trying to solve. The last step is then actually applying how you have linked the two problems together and solving the current problem.

I'm going to concentrate on that first step, noticing. It turns out that's the hardest of the three steps. What does it mean for two problems to be similar? How do you know when a past problem is going to help you solve the current problem? What causes you to remember or refer to a past problem as you are working on the current one? In a nutshell, we're not great at doing any of this. Some of this relates back to what I was talking about in the previous podcast concerning expertise. When we try to come up with a "similar" problem, we often base a lot of that similarity on surface features, what the problem is overtly about. If our current problem is about cars, then we are more likely to think of a past problem that also involves cars. To a novice, it doesn't matter if the current problem is a combinatorics problem and the car problem I just thought of was a permutation problem, I may still believe they are "similar" and map the features of the one problem onto the features of the other. In this particular case, I will probably get my current problem wrong. My undergraduate thesis advisor at the University of Illinois, Brian Ross, did a lot of research in this area. He examined what he referred to as "remindings" which is this process of noticing which problems are similar. And, he found time and again that remindings are often based on surface features, not deep structure, how you actually solve the problem.

It would be an interesting question to see how much this applies to games, both video games and board games. In the example I gave before, I was talking about deck builders. That's a mechanic, a deep structure. For these purposes, I guess I'm an expert at games, and so would classify games based on that kind of dimension, as I often hear other game players do. It might be an interesting experiment to do to see if you showed a novice game player say a deck builder with a fantasy theme, would they be more likely to say that a deck builder with a space theme or a worker placement with that same fantasy theme is more similar. Or, if the original game was a World War II third person shooter video game, would the more similar game be a World War II strategy game or a third person shooter set in space? It seems that in games the mechanics, the deep structure, might be more obvious and relevant to novices than in say probability problems, but that's an empirical question.

This of course all assumes that people even notice that two problems are similar. Gick and Holyoak with their research back in the early 1980s found that very often we fail to recognize two problems are similar, unless specifically prompted to do so. In a classic experiment, they gave participants a problem to solve. In the problem, a doctor is trying to figure out how to help a patient with an inoperable malignant tumor. The doctor has a device that can deliver a beam of radiation to the tumor, but if the doctor does so at a level sufficient to destroy the tumor, healthy tissue is also destroyed. The doctor needs to devise a way, using this device, to destroy the tumor. This is a hard problem, and only about 10 percent of people figure it out.

In one version of the experiment, Gick and Holyoak had participants read and memorize a story, under the guise that this is part of a memory experiment. The story is about a general who is tasked with taking out an enemy ruler, holed up in his fortress. The roads to the fortress are all mined, such that if the general took his troops down any one of them, the weight of all the troops will cause the mines to explode. The general splits his troops into several smaller groups, none of which are big enough to cause the mines to explode. Each group travels down their own separate road, meet at the enemy ruler's fortress, and successfully overtake the ruler.

You may be able to see how one can use the fortress problem to help solve the tumor problem. The doctor could use several low-dose beams of radiation, none of which by themselves could destroy healthy tissue, but they all intersect where the tumor is at, destroying it.

Having read the solution to the fortress problem before being asked to solve the tumor problem helps a little. About 30% of participants spontaneously note that the one can be used to help with the other, a bit better than the 10% that solved the tumor with no additional information. Before they allowed the participants to totally give up, Gick and Holyoak would simply prompt the participants to remember the fortress problem. That simple prompt, to merely remember the fortress problem, caused the lightbulb to go on, and with the prompt, the success rate goes up to 75%, over double the success without the small nudge.

On the surface, doctors and tumors don't have a lot in common with fortresses and enemy rulers. The majority of people don't make that connection. But, when prompted, they do so. Again, think about video games. As experts, we can probably pretty quickly look at a game and see what the basic mechanics are, third person shooter, real time strategy, or platformer. But, someone not at all into games may go mostly just by subject matter. Again, it would be an interesting empirical question.

Even though the research shows that we don't always make analogies when we should, that doesn't betray the main idea that I started with, that we use analogies a lot when game playing and in other parts of our lives. Like I mentioned in the beginning, just listen to a someone describing a new game, and more than likely they will make a comparison to at least one previous game they believe the listener might know. Analogies are extremely useful, and the research bears this out. I'll share with you one more study that makes this simple point. Stephen Reed and Cheryl Bolstad taught students algebra word problems in one of three ways: One condition was procedures only, giving the students good, abstract instruction on how to solve these problems. The second condition was examples only, nicely worked examples of similar problems they could analogize with, and the third condition was both the procedures and the

examples. Not surprisingly, the group that got both types of information did the best, scoring 42% overall—it must have been a pretty hard test. The question though is if you only had one source, which one should it be, examples or procedures? The examples only condition did not significantly differ from the condition that had both, scoring 34% on the test. The procedures group did by far the worst, scoring 15%. There are a whole host of studies that show that students really like learning from this type of analogy, worked examples, and do so better than most other types of instruction. Depending on the last time you had to do physics or math homework, that a common strategy students employ is to look back through the chapter and try to find a worked example to help them with their current problem, as opposed to carefully reading the procedure descriptions in the text. This goes for game playing too, when you are describing how to play Aeon's end in relation to how things work in Dominion.

So, when you describe a game in terms of another game, go for it! I believe the research bears this out, and again, we do this a lot when describing and teaching games to each other. Really lean into making those analogies, because using past knowledge to help learn new stuff is an efficient use of your cognitive resources.

That brings us to the close of this episode on analogy use. As always, I welcome any comments or questions you may have, so please email me, steve@cognitivegamer.com and also visit my website, cognitivegamer.com. Also, you can like me on Facebook, Cognitive Gamer, or follow me on Twitter, @cognitive_gamer. And, if you like the podcast, please give a rating in whatever service you use to play podcasts. Just like most dice rolls, higher is better better! This will make it easier for other people to discover. Until next time, remember to think about what you play, and have fun doing it.