**Ep 95 Stephen Chrisomalis**

**Mark:** [00:00:00] Welcome to the Endless Knot Podcast

**Aven:** where the more we know

**Mark:** the more we want to find out

**Aven:** tracing serendipitous connections through our lives

**Mark:** and across disciplines.

**Aven:** Hi, I'm Aven.

**Mark:** And I'm Mark.

**Aven:** And today we're talking about numbers. But before we get to this, which will be an interview, Mark has an announcement.

**Mark:** I'm going to be doing another session of the Speakeasy course, which is open to anyone. It's an online seminar that you can sign up for. And I'll just read you my little blurb for this.

Where do we words come from? How are languages related to one another? How do languages change over time and how have linguists and etymologists pieced together the story of English and its roots? In this four session seminar, we will learn some of the basic principles of etymology. Through a series of linguistic puzzles, we [00:01:00] will follow in the footsteps of etymologists and historical linguists to reconstruct the relationships between languages and long-forgotten roots of English words.

So this course will be running on Sundays from September 12th to October 3rd, at 2:00 PM Eastern standard time. They're one hour sessions. Now the space is limited to 12 attendees. So sign up now. You can find out all the details at speakeasy.com/e/origins-of-English.

We'll put a link in the show notes and if this is something you are interested in, you can go and register for my course.

**Aven:** And if you have any further questions, of course, you can ask Mark on Twitter. And if this time doesn't work for you, there is a link for you to let them know other schedules, let us [00:02:00] know another time that would work for you in the future.

Or let me know on Twitter or by email or whatever. And I will put your name on a list. And if Mark puts any other classes on, either this one again, or other classes--cause you're planning to do some other courses in the future. And if we do, we can let you know. I'll put together a little list of people who are interested. Because the first time you ran it, it went really well and you had a lot of fun, right?

**Mark:** Yeah.

And the last time I ran it, it was not a Europe-friendly time. It was in the evenings in Eastern time. But this is hopefully going to be convenient for those of you in Europe, in the UK and whatnot as well as, you know, it's still obviously, you know, perfectly convenient in the Western hemisphere.

So, but hopefully I know there were a number of you who were in Britain/Europe. And the previous time slot did not work for you. But hopefully this will be possible. So absolutely. have a look at this.[00:03:00]

**Aven:** So check that out. And in the meantime, we will go to today's episode, which is an interview with Dr. Stephen Chrisomalis. Stephen Chrisomalis is a professor at Wayne State University. He is a linguistic anthropologist who specializes in the anthropology of mathematics and the interaction of language, cognition, and culture. His anthropological training includes work in cultural, cognitive, archeological, and linguistic anthropology.

His previous publications include N*umerical Notation: A Comparative History* published by Cambridge university press in 2010, which is a cross-cultural cognitive analysis of written numerals over the past 5,000 years. Today, we'll be speaking to him about his latest book, R*eckonings, Numerals, Cognition, and History* published by MIT press in 2020, which investigates numbers and mathematics as both socio-cultural and cognitive phenomena.

And it's a very interesting book as you will hear. So let's turn to that.

[00:04:00] So, hi Stephen. Thanks so much for joining us.

**Stephen:** Thanks very much for having me. It's a pleasure to be here.

**Mark:** Welcome. So I want to start with a question that we ask all our guests about unexpected connections, either between, things in your life, things in your work, things in your particular subject, there certainly are a lot of surprising connections in your book, and I wonder if there are any that were surprising to you or any that you think that readers will find particularly surprising, that's not generally known.

**Stephen:** There are a lot!

**Aven:** Good. We really did appreciate that in the book.

**Stephen:** Yeah.

**Aven:** Oh, this is so much the way I think!

**Stephen:** Can you, can you ask a different question though? I mean, I think for me, one of the real joys of this book is putting together a really interdisciplinary account of numerical notations and numerical practices and things that are taken for granted.

[00:05:00] I'm a linguistic anthropologist by training and by profession. And one of the things that this has brought to my attention in writing *Reckonings* is thinking about the way in which my own discipline relates to some really big longstanding questions in the historical and linguistic disciplines, like in, in ranging from classical philology to historical linguistics, to the history of science and mathematics.

And so bringing all that together, and then also adding into that a bit of, of a cognitive science spin, which is to say that I'm not a, I'm not an experimental scientist or a bench scientist, but I am someone who takes very seriously the idea that to understand numbers, we need to understand numerical cognition.

And so for me, part of what this starts with is, is really little things like how do, how do we perceive numbers? One of the things that you sort [00:06:00] of learn very early in the cognitive psychology of number is about this property of human minds, but also of, some animal minds called subitizing.

And this is from "subito", rapidly. And this is the idea that, that you can very, very rapidly assess the quantity of small numbers of objects. So usually up to about three or four, and we don't really count them. So, if you see a dot pattern or if you see some little cluster of objects and it's up to about three or four of them, you very, very rapidly assess the quantity of that, if it's more than that, you don't do it. Now, why do we care about this little property of assessing dot patterns? It's because when we look at numbering systems, these fall within the subitizing limits. So you ask yourself, well, why do number systems tend to cluster in groups of three or four units? If you have repeated strokes or [00:07:00] repeated marks, why do we stop at three or four?

Well, the reason for that is actually a cognitive one, it's that this is easier to perceive rapidly. And so this is about making these connections across disciplines that wouldn't really otherwise be self-evident. It's hard and it's hard because often disciplines are speaking different languages, but bringing that together is part of my job.

**Mark:** Yeah. This is one of the things that, that got me really excited, reading your book, the fact that it is so insistently interdisciplinary. And I mean, there's this whole history of linguistics, , modern linguistics coming out of a field like anthropology. And then it sort of, , often becomes its own thing.

At least some linguists treat it as something very abstract and divorced from the actual human beings who are using language. And also the way that philology fits into all this and, and you write kind of a sort of defense of philology in a way

**Aven:** I have, I have never been so sort of somewhat [00:08:00] surprised, but also warmed by suddenly coming across philology in a book like that.

It's not a thing that I have very, have much experience of. But suddenly to be like, oh, oh, This is this thing that is the old fashioned word for what I do is suddenly being praised. And this is really exciting.

**Stephen:** Yeah. And it's really important to note that there are a huge number of problems with philology,

**Aven:** Yes, this is why I see it praised so rarely!

**Stephen:** Among the sort of elite elitist disciplines, a deeply racist, deeply problematic in a ton of different ways. There's also this core of understanding language, not in a decontextualized way, but as it's linked to literature and history and social change, and those questions have never been lost, but they have become disseminated.

They've become spread throughout the academy in ways that is important because [00:09:00] obviously disciplines have become much larger. The academy is much larger than it was in the 19th century, but at the same time, there's some value in still bringing those things back together. And so you look at the family resemblances among these things and look at why are anthropologists not talking to classicists?

We really ought to be. And so a lot of my work over the past 20 years has been about bringing those things together. And philology is sort of one of those places where you can find a catch-all term that doesn't, probably, I'm not arguing for a revitalization of philology, but I'm arguing that yeah, there's stuff in there that we need to be reading, as we think about how we got from where we were 150 years ago to where we are now.

**Mark:** And there was, there was a sort of movement in the late eighties, early nineties called the new philology which sought to, be more interdisciplinary and, in particular, look to what the theoretical linguists were [00:10:00] doing and apply some of those techniques or theories to old texts.

So I think, I agree that, there's a lot of important ideas in philology that need to be kind of rescued in a way

**Aven:** from the discipline as a whole. Yeah. I'll give you that. I'll totally grant you that, yeah. There's some methodology there that that is, worth not throwing it with the bath water basically, and that's a lot of bath water to be thrown out.

So I'm not, again, I agree with you that, that. It's not to say we just need to turn back the clock. That's not the point.

**Stephen:** And one of the challenges with the new philology is actually that as a movement, it got started probably about 15 or 20 years too early. That was the sort of a height of that was when I trained in linguistics and linguistics was deeply, deeply abstract at that point.

And with, with syntax as being that the central part of philology and Chomsky as the central figure. And [00:11:00] now I actually think there's more openness to some diversity, but I'm not sure whether people are having the same kinds of conversations as they were in 1990 or 1995.

**Mark:** I also found it really interesting that you, you kind of addressed this question.

Why isn't there a medieval anthropology? And yeah, it hadn't really occurred to me in those terms before, but there is this weird sort of gap, methodologically speaking, where the middle ages just doesn't get treated in the same way that other periods do.

**Stephen:** Yeah. And, and I really think this is a substantial problem. Both on the part of medievalists, but especially on the part of anthropologists who tend to see the rise of capitalism and the rise of industrial capitalism and colonialism, stuff that really happens in the sort of 16th, 17th, and later centuries as most important to [00:12:00] our understanding of history. And the stuff that comes before that isn't really seen as pertinent until you get far enough back that you're now, oh, that's the really old stuff. And then the archeologists can talk about that, but there really is no reason, there's no principled reason why we shouldn't do that.

And in my own field of the study of number and the cross-cultural study of number, the real implication and the real problem comes that exactly the central conceit that I'm hoping to address in *Reckonings* where the central problem that I'm looking to approach, which is why don't we use Roman numerals anymore, or why don't we use them in the way we used to, really requires that we understand what was going on and requires that we look at what did people in the 13th and 14th centuries think about this and how did we come to have the number systems that we currently have, say in Europe and north America, which then become globalized much later , they become globalized, but the [00:13:00] story doesn't start with the globalization of the 17th and 18th centuries.

The story really starts with what's happening in Europe, in the 13th, 14th and 15th centuries.

**Mark:** Yeah. And one of the things that I found really surprising coming out of that particular question about, , that transition from Roman numerals to a Western numeral system is first of all, that there is this important distinction between lexical numbers, words for numbers and the numerical system for writing numbers down.

And then also this, the relationship between arithmetic and notation or lack thereof, that it's not what people would imagine, right? Like until you get to, as you point out until you get to the Western number system, you don't have people using numbers to do a calculation, right?

You don't use Roman numerals to do that. They had other methods, they had their counting boards and that sort of thing.

**Aven:** Yeah. I found that really [00:14:00] interesting. And I'd, I think that would be great if you could expand on that for our listeners who haven't yet read the book, because I think that that point about the decoupling of arithmetic and the numerical notation systems made, I was completely convinced by it, but it was absolutely like breaking my brain while I read it.

So I think it, it's a really important point.

**Stephen:** Absolutely. So one of the places we start is by asking what makes one anything get replaced by another anything, regardless of what that is. And for the most part in the history of phenomena, there is a recognition that there are lots of reasons why one thing could get replaced by another thing, fashions get replaced all the time.

And we don't attribute the rise and fall of bell bottom jeans to anything inherently good about them. But in the case of technology, and in particular, in the case of mathematical objects, there is this [00:15:00] pervasive notion of progressivism and functionalism that numbers are for arithmetic.

And if a number system is better for arithmetic, that's what makes it replace other systems. We know that we don't use the Roman numerals the way people used to 500 or 800 or a thousand years ago. That is true. And so then that becomes linked to the assumption that the reason must be that they weren't very good for arithmetic.

But the challenge is that the Roman numerals were never used for arithmetic. At least not in the way that we think they are, you can use them to write down the result or you can use them to mark up an Abacus and put little column notations on an Abacus, but nobody ever lined up Roman numerals and did what we think of as pen and paper arithmetic with them.

This is really a modern problem. It really emerges in the late 19th century that we started to teach Roman numerals as part of [00:16:00] arithmetic classes, as part of the arithmetic curriculum as this sort of thing that you would do. And I certainly remember, and I know that many of your listeners will remember having been taught Roman numerals in a math class where it was like, oh, add up XVII and it's sort of presented as this sort of riddle.

It's a, it's an interesting puzzle, right? It might be fun for a moment, but it doesn't take very long to, to see that this actually wasn't the way that, this isn't the best way to think of the Roman numerals. And I don't think that people in the classrooms see that. They look at it and what they learn is, oh, these things are awkward and useless and , I understand why we got rid of them now.

It's because they're so awkward and useless, but that's because they're answering the question that nobody was asking, which is, how could you use these for arithmetic? Nobody was ever intending to use them for arithmetic. There's no evidence that they did, and there's no evidence that they evaluated the notation they were using. The Romans or [00:17:00] medieval Europeans didn't evaluate the Roman numerals in that way.

And so it only was very late really, after the fact, it was really only in the 17th, 18th, and 19th centuries that people really even began to disparage the Roman numerals. And so this is a modern problem that we created, but then has become part of the legendary framing of the onward and upward progress of technology.

**Mark:** is that a unique property of Western numerals that we expect it to do both jobs?

**Stephen:** It's not unique, but it's certainly not common. There are certainly other cases where numbers are used computationally, but for the most part, no, for the most part, when people do arithmetic, historically, mostly it's been done through embodied cognitive processes, for instance, using the fingers, the fingers and hands.

And I don't simply mean, sticking up 1, 2, 3, 4, 5 fingers for 1, [00:18:00] 2, 3, 4, 5. There was a very complex, classical medieval tradition of finger numbering that is basically used for representing and manipulating numbers sort of on the fly. And, and then a whole set of practices that rely on external technology, external cognitive artifacts, such as Abaci, counting boards of various sorts.

But I really think it's important to note that pen and paper is also a technology, pen and paper or whatever, written number on some sort of flat surface is also a technology. We rely on it. And then it's fascinating when you, when you look at how people calculate, you can often see them stick their fingers up in the air and do a little arithmetic.

So if I ask you what's 128 plus 72, then you might sit there and you might write with your finger one two eight and seven two, like, as if you had established some virtual paper in the sky so that you could do this [00:19:00] calculation. You've taken the fact that you may not have the paper and then you've turned it into an embodied technology to allow you to manipulate number in this way.

So this is something that you really see at a higher degree than ever before, in the case of modern European and north American educational systems and technologies. And that really is why I call this system, the Western numerals. I don't want to deny for one second that this system, which is often called Arabic numerals, but we know that ultimately has an Indian origin in probably the third or fourth century CE has these origins, the structure of the system, a decimal place, value notation with basically signs from zero to nine. But if you ask why don't we use Roman numerals anymore? It's not because of anything that India did or didn't do. It's actually because of changes in social life and changes in technology and changes in [00:20:00] practice that actually occur in late medieval and early modern Europe.

**Aven:** Yeah. I think this is a really interesting point. Because I think if you ask people who have not thought about this point do you need pen and paper to, to do math? They'd say, no, of course I can do mental math. But I think it's really important to note that the way I do arithmetic in my head is still conditioned by having been taught it and learned it by, the physical lining up and writing out of numerals. And even if I don't write it in the sky with my finger, I'm breaking things up by the decimal places, I'm using the number system that is a written number system. I'm not doing mental math that is divorced from that system. And I think that's probably something that again, is not, so it seems like a natural thing.

Well, that's just how math happens. And where your book does really carefully and well is de-naturalize that and say, no, just, , that is actually a taught system that relies on this numeral system. And without it, you would do it differently.

**Stephen:** Right. And [00:21:00] it's not to say that mathematics isn't true. I don't want to adopt some sort of extreme relativist position of like, oh one plus one could be three, if we just believed it were so. That's not the case at all. In fact, it's the fact that, the Romans and, Europeans and Chinese, everybody has agreed that one plus one equals two.

We've all found this out that actually should convince us that probably we're onto something. And, and that still leaves room for this variability. And in the same way that mathematicians today are always looking for different notations and recognizing that this lets them ask different questions. We should recognize that number systems have different affordances.

In other words, they let you ask different sorts of questions or do certain sorts of things differently. And to criticize the Roman numerals for a function for which they were never intended or used is a-historical and ethnocentric. It's fundamentally a misplaced logic.

**Mark:** One of the things that, that occurred to me when reading that, that discussion about [00:22:00] how the technology can change the way we do our numbers.

And as you say, like pen and paper, that's a technology, but, and also the way of doing things like long division or multiplication, those are technologies as well and in a certain way, , in the modern world now that, I mean, calculators are so ubiquitous, everyone has their phone and they can, , use it as a calculator.

In a sense the, the Western numbers are now just if you're doing it that way are now just a display system. Right. And what's actually going on inside the technology is in fact, it's binary, it's little switches, essentially turning on and off to do the calculation.

**Stephen:** And this actually raises a really important debate that happens again and again, and it's not so much among professional mathematicians as it is among the wide range of pundits and people who think that learning a particular form of arithmetic [00:23:00] is universally or singularly important for its cognitive effects on children.

And in many ways it parallels the debates about cursive writing, things that if they were lost something fundamental will be lost about our society. And I think the same sorts of things are going on with regard to the decline of pen and paper arithmetic. Now I should be clear. There's still a lot of pen and paper arithmetic that goes on in classrooms, at least right now.

But will that be the case in 30 or 50 years? I'm actually not sure. And then you're right. Then a number system does become what it has always been, which is a display technology, a communication technology. And it's that shift in thinking the shift from let's stop thinking about numbers as principally computational. And let's think about them as principally communicative or representational, that then lets us get into a linguistic analysis, that [00:24:00] lets us get into a question of what are the intentions of a writer in writing a number one way as opposed to another. And what are the ways that a reader will receive and understand that?

Because that function is, is universal among number systems, the idea that you need to be able to communicate a number in a non-linguistic or in a trans linguistic way. That's as true of the Roman numerals as it is of any other system.

**Mark:** Yeah, and that, was one of the things that, that really blew my mind is as soon as you, you kind of train yourself out of thinking well, of course, numbers are for doing arithmetic, then you're suddenly able to ask these other questions: why do we use Roman numerals still in some contexts?

Or, , why did they use them in the past for certain things? And before, before we're thinking about that, you couldn't even ask that question.

**Aven:** And also realize that that's the same question as asking why do I write out a hundred thousand or put it in numerals? Why would I say twenty twenty and not two thousand and twenty?

That those are all [00:25:00] parts of the same general question. Rather than that numbers are some completely distinct category.

**Stephen:** Yeah. I think one of the things that I really want to convey in my work is that we almost always have choice about how to represent a number that we can represent it using words, we can represent it using notation.

We can represent it using some combination of words and notation, and that there are good reasons to make the choices that we make, that people are generally rational. I don't mean that in a, in a really extreme way to say that humans are pure rational choice engines. No. I think even a brief examination of the world today would suggest that that's not the case, but I would insist that human behavior is explainable and that there are things that people do pursue, people pursue goals. And so for instance, one of the reasons why you use numerical notation as opposed to a linguistic [00:26:00] representation is that numerical notations are trans linguistic. I can read the number two zero two one as two thousand twenty one in English, but it's not dependent on any particular linguistic encoding.

It does let you have that flexibility. And one of the reasons why numerical notations can survive relatively unchanged a long, long time, thousands of years, is that language goes and it changes and all kinds of things are happening. And the number system is still essentially the same. If you go to the Coliseum today, you can go and see Roman numerals above every gate. And those are still perfectly readable to somebody 2000 years later. They don't present the same linguistic challenges that any linguistic representation would have. But on the other hand, sometimes you want to make your linguistic representation clear.

Sometimes you want to make it known. Whether that's writing a check out in words, in addition to writing the [00:27:00] numbers out as a kind of security measure, or whether that's because you want to emphasize a particular representation of a number rather than another representation, because it does matter, maybe, if you're writing a poem, whether you say two thousand twenty one or twenty twenty one, we might have reasons to care about any of those things. But now we're thinking about number as a communicative system.

**Aven:** And, your point that you said earlier about how we're completely unsurprised that fashion changes for reasons that are not strictly logical, like strictly utilitarian, let's say. But we assume that things to do with math must have changed only for utilitarian reasons has a lot to do with the way that our culture sort of hives off mathematics as a separate ultra rational ultra objective trans-cultural truth somehow.

And that's just not true, but I think that is a factor of how we think about the difference between language and numbers [00:28:00] now.

**Stephen:** Yeah. And it's even deeper than that in the sense that there's a very, very deep, really throughout the Indo-European languages, connection between thinking and counting and thinking and counting and talking.

And this is one of the reasons I use this word reckoning as a way to, to think about and why I chose the title of the book to be *Reckonings*, is that to reckon is both to count to compute, but it's also to recount or to give an account. And we see those same parallels that account and recount, are of course those are Romance derived, but reckon, that's a good Germanic word.

And so there are these sort of connections between counting and history and narration and thinking that actually go way, way back. Certainly well past , they are certainly present in old English and you see them in other places too. So for instance the [00:29:00] verb tell is originally both to think and to calculate, we still see that in German where zählen is to count.

And that's a cognate of tell. But then, in German, erzählen is like to speak or to narrate. And so this connection between talking and thinking and, computing is very fundamental to, a lot of the linguistic relationships among, different sorts of words. And so for me, that's actually a real hard problem to get past because I, think it is embedded in a lot of our linguistic framings.

It's not, it's not simply a modern conceit. And that actually is a different sort of challenge. The question of, can we get rid of it? And no, probably not. I think that kind of linguistic reform at that scale probably doesn't have much chance of succeeding, but once we know it's there, we can be alert to it.

We can be attentive to the [00:30:00] fact that we make this connection, that mathematics as the sort of height of reason, the height of thinking makes a connection that we can at least work around. If we let ourselves work around it.

**Mark:** is there any kind of indirect evidence about how people thought numerically before there's any writing, so that before there would be any direct written evidence?

**Stephen:** Sure. Do you, do you want me to talk some etymology for awhile?

**Mark:** Sure.

**Aven:** I don't know that doesn't sound like the kind of thing we're interested in. Please!

**Stephen:** One of the things I, I spent some time on maybe not as much as I could have in, in a, relatively short book, are things like tallying. And we think about tallying as, oh, this kind of maybe this vestige of the past, but of course we use tallying all the time. If you need to count votes for something in some interminable [00:31:00] faculty meeting the likelihood is that you're going to make a single mark for every event.

And that's not because we're hearkening back to some ancient time. It's because that's actually a practical tool for managing an event that's ongoing. If you don't know what the final count is, then you just start making marks and then you structure it in this way. And so one of the, other semantic connections that, really tells us a little bit about prehistoric or early historic ways of thinking about counting in, say, European societies, is the semantic connection between counting and cutting. And the word tally is related to Latin tallia, which is like a notched stick or French taille, which still means to cut, so this is a kind of a semantic connection that was very, very early in lots and lots of Indo-European languages.

And you also see this in the word [00:32:00] score. So score is really specific to Germanic languages. And really it's more of a north Germanic, it's a Scandinavian old Norse term originally, but score means to cut it's connected to a word like scar. It means to scratch and cut, but then of course it also serves to mean a word for 20.

And that's because there are a whole variety of Northern European languages that have bits and pieces of this vigesimal or base 20 in them. Welsh has it, French has it, Danish has it. So there are little pieces actually across different language sub families. And this idea of cutting, being connected to counting also is a representational act.

When you think about it, that actually is, for the vast majority of human existence, most people have been non-literate, but that kind of numerical practice that kind of representing through one-to-one correspondence is actually [00:33:00] much, much more widespread. I won't say universal. That's a, tricky question to know how something is universal, but it's extraordinarily, cross-culturally widespread, but what's specific in these words, like tally and score is this semantic connection between counting and cutting.

And of course, we still talk about the score of say a sports event. And that comes from that same thing. It's somebody taking the score, making the tally of points and saying at the end, who is the victor. And so this connection between counting and cutting sort of persists and has a lot of resonance for people.

Another place where you, you see this connection between reason and thinking and counting are even in funny little words that you wouldn't think of, like the number, word hundred and it's interesting because in old English, there are actually two words for a hundred.

The one word is hund. And the other word is hundtēontiġ, which sounds like it's hundred and [00:34:00] ten-ty, which it kind of is etymologically it is, but hundred is actually kind of a later way of saying hundred. And actually hundraede, that raede is like the same word as read. It's actually to count by hundreds or like a hundred count.

And this connection between reading and thinking and advising all of these conceptual relationships exist in this little-- it is a morpheme, but it doesn't look like one. I don't think if you asked a hundred people, they wouldn't divide hundred into hund-red except by syllables, but it really is really that hundum raed, to count by hundreds.

**Mark:** Yeah. And, that had occurred to me when I was reading the bit in your book where you talk about, this crazy fictional numbering system where you could have the same word referring to two different numbers. And I thought, oh, it's kind of like the long hundred, are you thinking of it as [00:35:00] 120 or are you thinking of it as a hundred? And , when there was that overlap of meaning, they would have to specify, this is a hundred counting by tens. So , hund, and then as you say counting in the tens, that hundred as opposed to the other one.

**Stephen:** Yeah. and people may not be aware that really, that persisted a very long time, especially in Scotland, the long hundred of 120 was really quite normal, well into, I think the 16th, even the 17th centuries, especially for counting certain quantities of things, you sort of have to indicate well, do you count this, are you counting a hundred, the hundred of five score, which is the short hundred or a hundred of six score which is 120. And English is not a very base 20 number system. It has the word score , but for the most part, it doesn't have that as a really productive aspect of the number system, but it has these little bits that sort of survive and tell us a little something about [00:36:00] how something that we actually take for granted doesn't change much, actually has lots and lots of changes. And so that's, for me, something that's very, very important to highlight because if you go into a historical linguistics class, almost certainly one of the examples that's going to be brought up very early in your training, it certainly was in mine is the number systems of Indo-European languages, which are still very visibly connected to one another, even after thousands of years of separation. And so it's very easy to look at that and imagine that number systems really don't change very much, but then to actually look at all of the ways that even in the past 200 years that English numbers have changed.

So for instance, one of the things that I show in *Reckonings* is that we would take a number like 1.2 million, and we might write it as in notation 1.2 followed by the word million. That's how I'm most likely to write it. Most of the time I could write it out in [00:37:00] words as one million, two hundred thousand, that's less likely, but actually, as late as the early 20th century, certainly throughout the 19th century, the way I might write it, especially in any sort of formal texts is actually twelve hundred thousand. Well, twelve hundred thousand to me is not grammatical English. That doesn't, I mean, I can parse it. I can make it make sense, but I can say twelve hundred, but I can't say twelve hundred thousand, that doesn't work for me.

And 150 years ago, that was actually the most common way to talk about it in print. And so there are these changes that are ongoing, that we don't really recognize, or that, that go against this narrative of numerical stasis. One of the other areas, and I talk about this a little bit in the book, and I've talked about it at greater length in other publications, one of the other whole branches of the number system in English that has emerged over the past hundred years or so, are what I call the [00:38:00] indefinite hyperbolic numerals.

And these are numerals like umpteen or jillion or zillion, they're numbers that don't have a numerical referent, but they're just indefinite numbers that represent something big, but they're not just like, it's not just like a word like heaps, or mounds , zillion is a good number word.

And we know that because we can do a nice linguistic test and we can say, oh, well, if you can say zillion, can you say six zillion? And people say, oh, of course I can say that. And you say, oh, umpteen, oh, well, can you say umpteen hundred? Oh yeah, that works for me. And then we recognize that these are actually number words, and these are all new.

So the English numerical lexicon has expanded vastly over the past hundred years or so in ways that we don't recognize if we take for granted that stasis is the norm. And that number systems tend to stay the same forever and ever, and ever.

**Aven:** And if we conflate , the reality of [00:39:00] mathematics with a stability of representation. Two plus two has been four forever and ever, but that does not mean that two numeral plus two numeral equals four is an unchanging objective truth, right?

**Stephen:** Yeah. And that makes it really hard for the people who study numerical cognition to look at this variation experimentally, because we're so ingrained in a single notation, in a single way of approaching things even more than writing systems.

So writing systems, obviously there are many many users of multiple writing systems. There are lots of people who will write in the Latin alphabet from left to right. And the Hebrew alphabet from right to left in a fairly fluid, easy way. And you can do lots of stuff with that, but there aren't a lot of users of multiple numerical notations around.

And so that's why the historical account and the look at well, what happened when people actually encountered new [00:40:00] number systems? What did they do with them? How did they manipulate and how did they use them to represent? What changed? That those questions can only be asked through this historical perspective.

**Aven:** And just for listeners, I want to make clear that, like we're asking a bunch of questions that have to do with the medieval and the ancient, and , that's obviously our particular interest, but you range very widely in the book. You do focus a fair amount of the sort of narrative around the disappearance or the abandonment of Roman numerals as a major system. And because I, I think that allows you to bring up a lot of the points you want to bring up, but there's a chapter on the Cherokee numeral system. And there's a lot of, discussion of other systems from around the world and their particularities and things like that.

So I just want to make that clear because there is a much wider scope in the book than we've talked about so far. And that was also something I found really interesting because again you can see if, there's this pretens teleology that happens [00:41:00] when you look only within the Roman to, Greek Roman, even Egyptian Greek, Roman medieval, modern looks like such a nice, neat -- from the outside -- nice, neat story. And it's not as you point out, but as soon as you bring in other systems around the world, you realize that that's very deceptive.

**Stephen:** That's exactly right. And over the past 5,500 years, there've been well over a hundred structurally different, notationally different ways of representing number through number signs that is outside of, language.

And I've studied those in a big comparative earlier volume. My earlier book, which is called *Numerical Notation*. And one of the things that really got me thinking about writing a book like *Reckonings* is a way of making this comprehensible to somebody who maybe doesn't want to spend , 10 or 15 years studying the history of number systems.

How do I make this make sense to somebody? And of course, [00:42:00] one of the ways you do it is by looking at what's familiar and taking what's familiar and making it weird, weirding it up and taking that narrative of here's something you've always known about: the Roman numerals. You hear about it every year.

There's a great news article -- by great, I mean that with the greatest possible sarcasm -- every year, late January, early February, right around the super bowl explaining how ridiculous it is that we're still using Roman numerals for the Superbowl. And there was even a commercial a few years ago -- Roman numerals! Every year, like clockwork, you could predict that this will happen.

And so, because this is, this narrative is so familiar to us and it's so deeply ingrained in us. It becomes a hook that I can use to then say, And now let's mess with this, and let's actually ask some good empirical questions about what numbers are for and how people perceive and use them.

**Mark:** And, I think one of the really interesting things about your book that makes [00:43:00] it have a broader appeal than just the particulars of this question is that there is this other kind of purpose here in terms of methodology and so forth that you talk about avoiding the sort of extremes of universalism on the one hand, and particularism on the other, and you argue for these kinds of comparative methods and so forth. And the last chapter is, I kind of read it as this call to action in a way, that goes beyond, , as I say, the particulars of this one book. But you're arguing for something for a larger point about how we do certain kinds of scholarship.

**Stephen:** Yeah, I really am. My training is very broadly interdisciplinary across archeology and history of science and linguistics and anthropology. And part of my frustration is that in our rush to make our work legible to [00:44:00] smaller and smaller disciplinary audiences, particularly as we are pulled by the needs to get funding or to make our work understandable to our colleagues who are going to be voting on a tenure case in the academy or whatever sorts of ways we need to make our work legible to those small audiences that we then fail to understand these broad range of connections.

And I don't want to trivialize that problem. It's hard. It's a hard problem. And I don't think that it's possible to write a world history. Like a history of the world. People have tried that, Oswald Spangler and Arnold Toynbee and these people who wrote these giant macro historical things.

And I don't think anybody can do that. And so my call then is to say, yeah, I've looked at numbers systems and that's a subject that after some years, I feel that I know enough about that. I can do that comparative analysis [00:45:00] for this domain, but now understand that that's just one domain of activity. It's just one area of life. That there are all sorts of areas that are open for that investigation.

And to invite that kind of comparative framework, to actually become a part of how we can teach students and teach scholars to think differently that rather than say taking a regional perspective which, , regionalism is really important. You can't study Egyptology without studying Egypt and knowing that. It's not about abandoning regionalism, but it's about then to say, well, what do you do with all that?

Once you've done it, how do you make it legible to a broader range of social scientists and humanists who want to understand it? And of course, that's one thing. The one thing that I love about contemporary linguistics is that contemporary linguistics as abstract as it sometimes is, which can be frustrating, it is explicitly [00:46:00] comparative. It explicitly takes for granted that you could take the different ways of using language and put them together into some general theories. Now that hasn't been fully successful. That's fine. I'm not arguing that we have to be fully, I don't think my book has been fully successful. I think there are a million ways, maybe even six zillion ways that I could expand or deal with something better. But it's really about that comparative impetus. And that is one of the things that keeps me coming back to anthropology as a discipline that can let you do

**Aven:** that.

Well. And , I've said this a million times for myself, but the point about interdisciplinarity is not to replace disciplinarity. Interdisciplinarity is not about dissolving disciplines and removing specificity and not allowing anyone to do deep dives into one. The point about it is to put disciplines in conversation with one another, and to [00:47:00] allow the insights that have come from those deep dives and those specific investigations and that, really focused knowledge, allow those insights out of those wells and into one another, into conversation with one another.

And, that, as you say, that's a really hard problem. There will never be an equilibrium there. There's always a tension between the specific and the interdisciplinary. And I think that's fine and that's, what's productive, but if we let it go too far in one direction each of those disciplines becomes the poorer for it.

**Stephen:** Absolutely. And that really returns to that, problem of the excluded medieval, that idea that, well, you can do comparison except for that. Which nobody would say that explicitly, I don't know of anybody who says, well, of course you can compare anything except for medieval Europe, that doesn't work.

Nobody really believes that when you put it that way, but to point out the ways in which there are gaps, that then lead to real problems, questions that end up unasked and unanswered in ways that I think could [00:48:00] be done if there were the will to do so. And if there were the incentives to do so.

And if there were models, that really is one of my goals, is to sort of say, here's a model for how it might be done for a little domain. Cause number systems is, let's grant it, even as big as it is. It's still kind of a small thing that you can get your, you can grasp it and you can make sense of it and to say, now, what else could we make sense of?

**Aven:** Yeah. I strongly recommend the book on the basis of lots of cool factoids. Like, let me make that clear. There's lots of fun, interesting things that are just like, oh, I didn't know that. Oh, that's really cool. I'd never thought of that, et cetera. Like it's tons of that, but it is really valuable as a call to methodology and to ask people to think, I feel like what one of the things you're saying and correct me if I'm putting words in your mouth, is that in this field and probably in many others too much has been taken for granted about the framing and the investigative [00:49:00] approach, and where numbers count in, what systems they're part of and what disciplines they should be addressed by, and that what you spend, the introduction, and then the first couple of chapters doing, and, come back to again, and again, is really explicitly working through the methodology.

What are the assumptions we're making? How do we take this back down to base level and say, okay, what, when I say this is this. What assumptions am I making? On what grounds can I make that assumption? Are these assumptions that we can't make? And we have to start again and say, why like, like the basic thing of numbers are used for arithmetic, but, but you go much further into that.

You go into, , when you discuss, oh, I'm going to get the terminology wrong. But the frequency, the idea that people start trying something new because more other people are trying it. Yeah. Am I missing?

**Stephen:** So this is the idea of a frequency dependent bias, right?

And actually, if I might say, having just caught up a little bit on listening to one of my favorite podcasts, the [00:50:00] Endless Knot, I was, I was listening to your episode about evolution, which is, really, really neat. And one of the challenges that you raise is that this concept of evolution has undergone these massive semantic shifts. And that, the way that we think of Darwinian fitness is one way to think about it. When you're talking about frequency dependent bias, this is really a different kind of evolutionary analysis, which is to say, well, what is useful to somebody in some context? And so that sounds kind of evolutionary and it is, but what's different is that what makes a communication system useful is not just, a does it have a good abstract structure? But the question is how many people can I communicate with it? And are they important? People are not important people. So when I want to use or adopt a new communication system, one of the central facts I want to know is: who do [00:51:00] I want to communicate with and what are they going to understand? And so frequency dependent bias is a mathematical representation actually of that feature of lots of different systems. So using a new notation presents a challenge, which is that nobody else is using it yet. And so a frequency dependent bias is the fact that for lots of phenomena out there in the world, including a new number system, that one of the things that you have to overcome is the fact that to use it to communicate, you need to have somebody to communicate with. And so until you have some users of a system, it's at a disadvantage. And this leads to a certain inertia or what looks like inertia on the part of people, but it's not a kind of unthinking inertia, it's that people are making very rational decisions to say, This system is used for communicating with people and the Roman numerals are just [00:52:00] fine for that.

So let's just keep doing it. What changes of course is in the 15th and 16th centuries with the rise of the printing press and the rise of a larger degree of literacy. You have a whole group of people who are not bound by any prior knowledge or use of a number system. They're free to adopt whatever system they like or to develop new groups of users.

They don't care what was going on in the medieval scribal tradition. And so they're really invited to and eagerly take up that possibility of adopting a new system that had previously been, not restricted for them, it was around and, it was irrelevant. And, and so it's a way of modeling or thinking about what makes a new system or any new technology appeal to people.

And much of that same analysis can be [00:53:00] applied to social media. Now, social media is a little different, but social media, one of the things about it is it has a constant influx of new users, which is to say young people. There's a constant influx of 11, 12, 13, probably younger eight, nine year olds who are coming newly to social media.

Do they want to talk to their parents? No, I can firmly say that they don't principally want to use this to talk to their parents

**Aven:** And they may in fact, want to exclude their parents, like it may actually be preferential to not be able to communicate with them. Yes.

**Stephen:** And so whereas we may think that like, oh, well Twitter is for everybody because Twitter lets you communicate with lots of people -- and Twitter's great, I'm on Twitter @SChrisomalis, come join me -- but, but the thing is that for a user, for whom that audience is not relevant, who cares, I'm going off to Tik TOK or whatever's new. And almost certainly whatever I say within a year will be irrelevant because [00:54:00] there'll be a new group of users who are coming in and that same process is ongoing.

And a little bit of a longer timescale in early modern Europe, as newly literate, middle-class mercantile folks are learning arithmetic and they're learning reading, and writing, and they're learning a whole set of conventions and notations. And that is actually where this change happens. Prior to that, Indian and Arabic arithmetic were known in Western Europe for hundreds of years before this change happened.

And so we kind of have to ask, well, if it was so good, wouldn't it have been replaced faster? And the answer is, well, what it was good for only became good once you had this new environment, a new social and a new technological environment that allowed this transition to

**Aven:** See, that's what I mean, there's a bunch of things in there that are really interesting individual facts like that one does, or doesn't know about when the transitions happen and you have a bunch of stuff [00:55:00] about early manuscripts and, early printed works specifically, and when they combined Roman and Western numerals in which ways, and clearly both were an option for a while and they made choices and that's a really telling thing, but also the larger question of saying, well, we can't take for granted that people change their number system because it's better plus the word better.

We need to spend at least two chapters talking about what better means. And I think that, that, methodological challenge or that methodological framing is really valuable because it's so easy to take stuff for granted and not ask the right questions, or not go far enough in asking the right questions and that's what you're trying hard to avoid.

And I think that that's really a good model for scholarship, as you say, in many, a domain, , not just numbers.

**Stephen:** Thank you.

**Aven:** Just to go back to some of the really cool stuff, I just want to talk a little bit more about that is specific to me. You talked about this a bit, and it just was one of these things that hadn't occurred to me because that's not what I work on. [00:56:00] You say that there's a lot of evidence in both our literary sources and in obviously in the archeological sources for high level computation and arithmetic and the ancient world, but no evidence for how they did it or no discussion of how they use numerals to, represent it or, or very little. Can you talk a little bit more about that because this is one of these things, I work on Latin poetry. I don't think about Roman math very much. So it's, but it's something that I'm kind of interested in.

Can you talk a little bit more about what do we know about how, if the Romans are not their using Roman numerals for arithmetic, how are they specifically doing it? In the Roman period and the pre-medieval period.

**Stephen:** Right. So we do know a couple of things, right. We know that they were using an Abacus which is not what we think of probably as an Abacus, which is to say beads on a rod, that's sort of the east Asian Abacus, that's sort of a translation. The Abacus became a bead-on-rod device once Westerners discovered east Asian devices, like the Chinese [00:57:00] suanpan or the Japanese soroban.

And they said, oh, that looks a lot like what those Romans used to call Abacus. So why don't we just call that the Chinese Abacus and then very quickly they started to just say, well, it's the Abacus it's all the same. But now when we think of that, we don't think of the Roman Abacus, which was actually really more of a pebble in groove device.

So Greco-Roman Abaci are grooves in a slab that you then put little pebbles or beads into, but you actually lift them up and move them from column to column. So we know that happened and we have some surviving Abaci, but we don't have any detailed accounts of what that looked like, how the computation actually worked.

And so we're kind of guessing and using analogy with modern east Asian Abaci, suanpan or soroban traditions, which are still taught and used quite widely think about how Romans were doing [00:58:00] arithmetic with them. We can also find examples in texts where there are arithmetical errors and we can, we can then conclude that, in some cases, oh, well this is because the bead for five got read as a bead for one. And so if that's got moved from one area of the Abacus to another, and so these little differences in a Latin or Greek text, lead us to conclude that the arithmetic that was done must have had an error.

But the only thing we have in those texts is the result or the answer. Right. So we have that and we also have things like accounts of finger numbering. So there are lots of textual representations of these systems of representing numbers. And we know how the system worked in the sense that we know how a Roman would have signed the number 64. We know how that would have happened, but we don't know how that was used as a practical device. And so nobody [00:59:00] shows that evidence in quite the way we would want there to be. And we know it must have happened. You, certainly didn't do this kind of work, I mean, the Romans were excellent accountants. They did a lot of great work, but we just have the kind of, we have the results much more than we have any of the accounts of working out. But I want to note that that's actually true for most periods and is certainly going to be true for our lives. Like how many, little evidences of little scraps of paper with post-it notes written on them are going to survive in the archives in a hundred or 200 or 500 years.

now of course, one of the advantages is we have arithmetic texts that actually say: line up your numbers like this and do this. But we don't have that for classical antiquity. And so we're left doing this kind of inferential game, but the one thing we do know is that there really [01:00:00] is basically no evidence that the Romans saw the Roman numerals as computational devices. You know, if you go to Pompei, there are lots of graffiti that have a numerical quality to them, but they are not like the kind of things where you might see, an account that with a bunch of numbers and then a total where we could see, oh, well this is cause they lined them all up where they, they worked in this way simply don't exist.

And so we're kind of, can I prove the negative case? Can I prove that no Roman ever did that? No, of course not. But I can suggest that at least from the textual evidence and the surviving material evidence, there's very good reasons to think that the finger numerals and the Abacus were used widely.

And there's basically no reason to suppose that anything else was used.

**Aven:** Yeah. And thinking now of the the only place that my own work has intersected with this discussion at all, which is the kisses poems of Catullus, because I always have to get Latin poetry in, it's not an episode if I [01:01:00] don't get Latin poetry in, where he talks about messing up the numbers, kissing so many kisses that he messes up the numbers so that they can't be reckoned properly.

**Stephen:** Yeah. There's a hundred and a thousand or a hundred

**Aven:** and a thousand and many hundreds of many thousands. And so we mix them all up so they can't be counted.

**Stephen:** Yeah. And, and actually that's one of the phrases that is actually used as evidence for Abacus computation, because thousands and hundreds are columns next to one another on the board.

So you can say, give me a thousand and a hundred and a thousand than another hundred. I don't know exact, I can't, I would have to look it up to see exactly how it goes,

**Aven:** I have the Catullus poem in front of me now because I couldn't help it, but

yeah, it's, give me a thousand, then another hundred, then another thousand, then a second hundred than yet another thousand more then another hundred. So when we've made many thousands, we will mix them all up so that nobody can count them.

And by knowing the exact number curse us, I mean, that's not exactly how he phrases it, but that's the intent of what he says.

**Stephen:** Right. And this is of course, one of the properties that is actually often derided about the Abacus [01:02:00] is that, well it doesn't leave a permanent record.

but of course, this is exactly seen as what's advantageous here. Let me, let me count them all up. And of course it's allegorical and poetic. It's not meant to be literal. But it's a way of understanding. We'll do these hundreds, thousands. We're basically putting them in different columns. And then at the end we can mix it all up and then nobody will know.

And it's extraordinarily evocative and powerful, but it actually highlights one of the features of this system. But remember that that's not going to be useful in every context. One of the contexts where mixing up your computation so you can't see how it was made might not be useful is say in an early or later, in industrial capitalist society where the accounting of how material is taken into the bureaucratic standardization.

You want to know exactly how the tally was taken and exactly how the count was made. And having written arithmetic actually serves that purpose. It allows scrutiny, [01:03:00] it allows inspection. And you can imagine that that would be useful for anybody, but you can also imagine reasons why people might not want it to always be so obvious why people might not always want it to be evident how they did the count.

**Mark:** Kind of summing things up a little bit then, , first of all, what was your goal in writing this book? Like what did you set out to do? And perhaps that's different from what you decide final purpose of your book is, and also what do you want our listeners to sort of, what one thing do you want them to come away with? Or, what do you want your readers to come away with, after having read the book.

**Stephen:** Yeah. One of the reasons I wanted to write *Reckonings* and the reason I wrote it the way I did, or at least the way I hope I did is to show some of the joy of numbers to an audience that might otherwise be disinclined to open a book on numbers or to think about [01:04:00] numbers.

One of the challenges, and it's a challenge, partly of disciplinary divisions, again, lots and lots of anthropology and classics and history students ended up in the field that they ended up in because either they were taught that they were no good at mathematics, they were explicitly told they were no good at mathematics or they were trained to think of it as something that was outside of their remit, outside of their interest, as something that weird math people do. And the idea that there are math people and not math people, and that the math people go over to the sciences and humanities people stay over here, leads to this field, the study of number, to be occupied by a lot of mathematicians.

And that's great. They do great work, but I also wanted to show that there was this other approach, that you don't need to be a mathematical expert. You don't need anything other than a [01:05:00] sort of vague general appreciation of arithmetic in the, in the broadest possible sense to really learn something about, not just about the history of numbers, but really the joy, the way that these numbers are playful, that numbers are textual, that numbers then become intertextual and that we're making reference to them.

And we're constantly using different numerical representations every day in all our lives. And so partly it's about writing a book that is open to that broad audience that says, Hey, if you're going to open one book about numbers, let it be this one, because there'll be some interesting things that happen here.

You know, one of the fascinating things that happened to me as I was basically in page proofs of this book is that Elon Musk, CEO of Tesla and his partner Grimes had a kid. And why do we care about this? And if I'd had more time and I hadn't been in page proofs, [01:06:00] I would have thrown this probably into two or three pages of the text, but it just ended up as a footnote.

So they had this baby and named X Æ A-12. And that's three, there's a letter X, then the Anglo-Saxon letter Ash, the Æ, and then A hyphen 12. The challenge was that this was in violation of California law. So the law of California is that numerals can not be used in a legal name, that the 26 letters of the alphabet are the only things that can be used in a name.

And so their solution was, well, we'll fix this. So they're like, well, we're still gonna call our kid X Æ A-12, but the 12, they wrote as XII using Roman numerals. And so this is basically a way of saying like the Roman numerals are letters. They're kind of not numbers anymore, but , for a Roman that was a numerical representation and it wasn't read as three [01:07:00] signs, XII, it was read as the number 12. You would read it out. And even when we look at the history of the Roman numeral signs, we imagine them as letters. We're like, oh, well, that's I V X L C D M. Those are seven letters of the Roman alphabet, but historically they weren't letters at all.

Historically they were abstract signs. And in fact, one of the reasons they are the letters they are is that each of the signs for half of a power is actually a visual halving of the original abstract sign. In other words, V is the top half of X. And L is like the bottom half of a C if you can imagine that.

And then the old sign for M which you actually still find in lots and lots of texts is actually not an M at all. It's basically a D and a reverse D kind of stuck together or [01:08:00] alternately parentheses with a line in between them. I don't know how to convey it well, in words, but the idea is that originally these were abstract signs.

They weren't letters at all, but they became accommodated to letters over time and they became the letters of the Roman alphabet. And then we now think of them in that same way. And so part of my goal is to take a little story like that, take something that you would laugh about or tweet about, or do something with and say like, actually this tells us something about the history of this notation. Roman numerals actually throughout medieval early modern Europe were actually usually called numeral letters. They weren't actually called Roman numerals because of course they weren't, they were Roman. In one sense, if they ask, did the Romans used them, everyone would say, well, yes, of course. But the point was, they were the numeral letters, but this is a way of thinking about the history of, the relationship between representation systems.[01:09:00]

You don't need to know any arithmetic to know this, but what you do need to have is you have to, be willing to let that sort of joy and that interest of that story, kind of ask different questions of the kinds of historical and empirical evidence that we have out there. And so for me, writing a book like *Reckonings* is to make sense of all those little stories, to make sense of why do we do the strange things that we do with numbers?

**Aven:** and I think it does that beautifully, frankly. I really enjoyed reading it. And I strongly recommend to all our listeners who have any interest in any of these overlapping connections to pick up *Reckonings: numerals, cognition, and history*, which I presume is available. anywhere that books are available.

**Stephen:** It is available now. And I really look forward to, hopefully people reading it and hearing from people.

I really enjoy having these sorts of conversations because for me, coming from a discipline where [01:10:00] lots of people are kind of it's, it's a, a subject of almost disgust or at least well, we don't do anything like that. It's a way to have some really, really nice conversations. And then people always come up with something that they know, whether it's about Catullus or Elon Musk, that there's always something new to come out of this discussion.

**Mark:** And I think it is a book that will appeal to a wide variety of people, partly because we're always all of us surrounded by numbers in some way in our lives. But I think it has something to tell everyone really.

**Aven:** We just have to make sure that they know it.

Right.

**Stephen:** It's been wonderful. I really appreciate the opportunity to talk about some of those little specialized things, but then to really make them, I dunno, to have that broader conversation.

**Aven:** Well, thank you so much. You've already mentioned your Twitter. Is there anywhere else that people should go to look for more of your work or, get in touch with you?

**Stephen:** [01:11:00] Sure. You can absolutely get in touch with me by Twitter @SChrisomalis. I also have a blog called Glossographia, which covers many of these same subjects, but also more broadly issues in linguistics and anthropology.

And I'm happy to talk to people there. And just in general I'm available by all the usual places by email. I'm a professor of anthropology and linguistics at Wayne State University. And then of course, the book itself, which is *Reckonings: numerals cognition and history* has its own webpage and all of the sort of things through MIT press.

**Aven:** Great. Perfect. And we will link as always all of those things in the show notes.

Well, thank you very much. It's been a real pleasure chatting with you. As we talked about before we started recording, we have clearly had many connections of mutual friends and places that we have almost crossed paths but have not done so before. So I'm thrilled that we had this opportunity to do.

**Mark:** [01:12:00] Yeah. And as we were saying before I, too, am sort of in a way surprised that we haven't really talked to each other before, because , reading this book so many times I was thinking, oh, someone else kind of wants to think this this way too. That's awesome!

**Aven:** Yeah. Yeah. You found your spiritual connection there. I know you did. So thank you so much.

**Stephen:** Thanks. Thank you very much.

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**Mark:** And please check out our Patreon where you can pledge to support this show and our video project. You can go directly to the videos at youtube.com/alliterative.

**Aven:** Our email is on the website, but the easiest way to get in touch with us is Twitter. I'm @AvenSarah A V E N S A R A H.

**Mark:** And I'm at @alliterative. To keep up with the podcast, subscribe on your favorite podcast app or to the [01:13:00] feed on the website.

**Aven:** And if you've enjoyed it, consider leaving us a review on Apple Podcasts or wherever you listen. It helps us a lot. We'll be back soon with more musings about the connections around us. Thanks for listening.

**Mark:** Bye.