



Ciara Greene on the quirks and complexities of human episodic memory

Greene's book, "Memory Lane: The Perfectly Imperfect Ways We Remember," explores the many factors that affect how we recall the events in our lives, from the mundane to the emotionally powerful.

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This transcript has been lightly edited for clarity; it may contain errors due to the transcription process.

Ciara Greene

I think one of the arguments we make in the book is that actually a lot of our memory problems aren't problems with memory itself, they're problems with what we expect our memories to do, a misunderstanding of what our memories can or should do. Memories are reconstructed and a side effect essentially of that sometimes is that you will incorporate misinformation or you'll reconstruct the memory in a way that isn't in line with the truth. It's just part and parcel of being a person. I think the problem there is the assumption again that the flaws and whatever in our memory are just glitches, that that's the system failing to act correctly. It's not like a little glitch in the code and a minor error, that's how our memory is fundamentally working.

[music]

Paul Middlebrooks

This is "Brain Inspired," powered by *The Transmitter*. One of my favorite memories was from when I was about 8 years old, and my parents took my brother and I on a snow skiing trip. We had skied during the day and night was upon us, and we were going to visit one of my dad's friends, and we walked out the door. My dad is a very fast walker, was a very fast walker. He was also a fairly large individual, wide, portly in some sense, but he carried his weight very well and he was a very fast walker. My brother and I were always striving to keep up with him whenever we were walking somewhere.

My brother and I were about 10 feet behind my dad as he's walking out the door. We were from the south, so we don't really know how to walk on ice very well, and that evening neither did my dad. My brother and I were watching my dad, trying to catch up, and all of a sudden, my dad flies into the air and just like a cartoon his legs start going back and forth really fast as if he's trying to run in midair but he's horizontal. He's just hanging in the air with those legs moving back and forth until he finally falls straight down onto the ground, right onto his back, onto the icy surface, and then lays there and starts grunting.

My brother and I, as good children do, immediately started laughing uncontrollably at Dad's foibles. That is one of my favorite memories. The problem is it didn't happen. It didn't happen exactly like that. My dad's not a cartoon. He didn't fly up into the air and stay up in the air in that horizontal fashion while his legs and feet violently swayed back and forth until he fell on the ground just like a cartoon. Why do I bring this up? As you know, we are on the precipice of building AGI, AGI, AGI. Pretty good sound effect, huh? AGI, Artificial General Intelligence, is artificial intelligence that is like humans but way better. One of the things that we can ask ourselves is, do we want to build AI that has human-like memory?

In this episode, Ciara Green joins me to discuss many of the ins and outs of said human memory. Ciara is an associate professor at the University of College Dublin School of Psychology, and she and her colleague Gillian Murphy recently wrote the book "Memory Lane: The Perfectly Imperfect Ways We Remember." One of the arguments they make throughout the book is that those flaws in our memories, those imperfections, as the subtitle would suggest, are features rather than bugs. That our memories have evolved to be the way that they are to help us function as we move forward in the world.

Throughout this discussion, we talk about many of the different ways that memories are "imperfect", and how those imperfections make sense when you think about what we need our memories for. We discuss things like how misinformation contributes to our memories, the reconstructive nature of memories. Every time we recall a memory, we're not just taking a little bit out of our brain and presenting it to our subjective awareness, we're actually reconstructing the entire memory based on the context that we're currently in, what we've experienced and learned since the events that took place formed our memory, the schema in which that memory has become consolidated, and so on.

We talk about the value of forgetting, how memories can be manipulated, implanted for lack of a better term, and many of these features and characteristics of memories are things that Ciara has studied in her own lab, and has gleaned from many other studies in many other labs. Of course, her book is filled with many more features that we don't cover in the discussion. A link to the book in the show notes at braininspired.co/podcast/206. Thank you for spending some time with me and Ciara today. Hope you enjoy the episode. Thank you to my Patreon supporters. You guys will be hearing from me soon. I have an idea about something that we could all do if you're interested in doing. I will leave it at that. You'll be hearing from me soon in the discord and in Patreon. Here is Ciara.

[transition]

We're going to talk about your book or ideas in your book and in your extensive research on memory. The book is called "Memory Lane: The Perfectly Imperfect Ways We Remember." I notoriously have a bad, well, what I used to call a bad memory. Then after reading your book, the idea of a good memory has shifted in my mind. Now I think I have a great memory because I can't remember anything.

Ciara Greene

I'm glad we had some effect on you. That's what we're hoping for. I think one of the big things that we're looking for with the book is that we want people to have a better understanding of their memory, but also just to be more understanding of what your memory can and can't do and just as much what it should and shouldn't do. That we shouldn't expect our memories to be computer programs or to be like a filing cabinet where everything is just stored. I think one of the arguments we make in the book is that actually a lot of our memory problems aren't problems with memory itself, they're problems with what we expect our memories to do. A misunderstanding of what our memories can or should do.

Paul Middlebrooks

You use this phrase "perfectly imperfect." This is just a very short quote from the book, "we argue that memory is imperfect, but perfectly imperfect. The flaws are the best and most interesting parts, giving us insight into how and why our memory works the way that it does." You were just alluding to that very concept, and man, our memory seems both robust and fragile, seems very fragile based on all the work that you write about in the book.

Ciara Greene

It is. I think what I would say is that memory is malleable, that memory can be changed and can be altered. It's very flexible. It's a maybe slightly more positive spin is to say that memory is very flexible.

Paul Middlebrooks

Mine is super flexible. That's great.

Ciara Greene

What it means is that sometimes what we're remembering might not necessarily be a perfect, exact recreation of the exact thing that actually happened. That's just not the way our memories are designed to work. If you think about how our memory works, memory is inherently reconstructive. When we remember something, we're not retrieving it from memory storage, we're actually actively rebuilding it. It's that really, I think, important idea that memory is an active process. It's not passive. You're not just the passive recipient of information that you just store and then you open a box and there it is and you take it back out again. It's active.

We actively engage in the process of building our memories and creating our memories. We do that to a purpose, not just in order to have a perfect encyclopedia of everything that ever happened to us. We use our memories in this very active way to access things as and when we need them and to use them for particular purposes. A lot of the time that means things like creating memories that will help support our social relationships or will help us think about ourselves in a slightly more positive light. It gives us a boost for our mental health, things like that.

I think it is that idea of, yes, we can say memory is fragile and I think what gets a lot of press is the really the negative consequences of that. They're very real. I wouldn't want to take away from those in any way. Probably the most famous example of that would be things like eyewitness memory failures where somebody identifies the wrong person as having committed a crime. Obviously, that's catastrophic for those people and has really, really huge consequences. I wouldn't want to suggest that that's nothing or to wave that away. I think that we need to recognize the value that memory is part and parcel of our evolved cognition.

Paul Middlebrooks

There you use the word evolved because a moment ago you said our memory isn't designed that way. Part of what you guys argue--

Ciara Greene

Yes, it's a shortcut.

Paul Middlebrooks

Yes, sure. You focus on evolution as a key way into understanding why our memory has evolved, why we have the kinds of memories and characteristics of our memories that we have. It is this reconstructive aspect and the adaption to function in the world and society and in our social situations and so on. You use the term reconstructive, right? You guys buy into the reconstructive story that memories are reconstructions, that we're not retrieving files from our brains, right?

Ciara Greene

Yes. Obviously, like in a pop science book, you're simplifying the science. There's a huge amount of behavioral evidence, but also neuroscientific evidence about this reconstructive nature of memory and essentially the shorthands and shortcuts that our brains use in order to help us build memory so that essentially, every time you encounter a new experience, you're not reinventing the wheel, you're not recording that entire memory like it's being laid down on tape and like you've never experienced anything like it before.

Every time you drive to work in the morning, you get up, you go out, you lock the door, you walk down the stairs, you go out to your car, you start the car, you drive out the driveway, you turn right, you follow these exact same steps. It would be a very inefficient use of storage, if you want to think in that computer metaphor, for us to lay down all of those things exactly the same way. Just the amount of duplication that would happen when we did that in our memories. Instead, a lot of the time, what happens when we're just in our normal day-to-day lives is our brains essentially recognize patterns, that we have these schemas. We think of them as a framework for how we lay down memory.

We recognize patterns in our day-to-day lives, in our experiences. Your brain, much like the way a JPEG-type program in a computer will say, "Hey, these are loads of pixels that are all blue. Rather than recording all of these individually as blue, blue, blue, blue, why not just say these ones are all the same?" Your brain essentially does something similar where it will do this sort of pattern recognition where it will say, "Okay, the structure of this memory is very similar to all my previous ones. I'm going to use all those previous ones, this schema as a structure, a framework that I'm going to hang this new event on."

What that helps us to do apart from just being efficient, what it helps us to do is to recognize commonalities across all of our different experiences. To recognize, for example, that every time you get out and go to work, that that isn't a completely unique experience, that there is a lot of overlap, and that there are things that you will expect to happen and equally things that you wouldn't expect to happen and that will jump out at you. That allows us to recognize and synthesize our experiences together, and to see the common themes between them, and to understand our lives in a slightly different way. We do have a good bit of understanding about how that happens in the brain. It's not really a mystery in that sense.

Paul Middlebrooks

Well now, it is somewhat of a mystery. As a neuroscientist, I'm comfortable with saying that.

Ciara Greene

I suppose, right. I would never say that all the answers are there. They're definitely not. There's still more research to be done. I think sometimes when people insist that, oh, in this very blank way, there's no such thing as false memory. All memories are real. I'm like, "No, we have quite a lot of evidence about this reconstructive nature of memory and how this works. For good and for ill."

As I say, that process has evolved mostly because, now drawing inferences about why something evolved is a notoriously tricky request. We can reach a fairly reasonable conclusion that our memories, and our memories is a very cognitively demanding and sort of energy demanding task, that we wouldn't have very detailed memories unless they served us in some way. That there was an evolutionary benefit to putting this level of energy and effort into creating memories in this way. That it's probably a fairly efficient use of our energy.

Paul Middlebrooks

I liked that you brought up schemas already because that's something that you focus on in the book. Then you revisit when you're talking about emotions and their effects on memories. The example that you gave, like driving to work, is one of essentially procedural memory. What I want to say is that what you focus on in the book is episodic memory, these event-type memories. During your drive to work, you are having those events, but they fit into the schema. You don't need to cache them away, right?

Ciara Greene

Yes.

Paul Middlebrooks

Then I immediately thought of the-- you guys write in the book about-- I don't remember the term. What are the people that have the super memories?

Ciara Greene

HSAMs. They're the highly superior autobiographical memory.

Paul Middlebrooks

There are people who can remember all the details of their drive to work, more or less. That's an overstatement, of course, but what's going on with them in regards to the schema that you were talking about?

Ciara Greene

They're quite rare, or at least there's been relatively few of these people, these we call HSAM for short. There's been relatively few of these people identified. The amount of research on them is relatively limited. What it seems to be the case, and I could be contradicted on this tomorrow, so we will see. What seems to be the case, what's going on with these people, these are people who do have these extraordinarily detailed and accurate episodic memories. People who, for example, if you said to them, "What was the weather like on the 27th of June 2011?" they could tell you, or like, "How much did you pay for your coffee Thursday, three months ago?"

Paul Middlebrooks

Is that more episodic or is that more semantic?

Ciara Greene

No, it's episodic. Actually, it's very much about autobiographical memory specifically. Autobiographical memory falls under, of course, episodic

memory, but it's a particular subset of episodic memory. It's very much only their autobiographical memory where they see this. They basically have no other benefits that are observed in other kinds of memory. Their procedural memories and their working memory, all that stuff is the same as you and me, there's no real benefit. It's just this very specific benefit in autobiographical memory.

Actually, what some of the research in this area suggests is that even though we refer to them as being highly superior, that in a way, or another way of looking at it is that what's really happening there is not a huge advantage to these people, but it's a failure of a really important process. It's a failure of forgetting, and a failure of that sort of synthesizing process of where we essentially extract the gist from all of our experiences and discard the specific details as being irrelevant a lot of the time. It's a more efficient way of allowing us to get to the gist of what's happening. This is the current theoretical thinking on this.

As I said, because they're a rare group, those individual people who have been identified have been very heavily studied, but there's not that many of them. As I say, we could end up finding out this is wrong, but at the moment, what seems to be the case is that it's not so much an advantage as it is a disadvantage, that it's a failure of the standard process of where we should be able to forget and to be able to leave details behind. We see that being important in emotional contexts.

For example, HSAM people will often talk about being completely unable to move on from, say, a breakup or bereavement because they're not able to put it behind them. Not that anybody ever forgets a breakup or forgets a bereavement, but you're able to move on and to forget every single detail, and to cast it in a nice, rosy light. In the same way, they'll often talk about being unable to ever let a grudge go because they can never really forget. You had that argument with your brother, and who doesn't argue with their siblings, and in order--

Paul Middlebrooks

Oh my God.

Ciara Greene

You have to be able to let it go. You have to be able to forget about it and decide that that's unimportant in the scheme of things. If you constantly remember every detail, it's very hard to do that.

Paul Middlebrooks

You don't want to be in an argument with someone like that either because they will remember all the details.

Ciara Greene

Oh yes. My brother has the memory of an elephant, but to be honest, I think his memory is wrong sometimes. Because the rest of us are like, "I'm not sure, I don't think that's right, but I don't remember it," and he's going, "I remember it."

Paul Middlebrooks

Oh God. There's the idea that time heals and that's because forgetting heals. I've been in lots of arguments, disagreements with friends over the years, and I'm always thankful when a little time goes by. I don't know if it's forgetting or accepting or a combination of the two, but then you can always come back together because you remember you love each other. Maybe you forget the real crux of your heated argument.

Ciara Greene

Yes. You can extract the gist of all of those many, many years of friendship and love and affection and all of that. Maybe those individual details are less important in that context.

Paul Middlebrooks

Right. Yes, that's good. I'm thankful that I'm not an HSAM.

Ciara Greene

Oh, me too. For most of these people, it doesn't really seem to have done them any particular good in their lives. They tend to have normal lives, normal careers, normal intelligence levels, normal earning potential.

Paul Middlebrooks

They're also normally susceptible to misinformation, right?

Ciara Greene

They are. Yes. To us, that's not a surprise. We've been involved in some research that's worked with some people in HSAM. Not we haven't worked with them directly, but we've been involved in some research working with those people where that's been involved in, that's been linked in with some of our research. Essentially, what you see is that people who have these highly superior autobiographical memories are just as susceptible to being misled by misinformation as anyone else. That's because the fundamental reconstructive nature of memory is still there. Even though they might not be boiling down their memories into this gist in the same way, they're still retrieving memories in these very particular ways that we all do.

We all reconstruct our memories when we retrieve them. We pull all those pieces together and rebuild them. We use this metaphor in the book of the Lego tower. We talk about memories, rather than being like a camera or being like a computer, that it's like a Lego tower. You're actively

building that tower whenever you remember something. People with HSAM are doing the same thing. They're also building that tower. They're just as susceptible as the rest of us to somebody essentially handing them a brick and saying, "Hey, I think this brick fits in your tower." Then we slot that in. Then we remember that particular detail that maybe wasn't in our memory, or we mix it up with something else.

Paul Middlebrooks

I want to get back to forgetting and schemas. What did you have for breakfast when you heard about 9/11? Was that you in the book?

Ciara Greene

It wasn't breakfast, but I was in Rome.

Paul Middlebrooks

That was your memory is that you came down in the morning.

Ciara Greene

I came down in the morning. My memory of 9/11, I was in Rome with my best friend. I was 18, which tells you my age. It was our first trip away by ourselves without adults because we were now worthy adults.

Paul Middlebrooks

Oh, yes, very salient. You're going to remember that as well.

Ciara Greene

Yes, absolutely. It was a big deal. We did all the things you do in Rome. On the morning of September 11th, we were staying in this hostel in the city center. We came downstairs, and into the central lobby of the hostel, there was a big TV hung up on the wall, high up on the wall. Everybody was standing around in the lobby and looking at the TV. We said, "Oh, what's going on?" Someone said, "Oh, well, a plane flew into the World Trade Center in New York." We stood there and went, "Oh my God." Everyone stood around and talked about it and said, "Oh God, it was like--" Somebody said, "Oh, it was like a small plane, I think, like a single-engine plane." Someone else said, "No, no, it was a passenger liner."

We were all like, "What happened? Did the pilot have a heart attack?" All that kind of thing. Then as we watched, the second plane flew in and hit. We saw that live. It was only many, many years later that I realized that my memory was wrong because, of course, if I remember this happening in the morning, there's a six-hour time difference between Rome and New York. I remember this happening in the morning, but the attacks, in fact, happened at 9:00 AM in New York time, which meant it had to be 3:00 PM in Rome. Most of my memory is accurate, but I had subbed in the idea that I knew those attacks happened in the morning.

My memory had become sort of contaminated by the information that I had that these attacks happened in the morning. I remembered it happening in the morning, in my morning. Of course, it was my afternoon. It's also worth noting that my friend, who was there as well, remembers this quite differently.

Paul Middlebrooks

Oh, really.

Ciara Greene

The same basic structure of us being there and watching it on TV.

Paul Middlebrooks

Same schema, yes.

Ciara Greene

Yes. She remembers different details and what people said. She says, "No, no, nobody said that thing." I'm like, "Yes, they did." We do both remember that event differently. We don't argue that it happened, that we learned about this on the TV in Rome, but the different details of it. I study memory for a living and I study memory reconstruction for a living. It was many, many years after I'd been doing that before I realized one of those core flashbulb memories. In fact, the time I realized it was wrong I was writing up a talk about flashbulb memories for a conference and I was talking about my flashbulb memory of Rome. Then I was like, "Wait, this can't be right."

Paul Middlebrooks

Wow. You were writing about it assuming it was accurate, right?

Ciara Greene

No, not necessarily. I was talking about a study we were doing about flashbulb memories generally. Flashbulb memories are those memories that are so clear and vivid that they seem like looking at a photograph. Most people might have them for something personal, like being in a car crash or the birth of your child, something like that. In research terms, we will often study them for big national or international events, things like 9/11. What we know about flashbulb memories is that they're just as susceptible to distortion and decay and everything else as normal memories.

I was introducing a study we had done on flashbulb memory and my little anecdotal hook to start the talk was like, "My flashbulb memory of 9/11 and why do people have flashbulb memories of 9/11, but they don't have flashbulb memories of the time the Ford Focus was released? Why does that not create a flashbulb memory for you?" It was an entry to talking about emotion and importance and media coverage and all that stuff. As I was writing that talk, I was like, "Oh, this core memory that I'm talking about here is actually wrong. I might need to incorporate that into my discussion."

Paul Middlebrooks

One of the many interesting tidbits that I hopefully remember from your book is about flashbulb memories and how they are susceptible to change. The big change, there are some core changes, core substitutions that happen in a year, and then it settles down and then you remember it the same over time. There's this trailing--

Ciara Greene

There was a fantastic study done by William Hearst and his colleagues who basically followed people. There's been lots of flashbulb memory studies, but this one was fantastic. They followed people up examining their memories of 9/11 over a course of 10 years. Within a few days of September 11th in 2001, they mobilized this big team and they got people out onto the university campuses, recruiting people, asking them about their memories of the event and also factual things like how many planes were there and things like that, but also their memories of their own experiences, like where they were at the time, who they told first, how they felt, a lot of that kind of thing.

They followed them up over a period of 10 years and they examined how their memories changed. For factual things like how many planes were there and where did they crash and so on, you can actually evaluate the accuracy of that. For somebody saying something like, "I was in the kitchen folding laundry," we can't evaluate the accuracy, but what you can do is evaluate the consistency. Whether people still say the same thing next week or in six months or in six years. Essentially, what they found was that consistency for those flashbulb memories declined quite sharply within the first year.

People's memories would flex and change and adapt while there was still a huge amount of coverage, of course, going on. The incident was being talked about really extensively. After about a year, those memories had crystallized and then people would continue to tell the same story. It is, I think, that element of it being a story.

Paul Middlebrooks

The fish gets bigger and yes.

Ciara Greene

Yes. Everyone has their story and they tell it the same way.

Paul Middlebrooks

There were some sort of inconsequential and surprising changes like someone changing their memory from driving a car to making breakfast when they found out or something like that just don't have any usefulness, I feel, to the story.

Ciara Greene

Yes. We have absolutely no way of knowing why that individual person's memory changed. It might have been that they encountered something else somebody said. It might have been misinformation. Somebody said something to them in the meantime. It might have been that they incorporated details from someone else's account of the day. They might have mixed it up with later on they were driving in the car and they were hearing about it, or later on they were listening to it on the radio while they made breakfast and then they mixed up those two very similar memories together.

We don't really know what it is that caused that particular person's memory to change. What we do know is that those changes do happen, but that they will tend to happen within that first year. Then after that, you've pretty much sort of settled on your story and then you're going to keep telling that story.

Paul Middlebrooks

All right. Let's go back for just a second because this is related to forgetting and schemas. We were talking about HSAM people and how they are unable to forget. Then I thought, okay, so normally when you think of forgetting, you think of something that sort of degrades or just disappears. The way that you perhaps understand it, and correct me if I'm wrong, it is forgetting more of a consolidation or a compression into the schema. How do you conceptualize forgetting?

Ciara Greene

It's a really good question. Traditionally, when people talk about forgetting, what they're talking about is decay. The idea that just over time, a memory just disappears and that it's literally a function of time. Actually, you'd see things like say the Ebbinghaus forgetting curve and so on, where it's just this slow curve and that eventually bottoms out and people just forget over time. What we know now, of course, is that a big part of what happens with forgetting is not just decay. Decay happens. It does happen. People will forget things over time. A lot of what's happening with decay is essentially that process of deciding what's the gist and what's irrelevant and boiling things down into the essential parts that will get filed away. That sort of pattern completion process in the hippocampus and then things get created in that way.

Another really important part in forgetting is interference. I think that's the part that was often neglected with the earlier studies of decay theory is this idea that when we think about information, any piece of information, whether it's an episodic event in your life or whether it's a list of words that you've been told to learn off, whatever it is, a lot of those earlier studies would have focused on that information in isolation. Let me just give you that information, it sits in a vacuum, and then you repeat it back to me later on. In the real world, that's not what happens.

Paul Middlebrooks

Ever. Never.

Ciara Greene

Never. You're exposed to some piece of information, whether it's an experience in your life, whatever it is. That is not on its own. That's not in a vacuum. That is going to be influenced by your existing knowledge and information. Essentially, you're existing schemas about the world that will affect literally how you process that information in the first place. That can interfere with it in this proactive way where old information will change how you will store the new information. Then we also have this retroactive interference, which is essentially misinformation, where new information will come along and will alter the way in which you're laying down or storing or consolidating that previous piece of information.

Paul Middlebrooks

It doesn't have to be misinformation to alter the memory, right?

Ciara Greene

No, it doesn't. Misinformation would often be talked about in that context of retroactive interference. It's a subset of retroactive interference. Of course, no, it doesn't have to be misinformation. This is actually a really good point to note. One of the good reasons probably why our memories are so flexible is that we can often update them with better information, with true information.

Paul Middlebrooks

Why would you want to update a memory with true information rather than just your current?

Ciara Greene

I suppose it comes back again to, what's a memory for?

Paul Middlebrooks

What is a memory for, Ciara?

Ciara Greene

This is the kind of question we're trying to grapple with in the book, really. We talk about what memory is, but also what memory is for, and we're not the first people to ask that question. Really, what we would say is, if we try to take this evolutionary perspective and say, "From an evolutionary perspective, everything is really about survival and reproduction." We can consider that in a very fairly broad way. We can consider survival in terms of forming stronger social networks improves your chances of survival, improves your health, it improves all kinds of things.

We could often think about, we can update memories in order to strengthen our social connections, to strengthen our sense of social identity and a variety of things like that. Often updating your memories with more accurate information is maybe a more practical use of memory. If the purpose of memory isn't to be a recording device, if the purpose of memory is to serve you in some way and to help you live your life, then maybe updating that with somebody else comes along and says, "No, no, no. Do you not remember? We weren't in the car. We were in the kitchen and we were listening to it on the radio," and you go, "Oh yes, no, I think I remember that now." Now your memory is now updated.

Then a third person comes along and goes, "No, I definitely remember you were in the kitchen because I rang you and you were both there." Now you've got a consensus saying, "My original recollection was wrong. Now I've got a consensus saying, actually, this information is more accurate." In this very active way, you'd start to search your memory and piece together those different elements. Now you create a memory that maybe has this piece that actually I was in the kitchen, I wasn't in the car. Now your memory is updated and maybe that's more in line with members of your social group, but also maybe it's more useful for you.

Paul Middlebrooks

In the very last chapter, you guys talk about, what do you do with all this information, all that we've learned from memory? One of the things is just being humble about your own memory, but in this situation that you just described, one could react with just throwing up their hand saying, "It doesn't matter because evolution has served this purpose for me and I must be remembering whatever I'm remembering, right or wrong, for some sort of usefulness for myself moving forward. Who cares?"

Ciara Greene

I never think that. There's a very important distinction. When we think about evolutionary stuff in particular, there's a really important distinction when we think about like from a scientific perspective learning about this because it's interesting. That doesn't mean that it necessarily has any value in terms of how we apply it now. This is outdated science, but, for example, you might have people saying, "There's no evolutionary reason why homosexuality should exist because that doesn't serve reproduction." You might investigate that from a scientific perspective, "Oh, what might the scientific purpose of it be?"

That's really interesting as a scientific question, but it's completely divorced from the social modern question of treating all people with respect and dignity. That's completely independent of whether or not you discover that there is a biological imperative, it's irrelevant in that sense. I would apply the same thing when we're talking about memory, that from a scientific perspective, it's really interesting to think about how these things came about and why and what the purpose is. We live in this society and at the end of the day, we live with other people and we use our memories in a way that the society has agreed that we use them.

We still have to live in that society, assuming that's what we choose to do. We still have to engage with other people in ways where we try to be honest with them and expect them to be honest with us as that sort of social contract. I would always push back a little bit on that argument that, if evolution says it's okay, that means it's morally or socially okay because those are different questions.

Paul Middlebrooks

That also gives evolution a normative view of evolution that's driving towards something in particular.

Ciara Greene

Exactly. There's no goal to evolution. Problematic fave, but I always loved back in the old days when Richard Dawkins used to talk about this idea of Mount Improbable.

Paul Middlebrooks

Of what improbable?

Ciara Greene

Mount Improbable.

Paul Middlebrooks

Mount Improbable. Oh, like a mountain. Okay.

Ciara Greene

He would use this metaphor of a mountain with all of these different peaks for evolution and how the goal in evolution is always to just keep climbing upwards. You have absolutely no idea what's going up. At any point climbing up this mountain, you might reach a fork in the path, and you can either go left or right. If you go left, you're going to end up in a dead end, but you have no way of knowing that at the time. Those are equally valid choices. Evolution has no foresight.

Paul Middlebrooks

Right. The vast majority of trails do lead to death of the species.

Ciara Greene

Yes, exactly.

Paul Middlebrooks

Do not trust evolution.

Ciara Greene

You don't want to fall into the trap of anthropomorphizing evolution.

Paul Middlebrooks

All right. There's a ton more fun examples for us to talk about, but overarching all of this is just-- I don't know how your conception of memory has changed, but now I'm somewhat confused about what the term good memory is. What do you consider a good memory?

Ciara Greene

You're going to hate this answer, but it depends.

Paul Middlebrooks

You scientists, you're all alike.

Ciara Greene

It depends on the context. It depends on what it is you're trying to achieve.

Paul Middlebrooks

It's not so simple as a good memory is the ability to recall accurately an event. That's not what you would call a good memory.

Ciara Greene

No, not necessarily. You might come back to those HSAM people and say, "Those are people who can accurately recall an event," but that doesn't

necessarily mean that that's a properly functioning memory. I would also say that when people talk about a good memory, sometimes they're talking about function and sometimes they're talking about processes and people can use that in very different ways. Sometimes when people are talking about like, "Oh, well, I have a good memory," sometimes they mean I can remember everything that ever happened to me. Sometimes they mean I've got a good memory for faces. Sometimes they're talking about things like dementia, like I'm becoming forgetful.

Perspective memory stuff. I had planned to go to the post office and I forgot to do it, or I forgot where I put my keys. There's a lot of different kinds of things that people mean when they talk about good memory. I don't think it's a particularly useful term in that sense. Also, of course, as you well know, there are a huge variety of different kinds of memory. Somebody who's has a fantastic working memory. Someone who's able to reel off a big long list of digits and then repeat them back later on, that can be really valuable in some areas, but that doesn't necessarily mean that your autobiographical memory is good or accurate or detailed or vivid or anything else. It varies. It depends.

Paul Middlebrooks

For you personally, how has it shaped your own memory and just, I'm going to use the word ontological, the nature of memory? Are you easier on yourself now than you were 20 years ago, for example? How has it changed?

Ciara Greene

In some ways, I definitely am. I think the thing is, you find yourself in a position where you second-guess everything.

Paul Middlebrooks

Yes, right. You're second-guessing, but this goes back to my throwing up the hands. Does it matter that I'm even second-guessing?

Ciara Greene

Sometimes that's fine, but I think sometimes as well, it's like the uncertainty principle thing of like, if something is observed, it's not operating in the way it would normally do. I feel like I'm constantly observing my own memory.

Paul Middlebrooks

By observing it, you change it because of the reconstructive nature.

Ciara Greene

Yes, exactly. I think I find it very difficult to not be constantly thinking about and reflecting on the nature of my own memory, whether that's memories of family or memories of what happened last week or whatever it is. By doing that, I'm interfering with its operations. It's very hard to know that. I do think I've become a lot more understanding of everybody's memory foibles. I think a key thing that I think is really important is we tend to think that if our memories disagree with someone else, that that person is lying to us.

Paul Middlebrooks

Oh, so this has to do with intentions.

Ciara Greene

Yes, exactly. I think a lot of the time it's that idea that like, if you're applying that kind of humility to yourself or that grace to yourself, that you could apply it to other people as well and recognize that sometimes somebody, even if they're a politician or whatever, that if somebody's memory doesn't accord with yours, they're not necessarily lying. They might be mistaken or you might be mistaken. I would give people that grace to say we shouldn't expect that everybody's memory should be perfect and we shouldn't hold them to an impossible standard.

Paul Middlebrooks

I agree with that, but then it's a slippery slope because if someone is lying, then you're giving them the ability to affect you by giving them the benefit of the doubt. This is a fine line.

Ciara Greene

It is in general. Actually, it's something that Gillian and I have talked about a lot. I don't know if we want to get into this whole thing. We do a lot of research in the area of false memory. People forming memories for events that didn't happen. This is a very, very sensitive area for very good reason. It's something that we give a lot of thought to. When we study things like, oh, well, how people can form a false memory of a traumatic event or something like that. Are we essentially giving solace to the enemy here? Are we giving a get out of jail free card to somebody who might use that research to--

Paul Middlebrooks

You could bring any expert in. Yes, put any expert on the stand and say, "Just bring up Ciara's research and you will be not guilty."

Ciara Greene

Yes, and we think about that a lot. Honestly, I think all scientists who work in an area like that have an ethical obligation to think about that and to think about the consequences of how your research can be used. On the one hand, you can say, "Look, science is science." You have to ask these questions and you can't burden yourself with thinking about how someone might use them. That's a valid way thinking about it. Sometimes you have to take that view or else you'd never move forward. You'd just be constantly stuck with all the possible outcomes of how somebody might misuse your work.

I think sometimes you have to try and take, I don't know, some kind of steps to try and remediate things a little bit as well. For example, we have an ongoing project where we're looking at the tendency for when people form false memories regarding, say, sexual assault. Typically, when people study that, they will only look at the memory of the complainant, so the putative victim. We are also studying the memory of the defendant there as well as the fugitive - the accused. We're studying that, too. Actually, what we're finding is that both parties' memories are equally susceptible to distortion.

We think that's actually a really important corrective because I think it can be very easy to say, "The very minute you become somebody who goes to the police or gets up on the stand and says someone did something to me, now your memory is fundamentally unreliable." What we would say is no more unreliable than anyone else's. All our memories are unreliable. It's very important that when people give expert witness testimony, it's really important to do that and to talk about mistaken identification and how people's memories can be altered in these really dramatic ways for things that happen.

I think it's also important to correct that and say, "It's not only one person whose memory is subject to that." Everyone's memory involved in this is subject to that, too, including the person who is saying, "Oh, well, I had total consent to engage in this activity," or whatever it might be. They may be lying, I have no way of knowing, but their memory is often faulty.

Paul Middlebrooks

That's right. Memory is part of that problem, but so is interpretation in that moment. If you misinterpret consent, then that is going to inform your memory.

Ciara Greene

Yes. The context in which you experience things. Absolutely, it will, yes. These things are obviously extremely naughty and we're not going to start talking--

Paul Middlebrooks

We'll come back to a less naughty example in a second. I want to talk about the mall example.

Ciara Greene

The mall example was intentionally chosen as a less traumatic analog for this.

Paul Middlebrooks

This has to do with how emotions affect the saliency of our memories, right?

Ciara Greene

Yes.

Paul Middlebrooks

This goes back to context is everything.

Ciara Greene

It does. Exactly. The context in which you experience things, it comes back to schemas. Again, not to bring everything back to schemas, but a confirmation bias idea more broadly that the context in which you experience something will hugely influence how you interpret that. Then the elements of that that you'll remember and how you'll encode that memory, all of that. To take that idea, somebody going into a situation genuinely convinced that there is consent, that their memory of that event probably will be different to somebody else's. All of this, of course, is assuming that nobody is lying. Of course, a lot of the time in various cases, people lie.

Paul Middlebrooks

Never the case.

Ciara Greene

We have absolutely no insight into whether someone is telling the truth or not about something. What we can talk about is theoretically, is it possible that your memory could be distorted?

Paul Middlebrooks

That's all you need on the stand, right?

Ciara Greene

Yes.

Paul Middlebrooks

Is it possible? Then it's not beyond a reasonable doubt, which is the criteria for.

Ciara Greene

That's for a jury to decide.

Paul Middlebrooks

Oh my God, I don't know this jury.

Ciara Greene

I know. I know. Jesus, the jury's-- Yes.

Paul Middlebrooks

That's a separate thing.

Ciara Greene

Yes, that's a whole separate issue that we won't get into now. It's something that honestly we give a huge amount of thought to, is answering questions that when you look at them on the one hand are really important. Even just like from a social justice perspective are really, really important. Then when you look at them sometimes from the other side, you're like, "God, could that cause harm? Could that cause damage?" The only way you can do this to an extent is to say-- Sometimes you have to ignore that question. You have to answer with science.

Then I think you also have a responsibility, in addition to doing that, to think about ways in which that can be interpreted. Part of that maybe is about guiding the interpretation of your work. In things like press releases or these kinds of podcasts, things like that, like talking about how the work can and should be interpreted. I think it's really important. I think we have a moral obligation, all scientists do, to think about not to stop doing the work, but to think about how it might be applied, how it might be used.

Paul Middlebrooks

However, I talk about this with some of my science friends. There's the science itself and then there's the extra step when you publish a paper, when you go on a podcast of the interpretation. In the end, it's always a story separate from the data or built on the data and the analyses. You can't dictate what story people tell themselves based on your own data. You're saying you have an obligation to tell your version of the interpretation.

Ciara Greene

Absolutely. Look, if I learned anything as a memory scientist is that I know for a fact that I cannot implant directly information that I believe into someone's mind and expect it to be repeated back verbatim. Even when we do these memory implantation studies, what you're really doing is asking somebody to incorporate that into their own pre-existing memories and to construct a memory around it. If I publish a paper and someone reads a summary of that in a newspaper or whatever, I have no control over how they will interpret that, how that will fit in with their pre-existing beliefs, their own experience, their political ideology, all of those things. I have no control over that.

You can't expect to have control over that. People are allowed to make up their own minds. Even if I don't agree with them, they're allowed to make their own decisions. What I can do is to try and be as clear and transparent when we write things about what they mean, what we mean by them. Maybe we're wide-ranging here, but I think it's part of it. Gillian and I both have a strong view when it comes to writing scientific papers that we don't go in for jargon, that we try to write things as clearly as possible in clear language, that you're not leaving things open to interpretation, that you're not saying there's some kind of shibboleth that only scientists are allowed to read this.

Paul Middlebrooks

How's that working for you? Because people will still do what they want with it.

Ciara Greene

They will. They will always. I teach a class on it actually for public health stuff. I take a paper, the particular paper that we publish, and then I track how that paper got reported in the media, and how the narrative shifts. You do your best, but you can't control that. Journalists or whatever, naturally enough, will be looking for the hook. We might be saying, "This is the really interesting thing." They're going, "Yes, I know. This is the part we want to talk about."

Paul Middlebrooks

Of course. Given the ethical implications of your research and the interpretations that people will run with, do you ever think maybe you should have gone into a different line of work? Does it ever get to that point?

Ciara Greene

No, not for a minute.

Paul Middlebrooks

You like the attention.

Ciara Greene

No, I love my work. I love it. Several years ago, maybe 10, 12 years ago, I was getting into a rut research wise and I was getting bored of what I was doing. Then we started working on a lot of this memory reconstruction stuff.

Paul Middlebrooks

It's juicy.

Ciara Greene

Yes, it's interesting.

Paul Middlebrooks

It's super interesting.

Ciara Greene

It's scientifically interesting. It's interesting in an applied context. I love it. Also, to be honest, this is going to sound maybe a little bit, I don't know, but if I'm thinking about the ethics of it and potential ethical quandaries, I'd rather that somebody who is thinking about that is doing it than someone who's not thinking about that.

Paul Middlebrooks

Those people are in Silicon Valley. How do I know you're not gaslighting me right now? No.

Ciara Greene

I could be playing 5D chess here.

Paul Middlebrooks

That's right. No, I can tell, you're too simple for that. No, just kidding. Let's take a step back from the edge, from the cliff. One of the things that you guys write about and I really appreciate is you did this big replication study about implanting false memories. I guess there's a fairly famous small based study where false memories were implanted in kids--

Ciara Greene

Oh, no. In adults about their childhood.

Paul Middlebrooks

Adults about their childhood. This was originally done by Elizabeth Loftus.

Ciara Greene

It was Elizabeth Loftus and Jacqueline Pickrell did the original study in 1995.

Paul Middlebrooks

Okay. You refer to Elizabeth Loftus a lot. Maybe, can you just take a second to say why you reference her so much and what her--

Ciara Greene

Yes. A little bit of Beth is how she goes, but she was just this incredibly enormously influential memory researcher. In the 1970s, she ran some of the very first studies investigating memory distortion. You probably have heard of some of the-- probably most people have heard of some of her earlier, very famous studies where, for example, you'd have people watch like a reconstruction of a car crash and then you'd ask them how fast the cars were going. You might say, "How fast was the car going when it made contact with the other car? How fast was it going when it smashed into the other car?" When people hear those more active verbs like smash, they estimate a higher speed.

This was very early work, like on 1974 or so. This was really showing that that very simple changing just one word in a question, like in a legal setting, could really quite dramatically alter people's memory. People were estimating in that original study that the car was going about 10 miles an hour faster when they heard smashed versus when they heard contacted. Of course, that could have huge legal consequences. That was the beginning.

Then, Beth and her colleagues did a lot of work studying all these different ways of memory distortion and talking about leading questions and eyewitness identification and all of that kind of stuff. It's very, very legal context and jurisprudential context. Then that all was going fine through the '70s and the '80s. Then in the late '80s and into the '90s, we had, well, the satanic panic. Have you heard of the satanic panic?

Paul Middlebrooks

I think so, but refresh my memory.

Ciara Greene

Satanic panic is the term that's given to this period of largely American history, but it was also in the UK and in various other places where there was this media driven belief that there were satanic cults operating and that they were abusing people and sexually abusing children and that people were being kidnapped by satanic cults and being put through all of these really elaborate and abusive rituals. There was essentially no evidence for it, but there was this big moral panic that built up around it.

There were a couple of very famous cases. There was a very famous case of the McMartin Preschool, and it was actually the biggest and most expensive trial in US history where, essentially, I don't want to go into incredibly long detail about it, but essentially, somebody had made a potential complaint about potential sexual abuse at a preschool. The police then hired some interviewers to interview all of the children and sent this really suggestive letter out to the parents saying that their children might have been abused. They were very small children.

Then they use these incredibly suggestive interviewing techniques to interview all of the children and essentially would say to them like, "Oh, we'll try again and give me the right answer," and it would really push them into giving these answers. A lot of the accusations that ended up going to trial were things like the children, like somebody flew through the air and the children were flown on a helicopter and forced to engage in all kinds of animal based ritualized abuse, that there was these rituals taking place in these underground rooms beneath the school, but the excavation, there were no underground rooms. There was all these really elaborate things, flying through the air, like magical stuff happening, stuff that like.

Some of it was slightly more mundane, but a lot of it was just this incredibly fantastical stuff that couldn't have happened. In the heel of the hunt, essentially, there were absolutely no convictions, even though people spent years in prison awaiting trial. There were no convictions because there was no evidence other than the witness statements from the very small children that were elicited through these incredibly suggestive methods.

In the context of all of this stuff, Beth and a couple of other people had started talking about, well, maybe some of the recollections that people have, and they were talking a lot as well about this idea of recovered memories of people recovering memories of childhood abuse.

Paul Middlebrooks

That they had repressed.

Ciara Greene

That they had previously repressed, exactly. There was a lot of discussion then, they called it the memory wars. There was a lot of discussion about how memory works. Beth was one of the leaders of this, but there were other people as well, who were strongly arguing that repression and so on is just not how memory works. Arguing that it was, based on the work that they had done looking at memory distortion, that some of these might be false memories.

Paul Middlebrooks

I think you suggest in the book that it seems that she's been fairly controversial. Is this where the controversy sort of--

Ciara Greene

This is where the controversy began. Prior to that, it was all fairly not very uncontroversial. This is all where it began. Essentially, some people said-- Beth and some other people had written some papers saying, "Hey, of these recovered memories, we think a lot of them might not be real. They might be false memories, particularly elicited again in therapy, using hypnosis and using truth serum type drugs, like sodium amytal, things like that we make people very suggestible." They said, "Look, we think some of these might be false memories."

Other people responded and quite reasonably said, "Right, but the only evidence you have is about people's memories for the speed of a car crash being distorted." It's a huge leap to go from, "Oh, well, I remember the car was going at 70 kilometers an hour versus 50 kilometers an hour." It's a big leap to go from that to, "Well, I remember that I was sexually abused." That's a massive leap. They said, "Yes, actually, that's a totally fair point."

They, and then some other people started doing work where they tried to see whether can you actually implant essentially a memory of an event, of a childhood event, that never happened into the mind of an adult, so that the way they went about doing this in the original mall study was they recruited a load of college students essentially, and then they recruited their older relatives, mostly their parents.

They said to the parents, "Okay, tell us some information about your child when they were about five, give us some true stories about their, things that happened to them when they were about that age." Then they also asked them things like, "Where did you used to go shopping when your child was young? Who would have gone along? What shops would have appealed to them?" Things like that. Then using that, they created a false thing of like, "When you were five, you were shopping with your family. You got lost. You got very upset. An old lady found you and brought you back to your family." They confirmed with the parents that this hadn't really happened.

Then over the course of a couple of interviews, they asked people about some of the true events that the parents had told them about things like, "All the time, we went on a holiday in a caravan and it rained and my shoes got wet," things like that, real events that had happened, or, "We went on a roller coaster and I threw up." Then they mixed in with that, the fake event that you got lost in the shopping center. They would ask people to think about their memories and try and bring it back to them using these kinds of slightly suggestive techniques. What they found was by the end of this protocol, about a quarter of their participants remembered having gotten lost in the shopping center, lost in the mall.

Paul Middlebrooks

Claimed to remember anyway.

Ciara Greene

Not that they claimed to remember that they talked about the details. They went with these things. It's not just that someone says, "Yes, I remember this." It's you code the transcript in the interview so that they talk about the details of their memory. "Oh, yes, I remember the old lady

and she was wearing brown trousers and she had a blue coat and I was crying." She said, "I went back to my mom. My mom said, 'Don't ever do that again.'"

Paul Middlebrooks

Those details that were false and suggested within the context of other things that were true then became part of their memory.

Ciara Greene

Exactly. Then, and I think one of the things I was mentioning there earlier on about this idea that you can't-- I was talking about it in the context of a press release or something, but the same thing really applies here. I think what's important when we think about these kinds of implanted memories is I think implantation is actually the wrong word--

Paul Middlebrooks

It's the wrong word, yes.

Ciara Greene

--because it's what tends to get used for-- I think it's the wrong word. It tends to mean that to suggest that I'm literally taking a piece of information and I'm slotting it directly into your mind. That's not how it works. It's this active process where you hear the participants start saying, "Oh, I didn't remember that, but then I've been thinking about it. Now I think actually, I remember that shopping center, and yes." They'll start to construct it and they'll build it in and fill in the blanks, essentially, with details from their own experience. That was the original lost in the mall study. There were loads of other ones around the same time as well.

Ira Hyman did a really cool one and where people remembered-- Ira Hyman is a colleague of ours, he's in the University of Western Washington. He did a really cool one where they got people to remember spilling a bowl of punch on the parents of the bride at a wedding and stuff like that. Kim Wade and her colleagues have done a lot of ones where they've persuaded people or gotten people to remember going on a hot air balloon ride as a child, things like that. Because they're really time-consuming, they're really hard to do, they were fairly small samples.

Paul Middlebrooks

Is that why you felt compelled to then--

Ciara Greene

There were a couple of reasons. Essentially, yes, there's not been a huge number of-- there's been several of these studies, like a substantial number, but they are very, very time-consuming and they're very labor-intensive. There haven't been a huge number of them and they've all been relatively small. That leads open various questions about the results.

The mall study in particular, because it was the first one and because Beth Loftus often gives testimony and so on, that one tends to get picked apart more than the others, and because it was the first effort at this methodology, it wasn't perfect. There were lots of various flaws in the study. It was an effort to see, "Hey, can we do this?" It wasn't in any way perfect. We said, "It'd be interesting if we tried to replicate that, if we tried to fix some of the problems, if we tried to do it with a larger sample, pre-register all of our goals, like there's no moving the goalposts later, we're really clear about what it is we're looking for, how we're going to measure everything."

Paul Middlebrooks

Was this during the replication crisis, the great replication crisis in psychology?

Ciara Greene

Well, I suppose we're still during it, if you want to think about it.

Paul Middlebrooks

Yes. You're helping fix it, which is great.

Ciara Greene

Yes. Also, well, on the nature of the replication crisis, I would always say, because I always want to say this to my students as well, psychology is not the only place that has a replication crisis. Psychology is just the field that's dealing with it.

Paul Middlebrooks

Neuroscience has it as well, for sure.

Ciara Greene

Yes. The psychology is grasping the nettle, and really trying to do something about it. No, it was a big part of that was saying like, "Yes, we should be able to replicate this." Honestly, we were saying like this project took us a full year to do, and we were saying, it'd be really interesting either way, if we replicate it, we'll be like, "Yes, look, it's stronger evidence for something we already had good reason to think was true. If we don't, that'll also be really interesting."

We replicated this with-- we had a whole gang of master's students working on it with us across. I'm in University College Dublin, Gillian is in University College Cork. We had our students across both universities, so we were recruiting from around Ireland, and we got about 120 pairs of participants in the end. Participants and their parent, which is a substantial number. It took us a full year to do.

Paul Middlebrooks

It's that big, yes.

Ciara Greene

It took us a really long time. You have to recruit the parents, then you recruit the participant. There's various surveys, then you interview them once with a week or two gap in between. It's very, very intensive. As closely as possible, we followed the original protocol from the Loftus and Pickrell study, but we filled in holes where we thought that the methodology was a bit weak. We improved how we coded, what a memory was, things like that.

We found essentially in our top line analysis, when we code people's transcripts, so how people are describing the event, we coded it that 35% of people were coded as having a false memory for the getting lost event. We also asked people at the end, we added an extra bit where we asked them straight out, "Do you remember this event for each of the four events?" We asked them, it's a three true and one fake. There we found it was a smaller number. Only 14% said straight out, "Yes, I remember it." An additional 52% of people told us they believed it happened. Two-thirds of our participants in total, so 66%.

Paul Middlebrooks

I don't remember it, but I believe it must've happened.

Ciara Greene

Yes, so that they didn't, they think. We asked them all kinds of questions like, "Would you testify on the basis of this?" They were saying, "Yes," 9 out of 10, "Definitely, I would testify this happened."

Paul Middlebrooks

It's scary. It's a little scary, but these are things that we already know.

Ciara Greene

Yes, we just now know it with a little bit more certainty and a little bit-- we've got a little bit more confidence in the results. It was nice. We really enjoyed running it. Just even looking at all the transcripts. I really have to say an enormous thank you to all the participants who took part in this, because it asks a lot of the participants as well, and of course, they don't know in advance what we're doing.

Paul Middlebrooks

They have to trust you.

Ciara Greene

Yes. We tell them that we're studying childhood memories, but of course, they don't know in advance that we're studying false memories.

Paul Middlebrooks

Yes. One more thing. Then, because I want to keep on this line of thought, but going back to the courtroom, I really enjoy watching interrogations of accused people, and the interrogator, if they're good, will use these tactics to misinform or mislead a subject, and almost every interrogation I watch, it's not like I'm just sitting watching interrogations all day, but I think about this, how the way that they're asking the questions, the frame, the suggestiveness of the way that they're asking totally has to affect the person's memory of what happened. It almost should be illegal, it seems like.

Ciara Greene

Well, in a lot of jurisdictions, it is.

Paul Middlebrooks

There are always loopholes, right? You can push it so far and they're going to take it to that limit.

Ciara Greene

In the US, for example, police are explicitly allowed to lie to a suspect.

Paul Middlebrooks

Yes. Right. They are. It's crazy.

Ciara Greene

A lot of other places.

Paul Middlebrooks

There are like instances where an interrogator will say, "Well, we have video," and there's no video right of you doing this. These are instances of innocent people. The person's like, "Great, you have the video that show me being innocent," and then you can tell they get confused and start second guessing themselves. It just seems awful.

Ciara Greene

This is where you get into false confessions stuff, and the false confessions literature is really interesting. Some of it is memory stuff, and there was a really cool paper. Wade and Porter did this study where they basically got people to form false memories of having gotten in trouble with the police when they were a teenager and having been arrested and questioned by the police. Really detailed like stuff. As a teenager, not as a small child.

I think in like in the real world, with false confessions, which happen really a lot, actually, there's memory elements, but a lot of it as well is just that thing of people being interviewed for 24 hours and just beaten down and then just being so confused and tired and just saying anything to get out of there, or genuinely coming to believe that they must be wrong, that they remember that they must be wrong. That's a huge problem in itself.

Paul Middlebrooks

Of course. I just realized that these won't be problems moving forward with our entire lives will be captured on cell phone video and photos, right?

Ciara Greene

Unless you want to talk about deep fakes.

Paul Middlebrooks

Oh, okay. No, we'll come back to that because I want to get to the AI line of questioning a little bit. Going back to my mother, I feel like I'm in a psychotherapy now.

Ciara Greene

Therapy session.

Paul Middlebrooks

No, but I personally feel like when I'm telling a story from my past and trying to recall things, that I question how much of it I'm confabulating. As I'm speaking to you to you right now, I don't know where these words are coming from and how it gets from, "Oh, did I intend to do this line of questioning," and just how the words are spilling out. Then I wonder how much I'm confabulating. In fact, you guys quote Mark Twain in the book saying, "Never let the truth get in the way of a good story," I believe.

Ciara Greene

Which is, I think it should be the Irish motto.

Paul Middlebrooks

Oh, is that right? Yes. Right. There's that. There's the reconstructive aspect of memory. What I want to ask about is the link, the possible link between memory and imagination, because some people think memory is for imagining.

Ciara Greene

There is definitely a link between memory and imagination.

Paul Middlebrooks

Then also confabulation. I'm wondering, are people who are high confabulators also high creatives? My mom's a pretty creative person. She has to be pretty creative to lie as much as she-- to confabulate as much as she does.

Ciara Greene

I can't answer that one directly. I don't know for a fact about relationships between creativity and confabulation, but there is definitely a link with creativity and memory.

Paul Middlebrooks

What's that link? What I'm going to guess is that the worse your memory is, the more creative you are or something like that.

Ciara Greene

No, it's not that. It's more that it's the same constructive process that like goes into, say, if you were thinking about, you went on holiday last summer and you went to Spain and you're picturing being on the beach in Spain and you're thinking about everything that happened there, or you're thinking about like, "I might go on holidays next year and I might go to Rome," or whatever it is. You're imagining what that is. It's the same process involved in that episodic future thinking, which is the jargony name that it gets given. As there is in retrieving those or constructing those episodic memories, it's the same underlying process involved.

Paul Middlebrooks

I can imagine someone who is-- and we're talking about these things as if they're crystallized, but I can imagine someone who is "more prone to misinformation" might be more prone to more creativity because then you're linking things that weren't actually linked. That's a generative process.

Ciara Greene

There is a link between individual differences in creativity and ability to create episodic memories and episodic-- there is a link there, but actually, when it comes to, say, different kinds of false memories and stuff, so there's loads of different ways you can measure memory distortion. You can look at misinformation stuff, like I give you a misleading question in an interrogation. You can look at misidentifying faces. You can look at memory implantation. You can look at false memories for fake news. There's a whole load of all these different kinds. There's also ones with word lists, things like that.

What you see, and we have a paper on this a while ago, is that there's basically no correlation between them. Essentially, what we're saying is it's not really there a huge matter of individual differences. It's really that all of these things do rely on this underlying constructive process, but that's an essential process that we all have to engage in. It's a requirement.

Paul Middlebrooks

That is the process.

Ciara Greene

Yes. It's a process as opposed to an individual tendency.

Paul Middlebrooks

I see.

Ciara Greene

There are links with those individual differences with creativity. There's this nifty little test. It's called the alternative uses test, where you give people everyday objects like a newspaper, and they have to come up with as many possible uses for that as possible. You might say, "Well, a newspaper is for getting the news," or you might say, "I'm going to make it into a paper hat, or I'm going to make it into a boat and sail it on the river, or I'm going to--"

Paul Middlebrooks

"I'm going to train my dog not to do that thing."

Ciara Greene

"I'm going to hit my dog over the head, or I'm going to mop up the dog's wee, or I'm going to wrap my fish and chips, or I'm going to cover up my windows when I'm painting," or whatever you think--

Paul Middlebrooks

Kill a snail with paper cuts.

Ciara Greene

That's very creative.

Paul Middlebrooks

Thank you.

Ciara Greene

Yes, there's loads of things like that. The more of those things people can come up with, they tend to be better at episodic future thinking, imagining stuff in the future, things like that.

Paul Middlebrooks

That makes a lot of sense.

Ciara Greene

Yes. I suppose the thing is people always want to know when we talk about memory distortion and so on, everybody wants to know about individual differences. In other words, they want to know who are the people who are vulnerable and who are the people who aren't. I think the underlying thing there is that people really want to hear that they are not vulnerable, but only somebody else. We have to disappoint them. It's the baseline process of how memory works. Memories are reconstructed. A side effect, essentially, of that sometimes is that you will incorporate misinformation, or you'll reconstruct the memory in a way that isn't in line with the truth. It's just part and parcel of being a person.

Paul Middlebrooks

The silver lining here is that, as you argue in the book, our memories are not for perfectly accurate recall, but for functioning in the world and reproducing. You point to this fact over and over in the book that a lot of the misinformation that causes alterations in memories doesn't really have bearing on its usefulness to your ongoing behavior. You can misremember that the woman was wearing a red dress instead of blue, and that really doesn't affect your future mating ability or something. Then you have to wonder how much of our memory is useful, right? If there's so much of it that's not necessarily affecting our ongoing life, if memory is for our functioning, how much of our memories are actually useful?

Ciara Greene

Yes. Good question. I can't give you a number. I can't give you a percentage.

Paul Middlebrooks

70%, right. Yes.

Ciara Greene

63.5. I think it's probably like with a lot of things. We evolve various functions physically, mentally, in response to particular pressures and evolutionary pressures. The way those end up manifesting isn't predetermined and isn't necessarily a one-on-one match to what it's for either. We can end up with lots of extraneous stuff that we can't find a direct link to evolutionary requirements, and yet they're there. Maybe cleverer people than me will find those links in the future. For now, maybe we just need to be happy that we have it.

Paul Middlebrooks

Okay. Very good. All right. Ciara, I know that our time is dwindling here, but this podcast is ostensibly about sort of the intersection of neuroscience and AI and explores artificial intelligence a lot as well. I had mentioned to you that I wanted to ask you about this, and you used the phrase, "I don't want to get over my skis about it." I've heard that phrase recently. Separately, I want to ask you, where did that originate? Why am I hearing it all the time now?

Ciara Greene

All I can tell you, I only went skiing once and it was a terrible experience and I'll never repeat it.

Paul Middlebrooks

You got over your skis while you were skiing, huh? Okay. I know that this is not your expertise, artificial intelligence, but I just-- one of the reasons why I enjoyed this book so much is because there are so many examples in my notes where I thought, where I wrote down, this would be useless for AI. There's this concept, artificial general intelligence, that we want artificial intelligence to mimic human intelligence and then supersede it. All of what you write about, the vast majority of you write about of how memory works, seems like you wouldn't want to mimic in an artificial.

Ciara Greene

I'm struck by you talking about confabulation because if you look at say like ChatGPT, all it does is confabulate.

Paul Middlebrooks

Right, but we confabulate perhaps even more. We complain that ChatGPT does that. We think of it as a failure.

Ciara Greene

Because we expect something different of it. We expect it to be a computer.

Paul Middlebrooks

A computer. This goes back to the computer metaphor. You have a memory, you're going to store it in a register, and then you're going to be able to perfectly recall it, assuming you have the address for that register. Do you have thoughts about this? Not necessarily, I know that you don't have advice for a computer scientist wanting to build better AI, but do you feel like this gives us any insights into how we might want to build memory as part of the cognition of an artificial system or how to think about artificial intelligence in general? I want to leave it broad since you are on your skis here.

Ciara Greene

Yes. I've got it. I'm actually really afraid to answer this because there'll be people listening going, "She has no idea what she's talking about."

Paul Middlebrooks

Nobody does.

Ciara Greene

Listeners, you're right. I don't know what I'm talking about in this.

Paul Middlebrooks

All right. Now we have that out of the way.

Ciara Greene

I suppose the thing is like, again, much as we talk when we talk about it with human cognition, I would come back to what's the goal. What are you trying to achieve here? Is it that you want to see what would an artificial intelligence look like? You want to make something that is-- you're just curious from a scientific perspective and you want to know what that would look like. You want to model it on human intelligence. Then I think what you need to model is that generative component that, but that isn't just spitting back out stuff like ChatGPT is doing.

What you would need to be doing is to actually able to create stuff, to take blocks and pull things together, but that it's generally-- and maybe in that way, things like ChatGPT are actually not a terrible model of what human memory does in some ways. If that's what your goal is, if your goal is to say, "Well, what would an artificial intelligence and actual intelligence look like," then that's the way to do it. If your goal is more top down, that you want it to be functional, that you want it to provide accurate information to users, then I'm not sure that that generative approach is necessarily going to do that.

Paul Middlebrooks

Yes, the question is, would we want an AI that misremembers things, but then that word misremember sort of loses meaning in the context of all of your studies and everything, because it's like the phrase, good memory. Maybe it's the wrong phrase, right? Given the nature of how memory works, it's reconstructive process that it's an active process that it's always being processed. Would it be okay to allow an AI to misremember some fact, right? It wouldn't be okay.

Ciara Greene

I don't think so. Again, it probably depends what you're using it for. Most of my encounters with it are trying to encourage students not to use it to write their essays because they're just skipping the entire point of learning things. When they are, if you're trying to say-- because essentially, the way it seems to me that people use or expect to use AI tools is to use it as a replacement for a search engine. That search engine that will actually, rather than just directing you to sources, will actually give you the information. If the information that it gives you isn't correct or has confabulations in it, then that isn't serving its purpose. It's not meeting its function. To me, no, I wouldn't want one that's misremembering, but then I'm not a computer scientist, and maybe they have loftier goals than helping somebody to write their essay.

Paul Middlebrooks

Another approach to this or facet of this is us neuroscientists are always complaining that the AI people don't pay enough attention to our brain science results, right? If they really wanted to build good AI, they would build it, they would pay more attention and use more principles from neuroscience, what we're learning in neuroscience. Then your book makes me think maybe we shouldn't, if we don't-- then you get that whole bag of what comes with it, which is the constructive, reconstructive process of memory, which may lead you down a road that you actually don't want to do that.

Ciara Greene

I think the problem there is the assumption, again, that the flaws and whatever in our memory are just glitches. That's the system failing to act correctly, as opposed to actually being the system in operation as it evolved, that it's not a little like glitch in the code and a minor error. That's how our memory is fundamentally working.

Paul Middlebrooks

Then that removes sort of the judgment of whether someone accurately recalls something, right? Well, it's just the process of how memory works. Jane is not at fault here.

Ciara Greene

Sometimes she is. Honestly, one of the biggest things that will determine whether you remember something is whether you're paying attention to it. A lot of the time, when we don't remember stuff, it's not a fault of our memory at all. It's a fault of our attention.

Paul Middlebrooks

Yes. We've already talked about flashbulb memories that are laden with emotion and high attention are just as susceptible to misinformation.

Ciara Greene

Yes, absolutely. Even things that you are paying-- yes, they are. That's not to say, and I think you don't want to leave people with the impression that none of your memories are trustworthy and you can't trust a single thing. That's not--

Paul Middlebrooks

You have to walk the fine line here.

Ciara Greene

Yes. That our memory is good enough. I think if you talk about memory being good, we would say it's good enough. It does the job, and I think it does what we want it to do most of the time. It gets us through life, but it's not a computer. Then the question is, if you're designing the computer essentially to be really smart, do you want it to be smart like a human or do you want it to be smart differently?

Paul Middlebrooks

Not smart like my mom. How about that?

Ciara Greene

Not smart like your mom. Okay, I think I'll put that one down on the list.

Paul Middlebrooks

She's a smart lady, but I don't want an AI like her.

Ciara Greene

I'm not sure I want one like me either, to be honest.

Paul Middlebrooks

Oh, I don't want one like me either.

Ciara Greene

Honestly, in all seriousness, if you think about what you want these things to do, surely what we want them to do is to supplement what we're missing.

Paul Middlebrooks

Not replace, supplement.

Ciara Greene

We have our blind spots and why. It's a different thing, but like Gillian and I often say that sometimes we're like the same brain in two bodies and that sometimes we have the same blind spots and that this is a problem because we don't have anybody saying to us, "You're both thinking about this the same way, but you're missing something." I think of that if there was a third person in this partnership and that person was an AI who also thought exactly the same way and had the same blind spots, I'm not sure that's contributing anything.

Paul Middlebrooks

Good point. Okay, I have one more question to ask you, and I this is more of a personal interest. Actually, well, two more, but one more major one. This is more of a personal one. Firstly, let me ask you, you got your PhD in neuroscience.

Ciara Greene

Yes, cognitive neuroscience.

Paul Middlebrooks

Cognitive neuroscience, which is one step more towards psychology. Was there any temptation to go in the brain, or were you always set on this behavioral level, experience level psychology?

Ciara Greene

No, my post-docs were all neuroimaging. I was doing--

Paul Middlebrooks

Some of this is like psychology anyway. The boundaries are blurred between cognitive neuroscience and psychology.

Ciara Greene

Yes, and I think they should be. I think that's good. I think the more we silo ourselves into our disciplines and refuse to talk to each other, the less we're learning from each other.

Paul Middlebrooks

Blind spots galore.

Ciara Greene

Exactly. No, I'll tell you, my little schtick that I always tell people about this is that-- so my PhD was all about fMRI and neuroimaging and imaging of working memory and stuff like that. It was fun. It was interesting. Then I was doing post-docs on that. Again, they were fun. They were interesting. I did about four years post-docs in Cambridge and in London.

At the end of that, then I came back to my first faculty job, which was down in Cork, which is where I met Gillian. It was my first faculty job and I had no money, none. I had no research funding. I was like, "Okay, I don't have any money to do fMRI. What am I going to do instead?" I realized, the more I thought about it and sat with it for a while that I realized I had gotten into this mindset of instead of thinking what's the next question I want to ask, I was thinking, what's my next MRI study going to be?

Paul Middlebrooks

Oh, that's great. It's not great that you were thinking that. It's great that you realized it.

Ciara Greene

It was this thing of like, all you have is a hammer and everything looks like a nail, and that it was like I was going down this thing of like, "Well, this is the next obvious step on this plan." I'm like, but I hadn't taken that step back and said, "But do I care about the answer to that question?"

When I actually really started thinking about that then, and started thinking what questions I actually wanted to answer and what was interesting. It all mostly came out being around a lot of memory system attention stuff, too, but became much more applied. I started thinking that actually where I had been very theoretical before.

I think it's great to have that foundation because I think it really helps me in keeping the more applied stuff grounded, and keeping it and making sure that I'm not going wildly off because I don't understand the basis, and I think it's really helpful. I started thinking that where my interest is was in more applied questions, things that would have real world consequences. Then around that time as well, that's when I met Gillian. Gillian was my very first PhD student. Then, the two of us--

Paul Middlebrooks

You're like, "I'm poor, but we can--"

Ciara Greene

No, literally, she had been taken on by the department and then her supervisor left before she even started. She was wandering the halls looking for a supervisor.

Paul Middlebrooks

Oh my gosh.

Ciara Greene

It was kismet. It's like we started working together. We've been working together now for, God, 12 years, something like that. We started realizing we had a lot of similar interests. Then I think having somebody-- I saw somebody recently on Twitter or Bluesky or something talking about this idea of a science buddy. I was like, "I have a science buddy, and it's great."

Paul Middlebrooks

Yes, that is great.

Ciara Greene

Somebody to just really bounce ideas off and you can call up and say, "Is this mad or should we do this?" Someone's like, "Yes, let's do it." Pushing yourselves, and we push each other to--

Paul Middlebrooks

How much do you check your blind spots, your common blind spots?

Ciara Greene

We try to. We do bring in other collaborators and we do try to have other people to come in and check us and say, "No, you're completely off base or you've missed something really important there." I think we tend to push each other along, and then to also to say, "Are we bored with this question? Let's do something else."

Paul Middlebrooks

Oh, yes, that's good. That's something I've come to realize pretty early on in my graduate work. You get into graduate school and then there are these arguments in the literature between ideas. Then there are these figures of principal investigators who you know are constantly butting heads and you think, "Well, they must hate each other." It turns out the vast majority, they're so appreciative that they have someone to check them and it improves your research. There's a lot of respect to your "enemies" in that regard because they're checking your blind spots.

Ciara Greene

That's where you get that idea of adversarial collaborations. It's one of those things where, in principle, I love that. In practice, I'm quite conflict averse. I don't actually want to spend my entire working life arguing with people.

Paul Middlebrooks

Then there's always the story part, the interpretation part that people are just going to argue to their death about as well. Yes, so that's the part that's--

Ciara Greene

Exactly.

Paul Middlebrooks

Ciara, a really fun book.

Ciara Greene
Thanks.

Paul Middlebrooks

I look forward to seeing you on the witness stand in the future on some big case. I'll be like, "Oh, I got to talk with her." Anything from the book that we didn't cover that? There's a lot that we didn't cover, but anything that you want to mention in closing?

Ciara Greene

I suppose we have some cool stuff, like in the second half, really about technology, I think, about fake news and deep fakes and how all of these different-- people have this idea that like new technology is almost hacking our minds, that it's implanting, like deep fakes will totally change the way we think about the world or all that stuff.

I think a lot of what we're saying is, yes, these things can influence our memory, but there's nothing new under the sun. They're not doing anything that reading about a story in the newspaper won't also do, that it's the same active processes in our mind that is responding to all this information and constructing it and actively building it in the same way. Yes, it's a whole new frontier to think about how we grapple with all this new forms of evidence and new forms of information and how they influence our memories.

Paul Middlebrooks

You do allude to a write about the Plato's dialogues where Socrates is worried about the technology of writing because--

Ciara Greene

Oh, yes, it's going to destroy the minds of the young, like they won't have memories anymore.

Paul Middlebrooks

I can tell you, though, it is so nerve wracking with-- I have children, and it's just a battle on screen time and I'm trying to-- oh, we live in a high consumer society and they're actually trying to trick you at every step, and it's working. That's kids. Okay, thanks so much again. I will link to the book in the show notes and continued success.

Ciara Greene

Thank you.

[music]

Paul Middlebrooks

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