WEBVTT

00:00:14.000 --> 00:00:16.358 And just swap your screen and

00:00:16.360 --> 00:00:17.640 then we'll be done. Exactly.

00:00:17.640 --> 00:00:18.876 We have this all nicely prepared,

00:00:18.880 --> 00:00:22.880 of course. That's OK. Perfect. Super.

00:00:25.440 --> 00:00:26.518 OK, Well, thank you very much indeed.

00:00:26.520 --> 00:00:28.158 Sorry about that. That that hiccup.

00:00:28.160 --> 00:00:30.320 No, nothing is quite as smooth as you hope.

00:00:30.320 --> 00:00:31.370 Thanks so much for that

00:00:31.370 --> 00:00:32.000 really generous introduction.

00:00:32.000 --> 00:00:32.918 You know, it's a really great

00:00:32.918 --> 00:00:33.800 pleasure and honour to be here.

00:00:33.800 --> 00:00:35.000 I really followed Phil's work

00:00:35.000 --> 00:00:36.200 over many years as well,

00:00:36.200 --> 00:00:37.397 really learned an awful lot from it.

NOTE Confidence: 0.800566788571429

00:00:37.400 --> 00:00:39.206 So. So it's really great to be

NOTE Confidence: 0.800566788571429

00:00:39.206 --> 00:00:40.878 here and thanks for the thanks.

NOTE Confidence: 0.800566788571429

00:00:40.880 --> 00:00:41.326 That's it.

NOTE Confidence: 0.800566788571429

00:00:41.326 --> 00:00:43.110 So the work I'm going to talk about

NOTE Confidence: 0.800566788571429

00:00:43.159 --> 00:00:44.755 is joint with a number of people.

NOTE Confidence: 0.800566788571429

00:00:44.760 --> 00:00:45.522 So Chris Gagney,

NOTE Confidence: 0.800566788571429

00:00:45.522 --> 00:00:47.300 who was a post doc in tubing

NOTE Confidence: 0.800566788571429

00:00:47.357 --> 00:00:49.293 and is now a now works for a

NOTE Confidence: 0.800566788571429

00:00:49.293 --> 00:00:50.800 company called Hume in New York,

NOTE Confidence: 0.800566788571429

00:00:50.800 --> 00:00:52.684 two research assistants in in tubing

NOTE Confidence: 0.800566788571429

00:00:52.684 --> 00:00:54.920 and Kevin Shen and Yannick Striker.

NOTE Confidence: 0.800566788571429

00:00:54.920 --> 00:00:56.372 And then I might also talk

NOTE Confidence: 0.800566788571429

00:00:56.372 --> 00:00:58.200 about some work with two of my

NOTE Confidence: 0.800566788571429

00:00:58.200 --> 00:00:59.540 other colleagues in Tubing and

NOTE Confidence: 0.800566788571429

00:00:59.540 --> 00:01:00.798 Kevin Lloyd and Shin Sui.

NOTE Confidence: 0.771251232857143

00:01:02.960 --> 00:01:04.628 So to introduce this,

NOTE Confidence: 0.771251232857143

00:01:04.628 --> 00:01:06.457 imagine the following game.

NOTE Confidence: 0.771251232857143

00:01:06.457 --> 00:01:09.342 You're controlling this rather crude

NOTE Confidence: 0.771251232857143

00:01:09.342 --> 00:01:12.160 refrigerator like a robot here,

NOTE Confidence: 0.771251232857143

00:01:12.160 --> 00:01:14.792 and your job is to get to

NOTE Confidence: 0.771251232857143

00:01:14.792 --> 00:01:16.241 this treasure chest here.

NOTE Confidence: 0.771251232857143

00:01:16.241 --> 00:01:18.488 And there's a word for getting to

NOTE Confidence: 0.771251232857143

00:01:18.488 --> 00:01:20.200 the treasure chest worth worth

NOTE Confidence: 0.771251232857143

00:01:20.200 --> 00:01:21.800 five points to our subjects.

NOTE Confidence: 0.771251232857143

00:01:21.800 --> 00:01:24.200 There's a cost for falling into

NOTE Confidence: 0.771251232857143

00:01:24.200 --> 00:01:25.640 these these things which Chris

NOTE Confidence: 0.771251232857143

00:01:25.640 --> 00:01:27.200 loves to call these lava pits.

NOTE Confidence: 0.771251232857143

00:01:27.200 --> 00:01:28.692 There's this,

NOTE Confidence: 0.771251232857143

00:01:28.692 --> 00:01:31.174 this this is the Iceland version of

NOTE Confidence: 0.771251232857143

00:01:31.174 --> 00:01:33.660 this with the with the the volcanoes you

NOTE Confidence: 0.771251232857143

3

00:01:33.660 --> 00:01:35.480 have when you try to move north-south,

NOTE Confidence: 0.771251232857143

00:01:35.480 --> 00:01:36.368 east and West,

NOTE Confidence: 0.771251232857143

00:01:36.368 --> 00:01:37.552 there are some blockages

NOTE Confidence: 0.771251232857143

00:01:37.552 --> 00:01:39.159 shown by these brick walls.

NOTE Confidence: 0.771251232857143

00:01:39.160 --> 00:01:40.972 And there's also an error chance

NOTE Confidence: 0.771251232857143

00:01:40.972 --> 00:01:42.970 of an error of a of a of an

NOTE Confidence: 0.771251232857143

00:01:42.970 --> 00:01:43.960 eighth when you try to move.

NOTE Confidence: 0.771251232857143

00:01:43.960 --> 00:01:45.556 So if you try to go north,

NOTE Confidence: 0.771251232857143

00:01:45.560 --> 00:01:46.590 there's an eighth chance you'll

NOTE Confidence: 0.771251232857143

00:01:46.590 --> 00:01:48.152 move in one of the other directions

NOTE Confidence: 0.771251232857143

00:01:48.152 --> 00:01:49.853 instead and then we have a discount

NOTE Confidence: 0.771251232857143

00:01:49.853 --> 00:01:51.029 factor to try and encourage you

NOTE Confidence: 0.771251232857143

00:01:51.029 --> 00:01:52.228 to get to the goal quickly.

NOTE Confidence: 0.771251232857143

00:01:52.228 --> 00:01:54.384 So the question then we pose our

NOTE Confidence: 0.771251232857143

00:01:54.384 --> 00:01:56.014 subjects is which route would

NOTE Confidence: 0.771251232857143

00:01:56.014 --> 00:01:57.278 you take given this?

NOTE Confidence: 0.771251232857143

00:01:57.280 --> 00:01:58.840 So there's a three obvious routes.

NOTE Confidence: 0.771251232857143

00:01:58.840 --> 00:02:00.358 I think there's this route that

NOTE Confidence: 0.771251232857143

00:02:00.358 --> 00:02:01.636 goes down here through all the

NOTE Confidence: 0.771251232857143

00:02:01.636 --> 00:02:02.840 lava hits to get to the reward,

NOTE Confidence: 0.771251232857143

00:02:02.840 --> 00:02:03.996 the most direct route.

NOTE Confidence: 0.771251232857143

00:02:03.996 --> 00:02:06.111 There's a route which goes as sort

NOTE Confidence: 0.771251232857143

00:02:06.111 --> 00:02:08.013 of the intermediate route which goes

NOTE Confidence: 0.771251232857143

00:02:08.013 --> 00:02:09.762 around here and then goes close

NOTE Confidence: 0.771251232857143

00:02:09.762 --> 00:02:11.703 to this lava but not not the the

NOTE Confidence: 0.771251232857143

00:02:11.703 --> 00:02:14.040 main bulk of lava to get to here like this.

NOTE Confidence: 0.771251232857143

00:02:14.040 --> 00:02:15.624 And then there's this long route

NOTE Confidence: 0.771251232857143

00:02:15.624 --> 00:02:17.346 that goes around here all the way

NOTE Confidence: 0.771251232857143

00:02:17.346 --> 00:02:19.034 and then gets to the novel pit that

NOTE Confidence: 0.771251232857143

00:02:19.034 --> 00:02:20.834 gets to the to the goal in that way.

NOTE Confidence: 0.771251232857143

00:02:20.840 --> 00:02:22.920 So we administered this to

NOTE Confidence: 0.771251232857143

00:02:22.920 --> 00:02:24.438 to our subjects in the lab.

NOTE Confidence: 0.771251232857143

00:02:24.440 --> 00:02:26.099 I promised I wouldn't tell tell you

NOTE Confidence: 0.771251232857143

00:02:26.099 --> 00:02:28.116 who they are because he's kind of

NOTE Confidence: 0.771251232857143

00:02:28.116 --> 00:02:29.676 revealing about about your colleagues

NOTE Confidence: 0.771251232857143

00:02:29.676 --> 00:02:31.495 when you do this and you can see

NOTE Confidence: 0.771251232857143

00:02:31.495 --> 00:02:33.320 that there are subjects divided about 1/3,

NOTE Confidence: 0.771251232857143

00:02:33.320 --> 00:02:33.920 a third,

NOTE Confidence: 0.771251232857143

00:02:33.920 --> 00:02:35.756 a third maybe a few fewer.

NOTE Confidence: 0.771251232857143

00:02:35.760 --> 00:02:37.254 So some people took this very

NOTE Confidence: 0.771251232857143

00:02:37.254 --> 00:02:38.920 direct route to get to the goal.

NOTE Confidence: 0.771251232857143

00:02:38.920 --> 00:02:40.500 Another group took this intermediate

NOTE Confidence: 0.771251232857143

00:02:40.500 --> 00:02:43.193 one and you can see here the where

NOTE Confidence: 0.771251232857143

00:02:43.193 --> 00:02:45.491 they're being deviated off this route

NOTE Confidence: 0.771251232857143

00:02:45.491 --> 00:02:47.993 by these by these random spots.

NOTE Confidence: 0.771251232857143

00:02:48.000 --> 00:02:49.380 And then some other subjects

NOTE Confidence: 0.771251232857143

00:02:49.380 --> 00:02:50.760 took all the way around.

NOTE Confidence: 0.771251232857143

00:02:50.760 --> 00:02:52.360 And so the question for this talk is,

NOTE Confidence: 0.771251232857143

00:02:52.360 --> 00:02:54.943 what is it that goes on in terms of

NOTE Confidence: 0.771251232857143

00:02:54.943 --> 00:02:57.236 evaluating the risk associated with these,

NOTE Confidence: 0.771251232857143

00:02:57.240 --> 00:02:57.864 with these parts?

NOTE Confidence: 0.771251232857143

00:02:57.864 --> 00:02:59.112 And how do you make these?

NOTE Confidence: 0.771251232857143

00:02:59.120 --> 00:03:00.716 How do you make these choices?

NOTE Confidence: 0.771251232857143

00:03:00.720 --> 00:03:01.434 In this instance,

NOTE Confidence: 0.771251232857143

00:03:01.434 --> 00:03:02.624 we're very interested in the

NOTE Confidence: 0.771251232857143

00:03:02.624 --> 00:03:04.080 case that you're making choices,

NOTE Confidence: 0.771251232857143

00:03:04.080 --> 00:03:05.800 not just a single choice,

NOTE Confidence: 0.771251232857143

00:03:05.800 --> 00:03:07.718 but by committing to this path here,

NOTE Confidence: 0.771251232857143

00:03:07.720 --> 00:03:10.671 you're successively adjusted.

NOTE Confidence: 0.771251232857143

00:03:10.671 --> 00:03:12.848 You have to adjust yourself so these

NOTE Confidence: 0.771251232857143

00:03:12.848 --> 00:03:14.677 many steps of risk that you get.

NOTE Confidence: 0.771251232857143

00:03:14.680 --> 00:03:15.320 And I think that in,

NOTE Confidence: 0.771251232857143

00:03:15.320 --> 00:03:16.776 you know a lot of the work that

NOTE Confidence: 0.771251232857143

00:03:16.776 --> 00:03:18.473 that that we and other people have

NOTE Confidence: 0.771251232857143

00:03:18.473 --> 00:03:19.758 done in reinforcement learning is

NOTE Confidence: 0.771251232857143

00:03:19.812 --> 00:03:21.036 thinking about sequential decision

NOTE Confidence: 0.771251232857143

00:03:21.036 --> 00:03:22.872 problems where you don't only make

NOTE Confidence: 0.771251232857143

00:03:22.880 --> 00:03:24.800 one choice, you make many choices.

NOTE Confidence: 0.771251232857143

00:03:24.800 --> 00:03:26.265 And when those choices are

NOTE Confidence: 0.771251232857143

00:03:26.265 --> 00:03:27.437 are infected by risk,

NOTE Confidence: 0.892384243333333

00:03:27.440 --> 00:03:29.215 risk can accumulate on paths

NOTE Confidence: 0.892384243333333

00:03:29.215 --> 00:03:30.635 in rather interesting ways.

NOTE Confidence: 0.892384243333333

00:03:30.640 --> 00:03:32.136 And that really is the context of my

NOTE Confidence: 0.892384243333333

00:03:32.136 --> 00:03:33.849 talk of my talk to think about what

NOTE Confidence: 0.892384243333333

00:03:33.849 --> 00:03:35.544 the consequences are of that and how we

NOTE Confidence: 0.892384243333333

00:03:35.544 --> 00:03:38.400 should think about that as the whole.

NOTE Confidence: 0.892384243333333

00:03:38.400 --> 00:03:39.351 So the original,

NOTE Confidence: 0.892384243333333

00:03:39.351 --> 00:03:41.253 some of the original thinking about

00:03:41.253 --> 00:03:43.076 risk was actually came from the

00:03:43.080 --> 00:03:44.272 Bernoulli's thinking about what's

00:03:44.272 --> 00:03:46.661 what then became known as or what is

00:03:46.661 --> 00:03:48.317 known as the Saint Petersburg problem.

00:03:48.320 --> 00:03:50.312 The way that you pose this is you're

00:03:50.312 --> 00:03:52.054 tossing a fair coin and then you

00:03:52.054 --> 00:03:53.792 look at the number of heads that

00:03:53.792 --> 00:03:55.514 you get before you get a tail.

00:03:55.520 --> 00:03:57.113 So if you get one head before a tail,

00:03:57.120 --> 00:04:00.120 you get to €2 or two monetary units.

00:04:00.120 --> 00:04:01.712 If you get 2 heads, you get 4,

00:04:01.712 --> 00:04:03.196 three heads, 8 and so forth.

00:04:03.196 --> 00:04:04.922 And the question is how much would

00:04:04.922 --> 00:04:06.754 you be willing to pay me to give

00:04:06.754 --> 00:04:08.397 you an instance of this game.

00:04:08.400 --> 00:04:10.672 And the the reason why it's a problem

00:04:10.672 --> 00:04:13.675 or a paradox is that the expected value,

00:04:13.680 --> 00:04:15.927 so the mean value of these of

00:04:15.927 --> 00:04:17.800 this sequence of of outcomes,

00:04:17.800 --> 00:04:19.739 this mean value of of of being

00:04:19.739 --> 00:04:21.658 playing this game like this is

00:04:21.658 --> 00:04:23.363 actually infinite because with a

00:04:23.363 --> 00:04:25.140 probably over half you get €2.00

00:04:25.140 --> 00:04:27.520 the probably of 1/4 you get €4.00

00:04:27.520 --> 00:04:29.996 probably an 8 you get €8 and so forth.

00:04:30.000 --> 00:04:31.880 And so the sum value each of these,

00:04:31.880 --> 00:04:33.530 each of these possibilities is

00:04:33.530 --> 00:04:35.499 worth €1.00 and that would then

00:04:35.499 --> 00:04:37.555 just go off to the off to Infinity.

00:04:37.560 --> 00:04:40.136 And so the expected value is about

00:04:40.136 --> 00:04:40.872 is Infinity,

NOTE Confidence: 0.892384243333333

00:04:40.880 --> 00:04:42.399 but the amount that most people think

NOTE Confidence: 0.892384243333333

00:04:42.399 --> 00:04:44.080 how much you'd be willing to pay most

NOTE Confidence: 0.892384243333333

00:04:44.080 --> 00:04:45.329 people will pay you know somewhere

NOTE Confidence: 0.892384243333333

00:04:45.329 --> 00:04:46.855 between 4:00 and 8:00 EUR or four

NOTE Confidence: 0.892384243333333

00:04:46.855 --> 00:04:48.557 and $8 to play a game like this.

NOTE Confidence: 0.892384243333333

00:04:48.560 --> 00:04:49.480 And so that's the paradox,

NOTE Confidence: 0.892384243333333

00:04:49.480 --> 00:04:51.520 is to try and understand why.

NOTE Confidence: 0.892384243333333

00:04:51.520 --> 00:04:53.044 But I think the paradox becomes

NOTE Confidence: 0.892384243333333

00:04:53.044 --> 00:04:54.831 sharper or at least the task becomes

NOTE Confidence: 0.892384243333333

00:04:54.831 --> 00:04:56.862 sharper when you think of it in the

NOTE Confidence: 0.892384243333333

00:04:56.862 --> 00:04:58.382 sequential manner that it really

NOTE Confidence: 0.892384243333333

00:04:58.382 --> 00:05:00.258 is originally could also be posed.

NOTE Confidence: 0.892384243333333

00:05:00.258 --> 00:05:02.232 So here you're tossing the first

NOTE Confidence: 0.892384243333333

00:05:02.232 --> 00:05:04.118 coin and at stake is €2.00.

NOTE Confidence: 0.892384243333333

00:05:04.120 --> 00:05:06.565 If you get a, if you get a a tail,

NOTE Confidence: 0.892384243333333

00:05:06.565 --> 00:05:07.855 that's what you're going to walk

NOTE Confidence: 0.892384243333333

00:05:07.855 --> 00:05:09.078 away with is just two EUR.

NOTE Confidence: 0.892384243333333

00:05:09.080 --> 00:05:11.075 On the other hand, if we're lucky,

NOTE Confidence: 0.892384243333333

00:05:11.080 --> 00:05:11.932 we get a head.

NOTE Confidence: 0.892384243333333

00:05:11.932 --> 00:05:13.480 This is the world's smallest gold coin,

NOTE Confidence: 0.892384243333333

00:05:13.480 --> 00:05:16.440 which is that Einstein, It's a Swiss coin.

NOTE Confidence: 0.892384243333333

00:05:16.440 --> 00:05:18.240 Then you get a head.

NOTE Confidence: 0.892384243333333

00:05:18.240 --> 00:05:20.715 That means that now you get stake is €4.00.

NOTE Confidence: 0.892384243333333

00:05:20.720 --> 00:05:22.005 And again you're tossing this

NOTE Confidence: 0.892384243333333

00:05:22.005 --> 00:05:23.033 coin and you're thinking,

NOTE Confidence: 0.892384243333333

00:05:23.040 --> 00:05:24.036 you know what's going to happen.

NOTE Confidence: 0.892384243333333

00:05:24.040 --> 00:05:25.594 I get a head or a tail.

NOTE Confidence: 0.892384243333333

00:05:25.600 --> 00:05:26.144 I'm lucky.

NOTE Confidence: 0.892384243333333

00:05:26.144 --> 00:05:28.320 I'll get a head and then now the

NOTE Confidence: 0.892384243333333

00:05:28.384 --> 00:05:30.712 stake becomes €8 and so forth and then

NOTE Confidence: 0.892384243333333

00:05:30.712 --> 00:05:33.128 you get a tail and then and then in

12

00:05:33.128 --> 00:05:35.400 this instance you'd walk away with the €8.

00:05:35.400 --> 00:05:37.528 And so you can imagine that as you're

00:05:37.528 --> 00:05:39.270 getting you know essentially more and

00:05:39.270 --> 00:05:41.724 more money is at stake as you do this.

00:05:41.724 --> 00:05:43.697 I'm sure many of you are familiar

00:05:43.697 --> 00:05:46.115 with the balloon adaptive risk task,

00:05:46.120 --> 00:05:47.376 the balloon adaptive risk,

00:05:47.376 --> 00:05:48.947 the bot task, which has something

00:05:48.947 --> 00:05:50.201 very similar where you're pumping up

00:05:50.201 --> 00:05:51.714 a balloon and you know at some point,

00:05:51.720 --> 00:05:52.808 you know one pump is going to make

00:05:52.808 --> 00:05:53.878 it burst and you lose everything.

00:05:53.880 --> 00:05:55.238 And the question is when do you,

00:05:55.240 --> 00:05:56.020 when do you quit?

00:05:56.020 --> 00:05:56.995 And the Saint Petersburg problem,

00:05:57.000 --> 00:06:00.834 it's you have to pay before you ever start.

NOTE Confidence: 0.579155921428571

00:06:00.840 --> 00:06:02.595 OK. So the plan for the talk is talk

NOTE Confidence: 0.579155921428571

00:06:02.595 --> 00:06:04.637 a bit about risk aversion in general,

NOTE Confidence: 0.579155921428571

00:06:04.640 --> 00:06:06.000 how it comes up,

NOTE Confidence: 0.579155921428571

00:06:06.000 --> 00:06:08.040 talk about the measure of risk,

NOTE Confidence: 0.579155921428571

00:06:08.040 --> 00:06:10.070 which I think is a particularly useful

NOTE Confidence: 0.579155921428571

00:06:10.070 --> 00:06:12.554 measure for the sort of work that that we do.

NOTE Confidence: 0.579155921428571

00:06:12.560 --> 00:06:14.079 And I think also that it applies

NOTE Confidence: 0.579155921428571

00:06:14.079 --> 00:06:15.240 also in animal cases too.

NOTE Confidence: 0.579155921428571

00:06:15.240 --> 00:06:16.710 And I'll give you a little example

NOTE Confidence: 0.579155921428571

00:06:16.710 --> 00:06:18.276 of that at the end of my talk,

NOTE Confidence: 0.579155921428571

00:06:18.280 --> 00:06:19.876 I hope if I have time,

NOTE Confidence: 0.579155921428571

00:06:19.880 --> 00:06:22.190 so talk about tail risk in

NOTE Confidence: 0.579155921428571

00:06:22.190 --> 00:06:22.960 sequential problems,

NOTE Confidence: 0.579155921428571

00:06:22.960 --> 00:06:24.585 then talk about risk of

NOTE Confidence: 0.579155921428571

00:06:24.585 --> 00:06:25.560 those online behaviour.

NOTE Confidence: 0.579155921428571

00:06:25.560 --> 00:06:27.385 So thinking about our subjects

NOTE Confidence: 0.579155921428571

00:06:27.385 --> 00:06:29.581 making their choices in the in

NOTE Confidence: 0.579155921428571

00:06:29.581 --> 00:06:31.335 that little maze that you know

NOTE Confidence: 0.579155921428571

00:06:31.335 --> 00:06:33.330 with the with the robot and the

NOTE Confidence: 0.579155921428571

00:06:33.395 --> 00:06:35.355 and the lava pits and so forth,

NOTE Confidence: 0.579155921428571

00:06:35.360 --> 00:06:36.440 say a word about risk,

NOTE Confidence: 0.579155921428571

00:06:36.440 --> 00:06:37.385 averse offline planning.

NOTE Confidence: 0.579155921428571

00:06:37.385 --> 00:06:39.980 So the idea is if you're in an

NOTE Confidence: 0.579155921428571

00:06:39.980 --> 00:06:41.595 environment in which risk is,

NOTE Confidence: 0.579155921428571

00:06:41.600 --> 00:06:43.080 which is replete with risk,

NOTE Confidence: 0.579155921428571

00:06:43.080 --> 00:06:44.669 then maybe there are things that you

NOTE Confidence: 0.579155921428571

00:06:44.669 --> 00:06:46.836 can do ahead of time to try and mitigate it.

NOTE Confidence: 0.579155921428571

00:06:46.840 --> 00:06:48.322 Maybe that's going to change the

NOTE Confidence: 0.579155921428571

00:06:48.322 --> 00:06:49.975 way you go about thinking about

NOTE Confidence: 0.579155921428571

00:06:49.975 --> 00:06:52.158 the about the aspects of the world,

NOTE Confidence: 0.579155921428571

00:06:52.160 --> 00:06:53.975 doing some offline planning to

NOTE Confidence: 0.579155921428571

00:06:53.975 --> 00:06:55.427 prepare yourself correctly and

NOTE Confidence: 0.579155921428571

00:06:55.427 --> 00:06:57.220 then think about what that looks

NOTE Confidence: 0.579155921428571

00:06:57.220 --> 00:06:59.754 like in the context of of of risk,

NOTE Confidence: 0.579155921428571

00:06:59.754 --> 00:07:02.239 risk diversion and risk sensitivity.

NOTE Confidence: 0.579155921428571

00:07:02.240 --> 00:07:03.311 And then also as I say if I have

NOTE Confidence: 0.579155921428571

00:07:03.311 --> 00:07:04.319 a chance I'll talk a word,

NOTE Confidence: 0.579155921428571

00:07:04.320 --> 00:07:06.686 say a word about a some modelling

NOTE Confidence: 0.579155921428571

00:07:06.686 --> 00:07:09.910 we've done of a some lovely data on

NOTE Confidence: 0.579155921428571

00:07:09.994 --> 00:07:13.090 how mice do apparently risk sensitive

NOTE Confidence: 0.579155921428571

00:07:13.090 --> 00:07:15.560 exploration with some data from

NOTE Confidence: 0.579155921428571

00:07:15.560 --> 00:07:20.278 whatabi Yoshida Mitsuko's work in in Harvard.

NOTE Confidence: 0.579155921428571

00:07:20.280 --> 00:07:20.640 OK,

NOTE Confidence: 0.579155921428571

00:07:20.640 --> 00:07:22.440 so decision making and risk.

NOTE Confidence: 0.579155921428571

00:07:22.440 --> 00:07:23.600 So as you all know,

NOTE Confidence: 0.579155921428571

00:07:23.600 --> 00:07:26.368 risk is a very critical aspect of decision

NOTE Confidence: 0.579155921428571

00:07:26.368 --> 00:07:29.055 making and it comes up anytime that

NOTE Confidence: 0.579155921428571

00:07:29.055 --> 00:07:31.640 we have uncertain or probabilistic outcomes.

NOTE Confidence: 0.579155921428571

00:07:31.640 --> 00:07:33.285 So here you know you're here in

NOTE Confidence: 0.579155921428571

00:07:33.285 --> 00:07:33.755 Saint Petersburg,

NOTE Confidence: 0.579155921428571

00:07:33.760 --> 00:07:35.839 we're spinning a coin in other contexts,

NOTE Confidence: 0.579155921428571

00:07:35.840 --> 00:07:37.358 we have other sorts of ways

NOTE Confidence: 0.579155921428571

00:07:37.358 --> 00:07:38.117 of generating these,

NOTE Confidence: 0.579155921428571

00:07:38.120 --> 00:07:40.640 these these probabilities.

NOTE Confidence: 0.579155921428571

00:07:40.640 --> 00:07:41.810 Obviously whole industries

NOTE Confidence: 0.579155921428571

00:07:41.810 --> 00:07:43.760 have been designed around it.

NOTE Confidence: 0.579155921428571

00:07:43.760 --> 00:07:45.240 So things like insurance markets.

NOTE Confidence: 0.579155921428571

00:07:45.240 --> 00:07:47.360 So this is the famous,

NOTE Confidence: 0.579155921428571

00:07:47.360 --> 00:07:48.240 this is Lloyds of London,

NOTE Confidence: 0.579155921428571

00:07:48.240 --> 00:07:50.158 a little picture of Lloyds of London.

NOTE Confidence: 0.579155921428571

00:07:50.160 --> 00:07:51.528 And I think that it's likely

NOTE Confidence: 0.579155921428571

00:07:51.528 --> 00:07:53.115 plays a very crucial role in

NOTE Confidence: 0.579155921428571

00:07:53.115 --> 00:07:54.359 many aspects of psychopathology.

NOTE Confidence: 0.579155921428571

00:07:54.360 --> 00:07:55.816 And this is a study that has

NOTE Confidence: 0.579155921428571

00:07:55.816 --> 00:07:57.360 been done by very many groups,

NOTE Confidence: 0.579155921428571

00:07:57.360 --> 00:07:59.040 including obviously working

NOTE Confidence: 0.579155921428571

00:07:59.040 --> 00:08:01.472 in in in in Yale too.

NOTE Confidence: 0.579155921428571

00:08:01.472 --> 00:08:03.440 So things like anxiety and mania

NOTE Confidence: 0.579155921428571

00:08:03.511 --> 00:08:05.656 are obviously issues about what

NOTE Confidence: 0.579155921428571

00:08:05.656 --> 00:08:07.352 might happen could could be there

NOTE Confidence: 0.579155921428571

00:08:07.352 --> 00:08:08.942 in OCD you'd see that as well

NOTE Confidence: 0.579155921428571

00:08:08.942 --> 00:08:10.106 something again something that

NOTE Confidence: 0.579155921428571

00:08:10.106 --> 00:08:11.800 Phil has actually worked on too.

NOTE Confidence: 0.579155921428571

00:08:11.800 --> 00:08:13.976 And you also you have this notion of

NOTE Confidence: 0.579155921428571

00:08:13.976 --> 00:08:15.917 these sort of ruminative what ifs.

NOTE Confidence: 0.9303524305

00:08:15.920 --> 00:08:18.336 So in the context of the complex world

NOTE Confidence: 0.9303524305

00:08:18.336 --> 00:08:20.776 that we occupy there are many ways in

NOTE Confidence: 0.9303524305

00:08:20.776 --> 00:08:23.492 which we can be many risks that can

NOTE Confidence: 0.9303524305

00:08:23.492 --> 00:08:25.790 with very low probability events there

NOTE Confidence: 0.9303524305

00:08:25.863 --> 00:08:28.122 will cast swerves on the ice in a in

NOTE Confidence: 0.9303524305

00:08:28.122 --> 00:08:30.555 a in Tubian this morning very icy.

NOTE Confidence: 0.9303524305

00:08:30.560 --> 00:08:32.240 So you can imagine when you're you know

NOTE Confidence: 0.9303524305

00:08:32.240 --> 00:08:33.862 walking on the pavement there is a

NOTE Confidence: 0.9303524305

00:08:33.862 --> 00:08:35.360 chance that something nasty can happen.

NOTE Confidence: 0.9303524305

00:08:35.360 --> 00:08:37.232 If you pay a lot of attention to these

NOTE Confidence: 0.9303524305

00:08:37.232 --> 00:08:39.277 very low probability probability outcomes,

NOTE Confidence: 0.9303524305

00:08:39.280 --> 00:08:42.000 then then of course that's going to be

NOTE Confidence: 0.9303524305

00:08:42.000 --> 00:08:43.576 problematical for your expectations

NOTE Confidence: 0.9303524305

00:08:43.576 --> 00:08:46.400 about what might about what might happen.

NOTE Confidence: 0.9303524305

00:08:46.400 --> 00:08:47.160 And when you do that,

NOTE Confidence: 0.9303524305

00:08:47.160 --> 00:08:49.384 when you know you commit to a long

NOTE Confidence: 0.9303524305

00:08:49.384 --> 00:08:51.558 series of choices, then as I as I said,

NOTE Confidence: 0.9303524305

00:08:51.560 --> 00:08:53.940 you have to worry about how risk

NOTE Confidence: 0.9303524305

00:08:53.940 --> 00:08:56.118 accumulates along these along these paths.

NOTE Confidence: 0.9303524305

00:08:56.120 --> 00:08:58.200 So it's been beautifully studied

NOTE Confidence: 0.9303524305

00:08:58.200 --> 00:09:00.280 using single shot gambling paradigms.

NOTE Confidence: 0.9303524305

00:09:00.280 --> 00:09:02.116 So here's a classic example where

NOTE Confidence: 0.9303524305

00:09:02.116 --> 00:09:04.360 you have a choice of either a Shaw

NOTE Confidence: 0.9303524305

00:09:04.360 --> 00:09:07.100 $5 or a 5050 chance of $10 or a 5050

NOTE Confidence: 0.9303524305

00:09:07.183 --> 00:09:08.479 chance of $16.00.

NOTE Confidence: 0.9303524305

00:09:08.480 --> 00:09:10.165 I'm sorry in this case

NOTE Confidence: 0.9303524305

00:09:10.165 --> 00:09:11.513 here so many paradigms.

NOTE Confidence: 0.9303524305

00:09:11.520 --> 00:09:12.660 Obviously Canavan diversity done a

NOTE Confidence: 0.9303524305

00:09:12.660 --> 00:09:14.440 lot of work on that in in in Yale.

NOTE Confidence: 0.9303524305

00:09:14.440 --> 00:09:16.771 IFAT has done a lot of beautiful

NOTE Confidence: 0.9303524305

00:09:16.771 --> 00:09:18.520 work along these lines too.

NOTE Confidence: 0.9303524305

00:09:18.520 --> 00:09:20.744 But what we want to look at is

NOTE Confidence: 0.9303524305

00:09:20.744 --> 00:09:22.378 the sequential problems and not

NOTE Confidence: 0.9303524305

00:09:22.378 --> 00:09:24.400 only not only single shot games.

NOTE Confidence: 0.9303524305

00:09:24.400 --> 00:09:26.920 And so we'll see how that comes out.

NOTE Confidence: 0.9303524305

00:09:26.920 --> 00:09:29.236 So in order to make progress,

NOTE Confidence: 0.9303524305

00:09:29.240 --> 00:09:31.208 we have to define what sort of what

NOTE Confidence: 0.9303524305

00:09:31.208 --> 00:09:33.040 measure of risk we're going to use.

NOTE Confidence: 0.9303524305

00:09:33.040 --> 00:09:35.537 So there are a number of measures that

NOTE Confidence: 0.9303524305

00:09:35.537 --> 00:09:36.599 have been studied in the literature.

NOTE Confidence: 0.9303524305

00:09:36.600 --> 00:09:37.920 So prospect theory, for instance,

NOTE Confidence: 0.9303524305

00:09:37.920 --> 00:09:40.608 very famously gives us a ways of thinking

NOTE Confidence: 0.9303524305

00:09:40.608 --> 00:09:43.491 about how to combine your utilities and

NOTE Confidence: 0.9303524305

00:09:43.491 --> 00:09:45.631 probabilities and these risk cases.

NOTE Confidence: 0.9303524305

00:09:45.640 --> 00:09:47.523 But there's also a lot of work

NOTE Confidence: 0.9303524305

00:09:47.523 --> 00:09:48.880 from the insurance industry,

NOTE Confidence: 0.9303524305

00:09:48.880 --> 00:09:49.760 which of course has been,

NOTE Confidence: 0.9303524305

00:09:49.760 --> 00:09:50.364 you know,

NOTE Confidence: 0.9303524305

00:09:50.364 --> 00:09:51.874 which was worried about many

NOTE Confidence: 0.9303524305

00:09:51.874 --> 00:09:53.896 aspects of risk for a long time

NOTE Confidence: 0.9303524305

00:09:53.896 --> 00:09:55.474 and in a very quantitative way.

NOTE Confidence: 0.9303524305

00:09:55.480 --> 00:09:56.950 And one of the and they've

NOTE Confidence: 0.9303524305

00:09:56.950 --> 00:09:58.640 sort of come up with ideas,

NOTE Confidence: 0.9303524305

00:09:58.640 --> 00:10:00.992 or the mathematical aspect of that has come

NOTE Confidence: 0.9303524305

00:10:00.992 --> 00:10:03.718 up with ideas about how to systematize risk.

NOTE Confidence: 0.9303524305

00:10:03.720 --> 00:10:06.640 And one of the systematic ways that they

NOTE Confidence: 0.9303524305

00:10:06.640 --> 00:10:09.555 think about is to think about tail events.

NOTE Confidence: 0.9303524305

00:10:09.560 --> 00:10:11.730 So here we think of the distribution

NOTE Confidence: 0.9303524305

00:10:11.730 --> 00:10:13.293 of possible returns as just

NOTE Confidence: 0.9303524305

00:10:13.293 --> 00:10:14.437 some sort of histogram.

NOTE Confidence: 0.9303524305

00:10:14.440 --> 00:10:16.648 And then we the the risks

NOTE Confidence: 0.9303524305

00:10:16.648 --> 00:10:18.120 that we worry about,

NOTE Confidence: 0.9303524305

00:10:18.120 --> 00:10:19.848 the risks we care about are risks which

NOTE Confidence: 0.9303524305

00:10:19.848 --> 00:10:21.560 are found typically in the lower tail.

NOTE Confidence: 0.9303524305

00:10:21.560 --> 00:10:23.436 They're the nastiest things that can happen.

NOTE Confidence: 0.9303524305

00:10:23.440 --> 00:10:24.247 So for instance,

NOTE Confidence: 0.9303524305

00:10:24.247 --> 00:10:26.556 many of you will know that you could

NOTE Confidence: 0.9303524305

00:10:26.556 --> 00:10:28.361 think about there these Markovits

NOTE Confidence: 0.9303524305

00:10:28.361 --> 00:10:30.471 utilities where you add to the

NOTE Confidence: 0.9303524305

00:10:30.471 --> 00:10:32.277 mean some fraction of the variance,

NOTE Confidence: 0.9303524305

00:10:32.280 --> 00:10:33.846 but the variance of the distribution

NOTE Confidence: 0.9303524305

00:10:33.846 --> 00:10:35.637 includes not only the lower tail but

NOTE Confidence: 0.9303524305

00:10:35.637 --> 00:10:37.275 also the upper tail that thinks about

NOTE Confidence: 0.9303524305

00:10:37.320 --> 00:10:39.120 the whole structure of the distribution.

NOTE Confidence: 0.9303524305

00:10:39.120 --> 00:10:40.245 Whereas the things that we

NOTE Confidence: 0.9303524305

00:10:40.245 --> 00:10:41.680 worry about are the tail risks.

NOTE Confidence: 0.9303524305

00:10:41.680 --> 00:10:42.480 They're the nastiest things

NOTE Confidence: 0.9303524305

00:10:42.480 --> 00:10:43.280 that could possibly happen.

NOTE Confidence: 0.9303524305

00:10:43.280 --> 00:10:45.597 So things like and that's naturally medicine,

NOTE Confidence: 0.826717684545455

23

00:10:45.600 --> 00:10:48.150 finance, engineering and maybe also

NOTE Confidence: 0.826717684545455

00:10:48.150 --> 00:10:51.080 things like predation in animals too.

NOTE Confidence: 0.826717684545455

00:10:51.080 --> 00:10:52.000 So how does that work?

NOTE Confidence: 0.826717684545455

00:10:52.000 --> 00:10:53.244 So just illustrate this

NOTE Confidence: 0.826717684545455

00:10:53.244 --> 00:10:54.799 with our very simple case,

NOTE Confidence: 0.826717684545455

00:10:54.800 --> 00:10:57.168 the Saint Petersburg problem.

NOTE Confidence: 0.826717684545455

00:10:57.168 --> 00:10:59.195 So yeah, So what I'm now doing is

NOTE Confidence: 0.826717684545455

00:10:59.195 --> 00:11:00.986 showing you all the outcomes and their

NOTE Confidence: 0.826717684545455

00:11:00.986 --> 00:11:02.672 weighted by the and their probabilities.

NOTE Confidence: 0.826717684545455

00:11:02.680 --> 00:11:04.714 So this is 5050 for two EUR up to,

NOTE Confidence: 0.826717684545455

00:11:04.720 --> 00:11:07.037 you know, gets vanishingly small with this,

NOTE Confidence: 0.826717684545455

00:11:07.040 --> 00:11:08.684 this average value outcome

NOTE Confidence: 0.826717684545455

00:11:08.684 --> 00:11:09.917 being worth Infinity.

NOTE Confidence: 0.826717684545455

00:11:09.920 --> 00:11:11.719 And if you think about the tail,

NOTE Confidence: 0.826717684545455

00:11:11.720 --> 00:11:13.078 what we might do is to say

NOTE Confidence: 0.826717684545455

00:11:13.078 --> 00:11:14.360 let's choose in this instance,

NOTE Confidence: 0.826717684545455

00:11:14.360 --> 00:11:17.440 let's say the lower 7/8 of the distribution.

NOTE Confidence: 0.826717684545455

00:11:17.440 --> 00:11:20.240 So that's just these three dark blue bars.

NOTE Confidence: 0.826717684545455

00:11:20.240 --> 00:11:22.208 And that cuts off the upper

NOTE Confidence: 0.826717684545455

00:11:22.208 --> 00:11:23.520 1/8 of this distribution,

NOTE Confidence: 0.826717684545455

00:11:23.520 --> 00:11:24.440 which is all the other,

NOTE Confidence: 0.826717684545455

00:11:24.440 --> 00:11:26.660 the much nicer outcomes you could

NOTE Confidence: 0.826717684545455

00:11:26.660 --> 00:11:30.644 possibly have and and this and then

NOTE Confidence: 0.826717684545455

00:11:30.644 --> 00:11:33.011 this the the value of the outcome

NOTE Confidence: 0.826717684545455

00:11:33.011 --> 00:11:35.524 at the which is which is defined

NOTE Confidence: 0.826717684545455

00:11:35.524 --> 00:11:38.039 by this by this lower 7/8 tail.

NOTE Confidence: 0.826717684545455

00:11:38.040 --> 00:11:38.931 That's a quantile.

NOTE Confidence: 0.826717684545455

00:11:38.931 --> 00:11:40.416 That's just a 7/8 quantile

NOTE Confidence: 0.826717684545455

00:11:40.416 --> 00:11:41.800 of this distribution.

NOTE Confidence: 0.826717684545455

00:11:41.800 --> 00:11:43.920 That's a risk measure itself

NOTE Confidence: 0.826717684545455

00:11:43.920 --> 00:11:46.680 called the Value at Risk or VAR,

NOTE Confidence: 0.826717684545455

00:11:46.680 --> 00:11:47.262 shown here.

NOTE Confidence: 0.826717684545455

00:11:47.262 --> 00:11:49.299 It turns out that the value at

NOTE Confidence: 0.826717684545455

00:11:49.299 --> 00:11:51.489 risk doesn't satisfy some of these

NOTE Confidence: 0.826717684545455

00:11:51.489 --> 00:11:53.736 nice qualities that we expect that

NOTE Confidence: 0.826717684545455

00:11:53.736 --> 00:11:55.501 the from the insurance industry

NOTE Confidence: 0.826717684545455

00:11:55.501 --> 00:11:57.284 nicely worked out by Artzner,

NOTE Confidence: 0.826717684545455

00:11:57.284 --> 00:12:00.196 Rockefeller and EUR 7 many others as well.

NOTE Confidence: 0.826717684545455

00:12:00.200 --> 00:12:02.288 But a measure which also thinks

NOTE Confidence: 0.826717684545455

00:12:02.288 --> 00:12:04.567 about the lower tail and does

NOTE Confidence: 0.826717684545455

00:12:04.567 --> 00:12:06.607 satisfy these axioms is called

NOTE Confidence: 0.826717684545455

00:12:06.607 --> 00:12:08.440 the conditional Value at Risk,

NOTE Confidence: 0.826717684545455

00:12:08.440 --> 00:12:10.420 which is simply the average

NOTE Confidence: 0.826717684545455

00:12:10.420 --> 00:12:12.400 value in that lower tail.

NOTE Confidence: 0.826717684545455

00:12:12.400 --> 00:12:13.779 So the idea is you say I'm

NOTE Confidence: 0.826717684545455

00:12:13.779 --> 00:12:14.640 worried about the tail,

NOTE Confidence: 0.826717684545455

00:12:14.640 --> 00:12:15.846 we have an alpha value saying

00:12:15.846 --> 00:12:17.319 which tail am I worried about?

00:12:17.320 --> 00:12:18.184 The 7/8 tail.

00:12:18.184 --> 00:12:20.497 If it's the if it's the 100% tail,

00:12:20.497 --> 00:12:21.388 the one tail,

00:12:21.388 --> 00:12:22.873 it's just the whole distribution.

00:12:22.880 --> 00:12:23.918 Here it's the seven eighths tail.

00:12:23.920 --> 00:12:25.294 I've cut off all the really

00:12:25.294 --> 00:12:26.843 nice outcomes and I'm left only

00:12:26.843 --> 00:12:27.999 with the nastiest outcomes.

00:12:28.000 --> 00:12:29.596 And as that gets more extreme,

00:12:29.600 --> 00:12:31.154 I think about more and more or

00:12:31.154 --> 00:12:32.879 less and less of the distribution,

00:12:32.880 --> 00:12:34.280 just more and more of the nastiest

00:12:34.280 --> 00:12:35.880 things that can happen are going to be

00:12:35.880 --> 00:12:37.280 the things that I imagine happening.

00:12:37.280 --> 00:12:38.765 And that then defines the

NOTE Confidence: 0.826717684545455

00:12:38.765 --> 00:12:39.953 average value in those,

NOTE Confidence: 0.826717684545455

00:12:39.960 --> 00:12:41.675 defines this conditional value at

NOTE Confidence: 0.826717684545455

00:12:41.675 --> 00:12:44.319 risk or this C bar value itself.

NOTE Confidence: 0.826717684545455

00:12:44.320 --> 00:12:46.560 So how does that look?

NOTE Confidence: 0.826717684545455

00:12:46.560 --> 00:12:49.000 As we reduce alpha so alpha equals one,

NOTE Confidence: 0.826717684545455

00:12:49.000 --> 00:12:50.200 we have the whole distribution.

NOTE Confidence: 0.826717684545455

00:12:50.200 --> 00:12:51.000 That's Infinity.

NOTE Confidence: 0.826717684545455

00:12:51.000 --> 00:12:53.000 If alpha is 15 sixteenths,

NOTE Confidence: 0.826717684545455

00:12:53.000 --> 00:12:54.836 we just get these four bars,

NOTE Confidence: 0.826717684545455

00:12:54.840 --> 00:12:56.320 7/8 the three bars,

NOTE Confidence: 0.826717684545455

00:12:56.320 --> 00:12:58.872 3/4 these two bars, and alpha is 1/2.

NOTE Confidence: 0.826717684545455

00:12:58.872 --> 00:13:00.800 We just have this one bar left

NOTE Confidence: 0.826717684545455

00:13:00.800 --> 00:13:03.180 and so as alpha gets smaller we're

NOTE Confidence: 0.826717684545455

00:13:03.180 --> 00:13:05.398 getting more and more risk averse.

NOTE Confidence: 0.826717684545455

00:13:05.400 --> 00:13:06.640 We're thinking about this lower

NOTE Confidence: 0.826717684545455

00:13:06.640 --> 00:13:08.320 tail of the outcomes that we could,

NOTE Confidence: 0.826717684545455

00:13:08.320 --> 00:13:10.320 that we could possibly have.

NOTE Confidence: 0.826717684545455

00:13:10.320 --> 00:13:12.912 So formally you can write that down as

NOTE Confidence: 0.826717684545455

00:13:12.912 --> 00:13:15.997 being the expected value in this lower tails.

NOTE Confidence: 0.826717684545455

00:13:16.000 --> 00:13:16.195 That's.

NOTE Confidence: 0.826717684545455

00:13:16.195 --> 00:13:17.560 Then you could just write down these,

NOTE Confidence: 0.826717684545455

00:13:17.560 --> 00:13:17.915 these,

NOTE Confidence: 0.826717684545455

00:13:17.915 --> 00:13:19.690 this expected value underneath this

NOTE Confidence: 0.826717684545455

00:13:19.690 --> 00:13:22.160 quantile of the of the distribution.

NOTE Confidence: 0.826717684545455

00:13:22.160 --> 00:13:23.140 But there's another way

NOTE Confidence: 0.826717684545455

00:13:23.140 --> 00:13:24.120 of thinking about this,

NOTE Confidence: 0.885950566666667

00:13:24.120 --> 00:13:25.612 exactly the same calculation,

NOTE Confidence: 0.885950566666667

00:13:25.612 --> 00:13:27.477 almost like a dual view,

NOTE Confidence: 0.885950566666667

00:13:27.480 --> 00:13:29.442 which also relates to the way

NOTE Confidence: 0.885950566666667

00:13:29.442 --> 00:13:30.750 that prospect theory controls

NOTE Confidence: 0.885950566666667

29

00:13:30.813 --> 00:13:32.477 or thinks about probabilities,

NOTE Confidence: 0.885950566666667

00:13:32.480 --> 00:13:35.128 which is to have a what they call

NOTE Confidence: 0.885950566666667

00:13:35.128 --> 00:13:37.280 a probability distortion function.

NOTE Confidence: 0.885950566666667

00:13:37.280 --> 00:13:40.296 So here I've also now written down explicitly

NOTE Confidence: 0.885950566666667

00:13:40.296 --> 00:13:42.158 these probabilities of these outcomes,

NOTE Confidence: 0.885950566666667

00:13:42.160 --> 00:13:44.038 so half, 1/4 and so forth.

NOTE Confidence: 0.885950566666667

00:13:44.040 --> 00:13:46.362 And what you do with probably

NOTE Confidence: 0.885950566666667

00:13:46.362 --> 00:13:48.847 distortion is to say I'm allowed

NOTE Confidence: 0.885950566666667

00:13:48.847 --> 00:13:51.403 to multiply the values or change

NOTE Confidence: 0.885950566666667

00:13:51.403 --> 00:13:54.199 the values of the nastier outcomes.

NOTE Confidence: 0.885950566666667

00:13:54.200 --> 00:13:56.792 I boost those probabilities and I

NOTE Confidence: 0.885950566666667

00:13:56.792 --> 00:13:58.520 suppress the higher probabilities,

NOTE Confidence: 0.885950566666667

00:13:58.520 --> 00:14:03.002 and the idea inside this conditional

NOTE Confidence: 0.885950566666667

00:14:03.002 --> 00:14:05.389 value at risk is that there's a

NOTE Confidence: 0.885950566666667

00:14:05.389 --> 00:14:07.557 maximum value of possible distortion.

NOTE Confidence: 0.885950566666667

00:14:07.560 --> 00:14:10.038 So if my alpha value is 7/8,

NOTE Confidence: 0.885950566666667

00:14:10.040 --> 00:14:11.396 which means I'm interested in this

NOTE Confidence: 0.885950566666667

00:14:11.396 --> 00:14:12.920 bottom 7/8 of the distribution,

NOTE Confidence: 0.885950566666667

00:14:12.920 --> 00:14:15.590 it means I'm allowed to multiply

NOTE Confidence: 0.885950566666667

00:14:15.590 --> 00:14:17.370 all my nastiest probabilities

NOTE Confidence: 0.885950566666667

00:14:17.449 --> 00:14:19.640 by 8 / 7 by 1 over alpha.

NOTE Confidence: 0.885950566666667

00:14:19.640 --> 00:14:20.956 And then I just keep on doing

NOTE Confidence: 0.885950566666667

00:14:20.956 --> 00:14:22.240 that until I run out of Rd.,

NOTE Confidence: 0.885950566666667

00:14:22.240 --> 00:14:24.151 until I run out of probability mass

NOTE Confidence: 0.885950566666667

00:14:24.151 --> 00:14:26.239 because in the end it still has

NOTE Confidence: 0.885950566666667

00:14:26.239 --> 00:14:27.754 to be a probability distribution.

NOTE Confidence: 0.885950566666667

00:14:27.760 --> 00:14:28.972 So in this instance,

NOTE Confidence: 0.885950566666667

00:14:28.972 --> 00:14:31.163 I multiply all these outcomes by a

NOTE Confidence: 0.885950566666667

00:14:31.163 --> 00:14:33.319 weighting factor which is 8 sevenths here

NOTE Confidence: 0.885950566666667

00:14:33.320 --> 00:14:35.880 until I then run out of run out of road.

NOTE Confidence: 0.885950566666667

00:14:35.880 --> 00:14:37.888 And so then then that just leaves the

NOTE Confidence: 0.885950566666667

00:14:37.888 --> 00:14:39.934 only these three bars as being something

NOTE Confidence: 0.885950566666667

00:14:39.934 --> 00:14:42.158 which is contributing to my to my values.

NOTE Confidence: 0.885950566666667

00:14:42.160 --> 00:14:44.248 And you can see that that's an exactly

NOTE Confidence: 0.885950566666667

00:14:44.248 --> 00:14:45.933 equivalent to the three bars that we

NOTE Confidence: 0.885950566666667

00:14:45.933 --> 00:14:47.998 have here in terms of the value at risk.

NOTE Confidence: 0.885950566666667

00:14:48.000 --> 00:14:50.800 So these are equivalent ways of thinking

NOTE Confidence: 0.885950566666667

00:14:50.800 --> 00:14:52.944 about, about thinking about this,

NOTE Confidence: 0.885950566666667

00:14:52.944 --> 00:14:56.120 about the effect of of these tales.

NOTE Confidence: 0.885950566666667

00:14:56.120 --> 00:14:58.280 And they're both very, I think,

NOTE Confidence: 0.885950566666667

00:14:58.280 --> 00:15:00.300 very useful constructs to think

NOTE Confidence: 0.885950566666667

00:15:00.300 --> 00:15:02.553 about the about these, these,

NOTE Confidence: 0.885950566666667

00:15:02.553 --> 00:15:05.718 these these nasty possible outcomes.

NOTE Confidence: 0.885950566666667

00:15:05.720 --> 00:15:07.040 OK, so just to summarise on,

NOTE Confidence: 0.885950566666667

00:15:07.040 --> 00:15:07.848 on Sevar,

NOTE Confidence: 0.885950566666667

00:15:07.848 --> 00:15:10.676 it's what's called a coherent risk measure.

NOTE Confidence: 0.885950566666667

00:15:10.680 --> 00:15:12.192 And that's these axioms I was

NOTE Confidence: 0.885950566666667

00:15:12.192 --> 00:15:13.992 referring to that that we want from

NOTE Confidence: 0.885950566666667

00:15:13.992 --> 00:15:15.474 insurance which have to do with

NOTE Confidence: 0.885950566666667

00:15:15.474 --> 00:15:17.226 things like you want the risk to

NOTE Confidence: 0.885950566666667

00:15:17.226 --> 00:15:18.940 decrease if we diversify your assets,

NOTE Confidence: 0.885950566666667

00:15:18.940 --> 00:15:20.790 something that's what the value

NOTE Confidence: 0.885950566666667

00:15:20.790 --> 00:15:22.560 at risk does not have.

NOTE Confidence: 0.885950566666667

00:15:22.560 --> 00:15:24.880 It emphasises the lower tail.

NOTE Confidence: 0.885950566666667

00:15:24.880 --> 00:15:26.326 So we're always interested in the

NOTE Confidence: 0.885950566666667

00:15:26.326 --> 00:15:27.640 nasty things that can happen.

NOTE Confidence: 0.885950566666667

00:15:27.640 --> 00:15:28.684 If alpha's one,

NOTE Confidence: 0.885950566666667

00:15:28.684 --> 00:15:30.076 it's the regular mean.

NOTE Confidence: 0.885950566666667

00:15:30.080 --> 00:15:31.800 We just think about the overall mean of

NOTE Confidence: 0.885950566666667

00:15:31.800 --> 00:15:33.117 the distribution that was the Infinity.

NOTE Confidence: 0.885950566666667

00:15:33.120 --> 00:15:35.436 Here, as alpha tends to zero,

NOTE Confidence: 0.885950566666667

00:15:35.440 --> 00:15:38.080 we only care about the worst possible case,

NOTE Confidence: 0.885950566666667

00:15:38.080 --> 00:15:40.800 which is the the minimum that can happen.

NOTE Confidence: 0.885950566666667

00:15:40.800 --> 00:15:43.236 And we have this nice equivalence

NOTE Confidence: 0.885950566666667

00:15:43.240 --> 00:15:45.340 to these distorted these probability

NOTE Confidence: 0.885950566666667

00:15:45.340 --> 00:15:47.020 distortion measures in which

NOTE Confidence: 0.885950566666667

00:15:47.020 --> 00:15:48.799 we favour that outcomes.

NOTE Confidence: 0.885950566666667

00:15:48.800 --> 00:15:49.040 OK,

NOTE Confidence: 0.885950566666667

00:15:49.040 --> 00:15:50.960 so that's when we can see the whole

NOTE Confidence: 0.885950566666667

00:15:50.960 --> 00:15:52.196 distribution in front of us like

NOTE Confidence: 0.885950566666667

00:15:52.196 --> 00:15:53.839 you have in a regular gambling case.

NOTE Confidence: 0.885950566666667

00:15:53.840 --> 00:15:55.856 You know if you're just specify

NOTE Confidence: 0.885950566666667

00:15:55.856 --> 00:15:58.044 that what happens if we the way

NOTE Confidence: 0.885950566666667

00:15:58.044 --> 00:15:59.976 we started thinking about this was

NOTE Confidence: 0.885950566666667

00:15:59.976 --> 00:16:01.807 to think about the sequential case

NOTE Confidence: 0.885950566666667

00:16:01.807 --> 00:16:03.968 where we spin the coin and then we

NOTE Confidence: 0.885950566666667

00:16:03.968 --> 00:16:05.736 either get it either get a head or

NOTE Confidence: 0.885950566666667

00:16:05.736 --> 00:16:07.914 tail and then we can spin the coin again.

NOTE Confidence: 0.885950566666667

00:16:07.920 --> 00:16:10.040 So how does that work in this in this domain?

NOTE Confidence: 0.713596822857143

00:16:10.040 --> 00:16:12.208 And you'll see a sort of surprise comes

NOTE Confidence: 0.713596822857143

00:16:12.208 --> 00:16:14.272 up that we then have to cope with.

NOTE Confidence: 0.713596822857143

00:16:14.272 --> 00:16:16.640 So here we started off with the first

NOTE Confidence: 0.713596822857143

00:16:16.708 --> 00:16:18.985 flip of the coin and so these you know

NOTE Confidence: 0.713596822857143

00:16:18.985 --> 00:16:21.279 if we get the tail we get to €2.00,

NOTE Confidence: 0.713596822857143

00:16:21.280 --> 00:16:23.216 we get the head, we get a chance

NOTE Confidence: 0.713596822857143

00:16:23.216 --> 00:16:25.411 to carry on to know and then we get

NOTE Confidence: 0.713596822857143

00:16:25.411 --> 00:16:27.359 to chances to spin the coin again.

NOTE Confidence: 0.713596822857143

00:16:27.360 --> 00:16:29.296 So and then if you spin the coin

NOTE Confidence: 0.713596822857143

00:16:29.296 --> 00:16:30.950 again you get to know again if

NOTE Confidence: 0.713596822857143

00:16:30.950 --> 00:16:32.595 you get a tail you get €4.00.

NOTE Confidence: 0.713596822857143

00:16:32.600 --> 00:16:33.160 If you get the head,

NOTE Confidence: 0.713596822857143

00:16:33.160 --> 00:16:34.216 you get, excuse me,

NOTE Confidence: 0.713596822857143

00:16:34.216 --> 00:16:36.200 the chance to spin the coin again,

NOTE Confidence: 0.713596822857143

00:16:36.200 --> 00:16:36.880 You spin the coin again,

NOTE Confidence: 0.713596822857143

00:16:36.880 --> 00:16:39.535 you get €8 and then and so forth and

NOTE Confidence: 0.713596822857143

00:16:39.535 --> 00:16:42.358 just carries on down and down and down.

NOTE Confidence: 0.713596822857143

00:16:42.360 --> 00:16:44.502 So as I mentioned now what we want to

NOTE Confidence: 0.713596822857143

00:16:44.502 --> 00:16:46.665 do when we're thinking about the the

NOTE Confidence: 0.713596822857143

00:16:46.665 --> 00:16:49.040 risk is we distort our probabilities.

NOTE Confidence: 0.713596822857143

00:16:49.040 --> 00:16:50.798 So we start at the beginning.

NOTE Confidence: 0.713596822857143

00:16:50.800 --> 00:16:53.344 We say OK well now I said that

NOTE Confidence: 0.713596822857143

00:16:53.344 --> 00:16:55.388 if alpha is 7 / 7 / 8,

NOTE Confidence: 0.713596822857143

00:16:55.388 --> 00:16:57.044 we get to distort the properties

NOTE Confidence: 0.713596822857143

00:16:57.044 --> 00:16:58.488 by 8 by by 8 / 7.

NOTE Confidence: 0.713596822857143

00:16:58.488 --> 00:17:00.328 Then we can distort those

NOTE Confidence: 0.713596822857143

00:17:00.328 --> 00:17:01.800 properties some maximum value,

NOTE Confidence: 0.713596822857143

00:17:01.800 --> 00:17:03.264 which means that we make it

NOTE Confidence: 0.713596822857143

00:17:03.264 --> 00:17:05.026 more likely to get the tail and

NOTE Confidence: 0.713596822857143

00:17:05.026 --> 00:17:06.478 less likely to get the head.

NOTE Confidence: 0.713596822857143

00:17:06.480 --> 00:17:08.096 So we make this bar the the the

NOTE Confidence: 0.713596822857143

00:17:08.096 --> 00:17:09.487 left bar slightly higher and

NOTE Confidence: 0.713596822857143

00:17:09.487 --> 00:17:11.037 the right bar slightly lower.

NOTE Confidence: 0.713596822857143

00:17:11.040 --> 00:17:12.345 That's our distortion.

NOTE Confidence: 0.713596822857143

00:17:12.345 --> 00:17:14.520 Our risk sensitivity has said,

NOTE Confidence: 0.713596822857143

00:17:14.520 --> 00:17:16.230 OK, we think that even though

NOTE Confidence: 0.713596822857143

00:17:16.230 --> 00:17:17.720 it should really be 5050,

NOTE Confidence: 0.713596822857143

00:17:17.720 --> 00:17:20.000 the the real answer is 5050.

NOTE Confidence: 0.713596822857143

00:17:20.000 --> 00:17:22.316 In our subjective evaluation of this,

NOTE Confidence: 0.713596822857143

00:17:22.320 --> 00:17:24.301 we boost the nasty one and and

NOTE Confidence: 0.713596822857143

00:17:24.301 --> 00:17:25.993 slightly suppress the the the nice

NOTE Confidence: 0.713596822857143

00:17:25.993 --> 00:17:27.820 one and the amount that we suppress

NOTE Confidence: 0.713596822857143

00:17:27.881 --> 00:17:30.032 it by then though is is is is also

NOTE Confidence: 0.713596822857143

00:17:30.032 --> 00:17:31.960 reflected by the to to make sure

NOTE Confidence: 0.713596822857143

00:17:31.960 --> 00:17:34.000 that the property is also up to 1.

NOTE Confidence: 0.713596822857143

00:17:34.000 --> 00:17:35.928 So you might think it'd be

NOTE Confidence: 0.713596822857143

00:17:35.928 --> 00:17:36.552 very natural thing.

NOTE Confidence: 0.713596822857143

00:17:36.552 --> 00:17:36.760 Well,

NOTE Confidence: 0.713596822857143

00:17:36.760 --> 00:17:38.044 now we have another choice and

NOTE Confidence: 0.713596822857143

00:17:38.044 --> 00:17:39.760 we do the same distortion again,

NOTE Confidence: 0.713596822857143

00:17:39.760 --> 00:17:41.200 and then we do the same

NOTE Confidence: 0.713596822857143

00:17:41.200 --> 00:17:42.520 distortion again and so forth.

NOTE Confidence: 0.713596822857143

00:17:42.520 --> 00:17:46.072 But that does actually

NOTE Confidence: 0.713596822857143

00:17:46.072 --> 00:17:48.440 generate a a version of sebar,

NOTE Confidence: 0.713596822857143

00:17:48.440 --> 00:17:49.675 but it doesn't generate the

NOTE Confidence: 0.713596822857143

00:17:49.675 --> 00:17:51.263 version of sebar that we started

NOTE Confidence: 0.713596822857143

00:17:51.263 --> 00:17:52.479 off with thinking about.

NOTE Confidence: 0.713596822857143

00:17:52.480 --> 00:17:54.405 So here I say what you want to do is just

NOTE Confidence: 0.713596822857143

00:17:54.405 --> 00:17:56.078 look only at the lower possible tail.

NOTE Confidence: 0.713596822857143

00:17:56.080 --> 00:17:57.767 You can see that if we just

NOTE Confidence: 0.713596822857143

00:17:57.767 --> 00:17:59.119 keep on distorting by the same

NOTE Confidence: 0.713596822857143

00:17:59.120 --> 00:18:00.496 fraction every single time,

NOTE Confidence: 0.713596822857143

00:18:00.496 --> 00:18:03.309 then we're going to actually get instead of

NOTE Confidence: 0.713596822857143

00:18:03.309 --> 00:18:05.717 getting distorting the the tails like this,

NOTE Confidence: 0.713596822857143

00:18:05.720 --> 00:18:07.394 we're actually going to get a

NOTE Confidence: 0.713596822857143

00:18:07.394 --> 00:18:09.479 contribution from all the possible outcomes.

NOTE Confidence: 0.713596822857143

00:18:09.480 --> 00:18:12.049 But now each of the outcomes instead

NOTE Confidence: 0.713596822857143

00:18:12.049 --> 00:18:14.478 of instead of being boosted by,

NOTE Confidence: 0.713596822857143

00:18:14.480 --> 00:18:16.550 instead of being going down like

NOTE Confidence: 0.713596822857143

00:18:16.550 --> 00:18:18.758 one like a half 1/4 and so forth,

NOTE Confidence: 0.713596822857143

00:18:18.760 --> 00:18:19.880 it tends to go,

NOTE Confidence: 0.713596822857143

00:18:19.880 --> 00:18:21.280 it actually goes down like

NOTE Confidence: 0.713596822857143

00:18:21.280 --> 00:18:22.320 3737 squared and so forth.

NOTE Confidence: 0.713596822857143

00:18:22.320 --> 00:18:24.320 There's a sort of technical reason for that.

NOTE Confidence: 0.713596822857143

00:18:24.320 --> 00:18:25.748 You can see that that doesn't

NOTE Confidence: 0.713596822857143

00:18:25.748 --> 00:18:27.165 have the property that I talked

NOTE Confidence: 0.713596822857143

39

00:18:27.165 --> 00:18:28.401 about in which we just sort

00:18:28.401 --> 00:18:29.600 of slice off this bottom,

00:18:29.600 --> 00:18:31.598 this bottom aspect of the distribution.

00:18:31.600 --> 00:18:33.193 It is a, it is a risk measure that

00:18:33.193 --> 00:18:34.757 we some that we could also use.

00:18:34.760 --> 00:18:38.396 And in fact in many cases it's a very,

00:18:38.400 --> 00:18:40.758 it's a very severe risk measure.

00:18:40.760 --> 00:18:42.278 It's a more severe risk measure.

00:18:42.280 --> 00:18:44.359 But the measure we wanted to talk

00:18:44.359 --> 00:18:45.936 about instead actually requires us to

00:18:45.936 --> 00:18:47.400 do a different sort of calculation,

00:18:47.400 --> 00:18:49.563 which I think is really important for

00:18:49.563 --> 00:18:51.244 thinking about how risk processing

00:18:51.244 --> 00:18:53.314 works in this this sequential way.

00:18:53.320 --> 00:18:56.834 So instead what happens is after we've,

00:18:56.840 --> 00:18:58.196 after we've boosted the, after we,

NOTE Confidence: 0.738826960625

00:18:58.200 --> 00:19:00.356 we're lucky and we we got ahead.

NOTE Confidence: 0.738826960625

00:19:00.360 --> 00:19:02.240 At this point, if you think about it,

NOTE Confidence: 0.738826960625

00:19:02.240 --> 00:19:03.675 we're trying to accumulate the

NOTE Confidence: 0.738826960625

00:19:03.675 --> 00:19:05.733 amount of luck that we can have

NOTE Confidence: 0.738826960625

00:19:05.733 --> 00:19:07.437 over a whole sequence of choices.

NOTE Confidence: 0.738826960625

00:19:07.440 --> 00:19:09.120 This is the sequential aspect.

NOTE Confidence: 0.738826960625

00:19:09.120 --> 00:19:11.595 And if we start off and we're already lucky,

NOTE Confidence: 0.738826960625

00:19:11.600 --> 00:19:12.940 it means we've already consumed

NOTE Confidence: 0.738826960625

00:19:12.940 --> 00:19:14.280 some of our good luck.

NOTE Confidence: 0.738826960625

00:19:14.280 --> 00:19:16.305 Which means that now we have to be a

NOTE Confidence: 0.738826960625

00:19:16.305 --> 00:19:18.092 little bit more risk averse in the

NOTE Confidence: 0.738826960625

00:19:18.092 --> 00:19:19.970 future in order that the total amount

NOTE Confidence: 0.738826960625

00:19:19.970 --> 00:19:22.171 of luck that we're expecting to get or

NOTE Confidence: 0.738826960625

00:19:22.171 --> 00:19:24.208 that good or bad luck we're expecting

NOTE Confidence: 0.738826960625

00:19:24.208 --> 00:19:27.077 to get is pegged to right at the beginning.

NOTE Confidence: 0.738826960625

00:19:27.080 --> 00:19:28.520 So that means that now

NOTE Confidence: 0.738826960625

00:19:28.520 --> 00:19:29.960 having been this much risk,

NOTE Confidence: 0.738826960625

00:19:29.960 --> 00:19:31.514 having been this lucky in this case,

NOTE Confidence: 0.738826960625

00:19:31.520 --> 00:19:33.680 we got our first tail,

NOTE Confidence: 0.738826960625

00:19:33.680 --> 00:19:35.236 we got Einstein first,

NOTE Confidence: 0.738826960625

00:19:35.236 --> 00:19:39.240 we now have to be a more risk averse.

NOTE Confidence: 0.738826960625

00:19:39.240 --> 00:19:41.922 So alpha started out at 7/8 and now it

NOTE Confidence: 0.738826960625

00:19:41.922 --> 00:19:44.318 turns out that it has to be boosted.

NOTE Confidence: 0.738826960625

00:19:44.320 --> 00:19:45.172 It has to be.

NOTE Confidence: 0.738826960625

00:19:45.172 --> 00:19:46.237 The amount of risk aversion

NOTE Confidence: 0.738826960625

00:19:46.237 --> 00:19:47.160 has to be boosted,

NOTE Confidence: 0.738826960625

00:19:47.160 --> 00:19:49.374 which means that the alpha value

NOTE Confidence: 0.738826960625

00:19:49.374 --> 00:19:51.758 decreases from being 7/8 to being 3/4.

NOTE Confidence: 0.738826960625

00:19:51.760 --> 00:19:54.800 So now when we do our probability distortion,

NOTE Confidence: 0.738826960625

00:19:54.800 --> 00:19:58.104 we're now we distort the we now make

NOTE Confidence: 0.738826960625

00:19:58.104 --> 00:20:00.248 it even more likely now with Four

NOTE Confidence: 0.738826960625

00:20:00.248 --> 00:20:02.036 Thirds more likely rather than rather

NOTE Confidence: 0.738826960625

00:20:02.036 --> 00:20:04.052 than 8 sevenths more likely that we're

NOTE Confidence: 0.738826960625

00:20:04.052 --> 00:20:05.996 going to get the unfortunate outcome,

NOTE Confidence: 0.738826960625

00:20:06.000 --> 00:20:09.920 which is the the the the tail in this case,

NOTE Confidence: 0.738826960625

00:20:09.920 --> 00:20:11.460 and we make it less likely that

NOTE Confidence: 0.738826960625

00:20:11.460 --> 00:20:12.800 we're going to get the head.

NOTE Confidence: 0.738826960625

00:20:12.800 --> 00:20:14.320 And now if we do get the head,

NOTE Confidence: 0.738826960625

00:20:14.320 --> 00:20:15.600 we've been lucky again.

NOTE Confidence: 0.738826960625

00:20:15.600 --> 00:20:18.160 We've consumed even more of our good luck.

NOTE Confidence: 0.738826960625

00:20:18.160 --> 00:20:20.288 And so now the we become even

NOTE Confidence: 0.738826960625

00:20:20.288 --> 00:20:21.200 more risk averse.

NOTE Confidence: 0.738826960625

00:20:21.200 --> 00:20:24.520 The alpha value goes down further to 1/2.

NOTE Confidence: 0.738826960625

00:20:24.520 --> 00:20:26.400 And so now when we do the distortion

NOTE Confidence: 0.738826960625

00:20:26.400 --> 00:20:28.439 it turns out we do maximal distortion.

NOTE Confidence: 0.738826960625

00:20:28.440 --> 00:20:31.380 So now the tail instead of being

NOTE Confidence: 0.738826960625

00:20:31.380 --> 00:20:34.161 probably 5050 in our minds it's gone

NOTE Confidence: 0.738826960625

00:20:34.161 --> 00:20:36.357 up to the probably has gone up to 1.

NOTE Confidence: 0.738826960625

00:20:36.360 --> 00:20:37.200 The probably getting the head,

NOTE Confidence: 0.738826960625

00:20:37.200 --> 00:20:38.395 the sorry the probably getting

NOTE Confidence: 0.738826960625

00:20:38.395 --> 00:20:39.880 the head has gone to zero.

NOTE Confidence: 0.738826960625

00:20:39.880 --> 00:20:41.280 And that is then means that we

NOTE Confidence: 0.738826960625

00:20:41.280 --> 00:20:42.240 therefore can never get the,

NOTE Confidence: 0.738826960625

00:20:42.240 --> 00:20:45.273 we never get any more further down the tree.

NOTE Confidence: 0.738826960625

00:20:45.280 --> 00:20:48.094 And so in order to compute the

NOTE Confidence: 0.738826960625

00:20:48.094 --> 00:20:49.760 Sivar in this way,

NOTE Confidence: 0.738826960625

00:20:49.760 --> 00:20:51.874 when we think about a sequential problem,

NOTE Confidence: 0.738826960625

00:20:51.880 --> 00:20:55.000 we have to keep on revaluing our alphas.

NOTE Confidence: 0.738826960625

00:20:55.000 --> 00:20:55.948 If we're lucky,

NOTE Confidence: 0.738826960625

00:20:55.948 --> 00:20:58.160 it means we become more risk averse,

NOTE Confidence: 0.738826960625

00:20:58.160 --> 00:20:59.640 which means alpha gets lower.

NOTE Confidence: 0.738826960625

00:20:59.640 --> 00:21:00.357 If we're unlucky,

NOTE Confidence: 0.738826960625

00:21:00.357 --> 00:21:02.030 it means in fact we can become

NOTE Confidence: 0.738826960625

00:21:02.087 --> 00:21:03.671 more risk seeking in the future

NOTE Confidence: 0.738826960625

00:21:03.671 --> 00:21:04.727 because we're sort of

NOTE Confidence: 0.866114429

00:21:04.783 --> 00:21:06.615 trying to peg the total amount of risk

NOTE Confidence: 0.866114429

00:21:06.615 --> 00:21:09.080 that we suffer along the whole path

NOTE Confidence: 0.866114429

00:21:09.080 --> 00:21:11.718 along the way towards towards the end.

NOTE Confidence: 0.866114429

00:21:11.718 --> 00:21:13.102 So there's this notion

NOTE Confidence: 0.866114429

00:21:13.102 --> 00:21:14.960 here of pre commitment.

NOTE Confidence: 0.866114429

00:21:14.960 --> 00:21:17.480 When we start the problem we think how

NOTE Confidence: 0.866114429

00:21:17.480 --> 00:21:19.565 much risk are we willing to endure

NOTE Confidence: 0.866114429

00:21:19.565 --> 00:21:22.303 or and then as we then are lucky or

NOTE Confidence: 0.866114429

00:21:22.303 --> 00:21:24.825 unlucky we don't have to adjust the

NOTE Confidence: 0.866114429

00:21:24.825 --> 00:21:29.466 way that we we endure this the way

NOTE Confidence: 0.866114429

00:21:29.466 --> 00:21:32.196 that we evaluate future outcomes.

NOTE Confidence: 0.866114429

00:21:32.200 --> 00:21:33.992 So in pre committed C bar we're

NOTE Confidence: 0.866114429

00:21:33.992 --> 00:21:35.398 privileging a start saying we're

NOTE Confidence: 0.866114429

00:21:35.398 --> 00:21:37.144 saying this is where we're defining

NOTE Confidence: 0.866114429

00:21:37.144 --> 00:21:38.765 risk from because then because

NOTE Confidence: 0.866114429

00:21:38.765 --> 00:21:40.400 we're then revaluing our alpha,

NOTE Confidence: 0.866114429

00:21:40.400 --> 00:21:41.580 our risk aversion in order

NOTE Confidence: 0.866114429

00:21:41.580 --> 00:21:42.760 to peg where we're going.

NOTE Confidence: 0.866114429

00:21:42.760 --> 00:21:44.153 So you might think of that as

NOTE Confidence: 0.866114429

00:21:44.153 --> 00:21:45.855 being like a home or a or a nest

NOTE Confidence: 0.866114429

00:21:45.855 --> 00:21:47.040 for an animal for instance.

NOTE Confidence: 0.866114429

00:21:47.040 --> 00:21:48.839 And then we have to change alpha

NOTE Confidence: 0.866114429

00:21:48.839 --> 00:21:51.211 and the way we change it is like a

NOTE Confidence: 0.866114429

00:21:51.211 --> 00:21:52.960 justified form of the gambler's fallacy.

NOTE Confidence: 0.866114429

00:21:52.960 --> 00:21:54.040 If you're unlucky,

NOTE Confidence: 0.866114429

00:21:54.040 --> 00:21:55.558 you've been unlucky for a while,

NOTE Confidence: 0.866114429

00:21:55.560 --> 00:21:57.198 then you then in some sense

NOTE Confidence: 0.866114429

00:21:57.198 --> 00:21:58.680 you can be more risk.

NOTE Confidence: 0.866114429

00:21:58.680 --> 00:22:00.024 You can be more a little

NOTE Confidence: 0.866114429

00:22:00.024 --> 00:22:00.920 bit more risk seeking,

NOTE Confidence: 0.866114429

00:22:00.920 --> 00:22:02.480 you mean less risk averse.

NOTE Confidence: 0.866114429

00:22:02.480 --> 00:22:04.195 If you've been lucky then you're expecting

NOTE Confidence: 0.866114429

00:22:04.195 --> 00:22:05.997 to be more unlucky in the future,

NOTE Confidence: 0.866114429

00:22:06.000 --> 00:22:08.191 so therefore your alpha decreases in that

NOTE Confidence: 0.866114429

00:22:08.191 --> 00:22:10.530 way in order to peg the total amount

NOTE Confidence: 0.866114429

00:22:10.530 --> 00:22:12.678 of risk you have along a whole path.

NOTE Confidence: 0.866114429

00:22:12.680 --> 00:22:15.277 Alpha equals zero and one are special,

NOTE Confidence: 0.866114429

00:22:15.280 --> 00:22:17.920 so alpha equals one is means.

NOTE Confidence: 0.866114429

00:22:17.920 --> 00:22:19.312 It's just the mean and then

NOTE Confidence: 0.866114429

00:22:19.312 --> 00:22:20.240 you never revalue that.

NOTE Confidence: 0.866114429

00:22:20.240 --> 00:22:21.500 You just keep on without

NOTE Confidence: 0.866114429

00:22:21.500 --> 00:22:22.760 value of alpha equals one,

NOTE Confidence: 0.866114429

00:22:22.760 --> 00:22:24.424 alpha equals 0 is the minimum and you

NOTE Confidence: 0.866114429

00:22:24.424 --> 00:22:25.923 stick with that too because you can

NOTE Confidence: 0.866114429

00:22:25.923 --> 00:22:27.439 never you can never get more risk.

NOTE Confidence: 0.866114429

00:22:27.440 --> 00:22:28.590 You know you you basically

NOTE Confidence: 0.866114429

00:22:28.590 --> 00:22:30.080 if you you've run out of Rd.

NOTE Confidence: 0.866114429

00:22:30.080 --> 00:22:31.805 you're always thinking about the

NOTE Confidence: 0.866114429

00:22:31.805 --> 00:22:33.530 worst possible outcome that can

NOTE Confidence: 0.866114429

00:22:33.594 --> 00:22:35.253 ever happen and so you have to

NOTE Confidence: 0.866114429

00:22:35.253 --> 00:22:37.166 then in order to do this you don't

NOTE Confidence: 0.866114429

00:22:37.166 --> 00:22:38.488 have to have this either.

NOTE Confidence: 0.866114429

00:22:38.488 --> 00:22:40.936 So monitor how much luck you've

NOTE Confidence: 0.866114429

00:22:40.936 --> 00:22:43.681 had along a path or we just think

NOTE Confidence: 0.866114429

00:22:43.681 --> 00:22:45.127 about changing the value of alpha

NOTE Confidence: 0.866114429

00:22:45.127 --> 00:22:47.053 as we go along and then we make it

NOTE Confidence: 0.866114429

00:22:47.053 --> 00:22:49.058 in the way I showed you for Saint

NOTE Confidence: 0.866114429

00:22:49.058 --> 00:22:50.543 Petersburg problem where we make

NOTE Confidence: 0.866114429

00:22:50.543 --> 00:22:51.935 alpha where there we made alpha

NOTE Confidence: 0.866114429

00:22:51.935 --> 00:22:53.268 smaller and smaller because we kept

NOTE Confidence: 0.866114429

00:22:53.268 --> 00:22:54.633 on being lucky and lucky and lucky.

NOTE Confidence: 0.866114429

00:22:54.640 --> 00:22:56.117 Every time we got the head until

NOTE Confidence: 0.866114429

00:22:56.117 --> 00:22:57.928 the end we ran out of road and then

NOTE Confidence: 0.866114429

00:22:57.928 --> 00:22:59.756 we ran out of the at the after the,

NOTE Confidence: 0.866114429

00:22:59.760 --> 00:23:01.160 you know, evaluation of this,

NOTE Confidence: 0.866114429

00:23:01.160 --> 00:23:05.318 we ran out of at the third outcome.

NOTE Confidence: 0.866114429

00:23:05.320 --> 00:23:07.368 So how does that look in a more

NOTE Confidence: 0.866114429

00:23:07.368 --> 00:23:08.718 conventional sort of random walk?

NOTE Confidence: 0.866114429

00:23:08.720 --> 00:23:11.051 So here's a simple random walk where

NOTE Confidence: 0.866114429

00:23:11.051 --> 00:23:14.514 we have a agent which can go left or right,

NOTE Confidence: 0.866114429

00:23:14.520 --> 00:23:16.277 or try to stay where it is.

NOTE Confidence: 0.866114429

00:23:16.280 --> 00:23:17.464 There are two rewards,

NOTE Confidence: 0.866114429

00:23:17.464 --> 00:23:19.240 one on the right hand side,

NOTE Confidence: 0.866114429

00:23:19.240 --> 00:23:21.480 a small reward worth +11,

NOTE Confidence: 0.866114429

49

00:23:21.480 --> 00:23:23.517 on the left hand side worth +2.

NOTE Confidence: 0.866114429

00:23:23.520 --> 00:23:25.320 And then here's one of Chris's Lava pits,

NOTE Confidence: 0.866114429

00:23:25.320 --> 00:23:26.216 which is,

NOTE Confidence: 0.866114429

00:23:26.216 --> 00:23:27.560 which is threatening.

NOTE Confidence: 0.866114429

00:23:27.560 --> 00:23:29.504 And you have again a small

NOTE Confidence: 0.866114429

00:23:29.504 --> 00:23:30.800 probability of an error

NOTE Confidence: 0.952537403636364

00:23:30.800 --> 00:23:33.306 in the choices. So here if you

NOTE Confidence: 0.952537403636364

00:23:33.306 --> 00:23:34.920 have completely uniform choice,

NOTE Confidence: 0.952537403636364

00:23:34.920 --> 00:23:36.453 you go left, right or try to

NOTE Confidence: 0.952537403636364

00:23:36.453 --> 00:23:38.078 stay where you are equally often.

NOTE Confidence: 0.952537403636364

00:23:38.080 --> 00:23:39.914 Then if this is our start state,

NOTE Confidence: 0.952537403636364

00:23:39.920 --> 00:23:41.678 this is the distribution of outcomes

NOTE Confidence: 0.952537403636364

00:23:41.678 --> 00:23:43.386 you would actually get with some

NOTE Confidence: 0.952537403636364

00:23:43.386 --> 00:23:44.838 with a discount factor of .9.

NOTE Confidence: 0.952537403636364

00:23:44.840 --> 00:23:46.128 So then because in the end you

NOTE Confidence: 0.952537403636364

00:23:46.128 --> 00:23:47.437 get trapped by the lava pit and

NOTE Confidence: 0.952537403636364

00:23:47.437 --> 00:23:48.511 then that's the end of the,

NOTE Confidence: 0.952537403636364

00:23:48.520 --> 00:23:49.678 that's the end of the game.

NOTE Confidence: 0.952537403636364

00:23:49.680 --> 00:23:51.556 And so here from the stored state,

NOTE Confidence: 0.952537403636364

00:23:51.560 --> 00:23:52.584 this is the distribution.

NOTE Confidence: 0.952537403636364

00:23:52.584 --> 00:23:54.120 So we're thinking about C bar,

NOTE Confidence: 0.952537403636364

00:23:54.120 --> 00:23:55.192 We're obviously thinking about

NOTE Confidence: 0.952537403636364

00:23:55.192 --> 00:23:56.800 the tails of this PC bar.

NOTE Confidence: 0.952537403636364

00:23:56.800 --> 00:23:59.680 We're thinking about the tails of

NOTE Confidence: 0.952537403636364

00:23:59.680 --> 00:24:01.588 this distribution to think about.

NOTE Confidence: 0.952537403636364

00:24:01.588 --> 00:24:03.484 So how can we evaluate the

NOTE Confidence: 0.952537403636364

00:24:03.484 --> 00:24:05.197 locations in this in this world?

NOTE Confidence: 0.952537403636364

00:24:05.200 --> 00:24:07.881 Well, if you have the this uniform

NOTE Confidence: 0.952537403636364

00:24:07.881 --> 00:24:10.720 policy and here our alpha value is 1.

NOTE Confidence: 0.952537403636364

00:24:10.720 --> 00:24:12.544 So we're just a regular reinforcement

NOTE Confidence: 0.952537403636364

00:24:12.544 --> 00:24:14.053 learner thinking about the average

NOTE Confidence: 0.952537403636364

00:24:14.053 --> 00:24:15.517 value of each of the states.

NOTE Confidence: 0.952537403636364

00:24:15.520 --> 00:24:17.096 So you can see that here I've shown

NOTE Confidence: 0.952537403636364

00:24:17.096 --> 00:24:18.914 them in colour from -10 up to plus 10.

NOTE Confidence: 0.952537403636364

00:24:18.920 --> 00:24:21.008 So the ones on the right are relatively

NOTE Confidence: 0.952537403636364

00:24:21.008 --> 00:24:22.645 good because you have this reward of

NOTE Confidence: 0.952537403636364

00:24:22.645 --> 00:24:24.344 one it you tend to a while before

NOTE Confidence: 0.952537403636364

00:24:24.344 --> 00:24:26.396 you you end up in the in the lavapia,

NOTE Confidence: 0.952537403636364

00:24:26.396 --> 00:24:28.086 which means that that value

NOTE Confidence: 0.952537403636364

00:24:28.086 --> 00:24:29.520 is discounted by a lot.

NOTE Confidence: 0.952537403636364

00:24:29.520 --> 00:24:32.400 If alpha is 0 you always think the worst

NOTE Confidence: 0.952537403636364

00:24:32.400 --> 00:24:34.676 possible thing can happen will happen.

NOTE Confidence: 0.952537403636364

00:24:34.680 --> 00:24:36.353 So the way I'm showing you that

NOTE Confidence: 0.952537403636364

00:24:36.353 --> 00:24:38.019 is there are these grey arrows

NOTE Confidence: 0.952537403636364

00:24:38.019 --> 00:24:39.795 here and so though inside this,

NOTE Confidence: 0.952537403636364

00:24:39.800 --> 00:24:43.060 inside these, inside these the choices,

NOTE Confidence: 0.952537403636364

00:24:43.060 --> 00:24:45.960 it says how frequently you try to go left,

NOTE Confidence: 0.952537403636364

00:24:45.960 --> 00:24:48.634 right or or stay where you are.

NOTE Confidence: 0.952537403636364

00:24:48.640 --> 00:24:50.520 The re weighting system says,

NOTE Confidence: 0.952537403636364

00:24:50.520 --> 00:24:52.360 well I'm going to think about the outcome,

NOTE Confidence: 0.952537403636364

00:24:52.360 --> 00:24:53.896 which is the worst possible outcome

NOTE Confidence: 0.952537403636364

00:24:53.896 --> 00:24:55.989 because my alpha is 0 and that puts all

NOTE Confidence: 0.952537403636364

00:24:55.989 --> 00:24:57.595 the weight on going left because the

NOTE Confidence: 0.952537403636364

00:24:57.595 --> 00:24:59.715 nastiest thing that can happen is going left.

NOTE Confidence: 0.952537403636364

00:24:59.720 --> 00:25:01.712 And so here you can see that all

NOTE Confidence: 0.952537403636364

00:25:01.712 --> 00:25:03.716 the values are then much much worse,

NOTE Confidence: 0.952537403636364

00:25:03.720 --> 00:25:05.435 and indeed you then just go left.

NOTE Confidence: 0.952537403636364

00:25:05.440 --> 00:25:07.800 Every time you just end up in the lava pit.

NOTE Confidence: 0.952537403636364

00:25:07.800 --> 00:25:10.398 And then in for intermediate values.

NOTE Confidence: 0.952537403636364

00:25:10.400 --> 00:25:12.675 You can see intermediate values of alpha,

NOTE Confidence: 0.952537403636364

00:25:12.680 --> 00:25:14.878 you can see how states get evaluated.

NOTE Confidence: 0.952537403636364

00:25:14.880 --> 00:25:16.917 And again you can see this effect.

NOTE Confidence: 0.952537403636364

00:25:16.920 --> 00:25:19.680 When I said that if you are lucky,

NOTE Confidence: 0.952537403636364

00:25:19.680 --> 00:25:21.168 that means in this instance that

NOTE Confidence: 0.952537403636364

00:25:21.168 --> 00:25:22.160 means you're going white.

NOTE Confidence: 0.952537403636364

00:25:22.160 --> 00:25:23.880 Because right states are better,

NOTE Confidence: 0.952537403636364

00:25:23.880 --> 00:25:25.530 then you tend to decrease your

NOTE Confidence: 0.952537403636364

00:25:25.530 --> 00:25:26.355 value of alpha.

NOTE Confidence: 0.952537403636364

00:25:26.360 --> 00:25:27.580 So these these arrows,

NOTE Confidence: 0.952537403636364

00:25:27.580 --> 00:25:28.800 these little grey arrows,

NOTE Confidence: 0.952537403636364

00:25:28.800 --> 00:25:30.720 outside the choices that you make,

NOTE Confidence: 0.952537403636364

00:25:30.720 --> 00:25:32.680 they tend to point downwards.

NOTE Confidence: 0.952537403636364

00:25:32.680 --> 00:25:33.769 If you're unlucky,

NOTE Confidence: 0.952537403636364

00:25:33.769 --> 00:25:35.221 which in this instance

NOTE Confidence: 0.952537403636364

00:25:35.221 --> 00:25:36.680 means going going left,

NOTE Confidence: 0.952537403636364

00:25:36.680 --> 00:25:38.320 then you tend to become a bit more,

NOTE Confidence: 0.952537403636364

00:25:38.320 --> 00:25:40.434 you become a bit less risk averse,

NOTE Confidence: 0.952537403636364

00:25:40.440 --> 00:25:41.815 which means that the arrows

NOTE Confidence: 0.952537403636364

00:25:41.815 --> 00:25:42.640 then point upwards.

NOTE Confidence: 0.952537403636364

00:25:42.640 --> 00:25:44.602 And so you can see that as we become

NOTE Confidence: 0.952537403636364

00:25:44.602 --> 00:25:46.406 more and more risk averse so this

NOTE Confidence: 0.952537403636364

00:25:46.406 --> 00:25:48.250 alpha value we have this very nice

NOTE Confidence: 0.952537403636364

00:25:48.250 --> 00:25:50.271 way of looking at the the changes of

NOTE Confidence: 0.952537403636364

00:25:50.271 --> 00:25:52.119 how states go from being on the right.

NOTE Confidence: 0.952537403636364

00:25:52.120 --> 00:25:54.190 For instance go from being good

NOTE Confidence: 0.952537403636364

00:25:54.190 --> 00:25:54.880 to being

NOTE Confidence: 0.66603186875

00:25:54.880 --> 00:25:57.680 go to from being good to being bad.

NOTE Confidence: 0.66603186875

00:25:57.680 --> 00:25:59.840 So you don't only have to

NOTE Confidence: 0.66603186875

00:25:59.840 --> 00:26:01.508 think about evaluation here,

NOTE Confidence: 0.66603186875

00:26:01.508 --> 00:26:04.010 you can also optimise your policy

NOTE Confidence: 0.66603186875

00:26:04.083 --> 00:26:06.435 based on the on your risk aversion.

NOTE Confidence: 0.66603186875

00:26:06.440 --> 00:26:08.960 You try to optimise say what's

NOTE Confidence: 0.66603186875

00:26:08.960 --> 00:26:11.356 the policy which maximises my my

NOTE Confidence: 0.66603186875

00:26:11.356 --> 00:26:13.258 this pre committed C var value

NOTE Confidence: 0.66603186875

00:26:13.258 --> 00:26:15.518 with a given value of alpha.

NOTE Confidence: 0.66603186875

00:26:15.520 --> 00:26:22.160 So if your alpha is 1, then then,

NOTE Confidence: 0.66603186875

00:26:22.160 --> 00:26:23.880 then, then the risk averse.

NOTE Confidence: 0.66603186875

00:26:23.880 --> 00:26:24.840 You're not risk averse at all,

NOTE Confidence: 0.66603186875

00:26:24.840 --> 00:26:26.160 you're just thinking about the mean.

NOTE Confidence: 0.66603186875

00:26:26.160 --> 00:26:27.762 We designed it such that the

NOTE Confidence: 0.66603186875

00:26:27.762 --> 00:26:29.160 from the start state here,

NOTE Confidence: 0.66603186875

00:26:29.160 --> 00:26:30.268 if alpha equals one,

NOTE Confidence: 0.66603186875

00:26:30.268 --> 00:26:32.456 the best thing you can do is just

NOTE Confidence: 0.66603186875

00:26:32.456 --> 00:26:34.570 to go left and you can try and stay

NOTE Confidence: 0.66603186875

00:26:34.570 --> 00:26:36.680 at the at the reward is worth 2 and

NOTE Confidence: 0.66603186875

00:26:36.680 --> 00:26:38.973 as long as you can and that's then

NOTE Confidence: 0.66603186875

00:26:38.973 --> 00:26:40.953 a way of maximizing your reward.

NOTE Confidence: 0.66603186875

00:26:40.960 --> 00:26:43.798 If alpha equals zero, you try.

NOTE Confidence: 0.66603186875

00:26:43.800 --> 00:26:45.185 Well, the IT actually doesn't

56

NOTE Confidence: 0.66603186875

00:26:45.185 --> 00:26:47.158 matter at all what you try to do,

NOTE Confidence: 0.66603186875

00:26:47.160 --> 00:26:49.000 because there's a chance that if you try,

NOTE Confidence: 0.66603186875

00:26:49.000 --> 00:26:51.120 if you try to stay where you are,

NOTE Confidence: 0.66603186875

00:26:51.120 --> 00:26:52.398 you'll know less will go left.

NOTE Confidence: 0.66603186875

00:26:52.400 --> 00:26:53.954 If you think about the worst outcome,

NOTE Confidence: 0.66603186875

00:26:53.960 --> 00:26:55.360 it's always to go left.

NOTE Confidence: 0.66603186875

00:26:55.360 --> 00:26:56.648 And so you can see that the

NOTE Confidence: 0.66603186875

00:26:56.648 --> 00:26:57.320 alpha value equals 0.

NOTE Confidence: 0.66603186875

00:26:57.320 --> 00:26:57.566 Here,

NOTE Confidence: 0.66603186875

00:26:57.566 --> 00:26:59.042 the optimum policy is just the

NOTE Confidence: 0.66603186875

00:26:59.042 --> 00:27:00.659 same as the uniform policy or

NOTE Confidence: 0.66603186875

00:27:00.659 --> 00:27:02.034 any other policy as well.

NOTE Confidence: 0.66603186875

00:27:02.040 --> 00:27:02.988 You'll always go left.

NOTE Confidence: 0.66603186875

00:27:02.988 --> 00:27:05.379 So in fact this is sort of a form

NOTE Confidence: 0.66603186875

00:27:05.379 --> 00:27:06.595 of learned helplessness where

NOTE Confidence: 0.66603186875

00:27:06.595 --> 00:27:08.092 although you really have control

NOTE Confidence: 0.66603186875

00:27:08.092 --> 00:27:09.933 in this world and some control in

NOTE Confidence: 0.66603186875

00:27:09.933 --> 00:27:11.845 this world because you think about

NOTE Confidence: 0.66603186875

00:27:11.845 --> 00:27:13.960 the worst thing that could happen,

NOTE Confidence: 0.66603186875

00:27:13.960 --> 00:27:16.760 you sort of don't trust your own control.

NOTE Confidence: 0.66603186875

00:27:16.760 --> 00:27:18.272 And therefore you think the the worst

NOTE Confidence: 0.66603186875

00:27:18.272 --> 00:27:19.719 thing that could happen will happen.

NOTE Confidence: 0.66603186875

00:27:19.720 --> 00:27:21.205 And thereby therefore it doesn't

NOTE Confidence: 0.66603186875

00:27:21.205 --> 00:27:22.930 matter what you do, you can't.

NOTE Confidence: 0.66603186875

00:27:22.930 --> 00:27:24.520 There's nothing you can do to

NOTE Confidence: 0.66603186875

00:27:24.520 --> 00:27:25.889 mitigate that that chance and

NOTE Confidence: 0.66603186875

00:27:25.889 --> 00:27:27.881 then in the middle so here we had

NOTE Confidence: 0.66603186875

00:27:27.881 --> 00:27:29.799 this the pre commitment remember

NOTE Confidence: 0.66603186875

00:27:29.800 --> 00:27:31.558 is relative to a start state.

NOTE Confidence: 0.66603186875

00:27:31.560 --> 00:27:33.808 So here our start state is this is

NOTE Confidence: 0.66603186875

00:27:33.808 --> 00:27:36.036 this at alpha equals .3 and you

00:27:36.036 --> 00:27:38.420 can see again that now we have a

00:27:38.503 --> 00:27:40.965 policy where you know in this in

00:27:40.965 --> 00:27:42.530 this particular domain the optimal

00:27:42.597 --> 00:27:44.550 policy at that start state is to

00:27:44.550 --> 00:27:46.514 go right rather than to go left

00:27:46.514 --> 00:27:48.420 because of the problems of the risk.

00:27:48.420 --> 00:27:50.820 And then as you as then this is

00:27:50.820 --> 00:27:52.478 what you you try to do.

00:27:52.480 --> 00:27:53.964 And then and then you try to

00:27:53.964 --> 00:27:55.480 stay here as long as you can.

00:27:55.480 --> 00:27:56.080 And so you can see that,

00:27:56.080 --> 00:27:58.720 as you might expect for everywhere

00:27:58.720 --> 00:28:01.552 else in the in this random walk,

00:28:01.552 --> 00:28:04.240 apart from the value alpha equals zero,

00:28:04.240 --> 00:28:07.360 you have a better outcome.

00:28:07.360 --> 00:28:08.960 You have all these values.

NOTE Confidence: 0.66603186875

00:28:08.960 --> 00:28:10.442 All the values of the optimum

NOTE Confidence: 0.66603186875

00:28:10.442 --> 00:28:11.987 policy are much better than the

NOTE Confidence: 0.66603186875

00:28:11.987 --> 00:28:13.517 values of the uniform policy here,

NOTE Confidence: 0.66603186875

00:28:13.520 --> 00:28:15.175 except for this long nastiest

NOTE Confidence: 0.66603186875

00:28:15.175 --> 00:28:15.837 possible outcome,

NOTE Confidence: 0.66603186875

00:28:15.840 --> 00:28:17.395 nastiest possible degree of risk

NOTE Confidence: 0.66603186875

00:28:17.395 --> 00:28:18.950 aversion where you're where you

NOTE Confidence: 0.66603186875

00:28:19.000 --> 00:28:20.264 just think whatever terrible

NOTE Confidence: 0.66603186875

00:28:20.264 --> 00:28:22.160 happened will happen no matter what.

NOTE Confidence: 0.854460794

00:28:25.160 --> 00:28:26.160 I should just say so.

NOTE Confidence: 0.854460794

00:28:26.160 --> 00:28:27.840 There's also this this NC,

NOTE Confidence: 0.854460794

00:28:27.840 --> 00:28:29.575 this other mechanism which doesn't

NOTE Confidence: 0.854460794

00:28:29.575 --> 00:28:32.047 pre commit to a value but instead

NOTE Confidence: 0.854460794

00:28:32.047 --> 00:28:33.722 just sticks at a particular

NOTE Confidence: 0.854460794

00:28:33.722 --> 00:28:35.719 value of alpha the whole time.

NOTE Confidence: 0.854460794

00:28:35.720 --> 00:28:37.592 That's what I showed you in the in

NOTE Confidence: 0.854460794

00:28:37.592 --> 00:28:39.040 the Saint Petersburg paradox where

NOTE Confidence: 0.854460794

00:28:39.040 --> 00:28:41.529 you just waited the the the heads and

NOTE Confidence: 0.854460794

00:28:41.529 --> 00:28:43.433 tails the same way every single time.

NOTE Confidence: 0.854460794

00:28:43.440 --> 00:28:45.192 So in this domain that actually

NOTE Confidence: 0.854460794

00:28:45.192 --> 00:28:47.232 turns out to be for alpha equals one,

NOTE Confidence: 0.854460794

00:28:47.232 --> 00:28:49.308 it's the same as PC bar for alpha which

NOTE Confidence: 0.854460794

00:28:49.308 --> 00:28:51.120 is just the mean for alpha equals 0.

NOTE Confidence: 0.854460794

00:28:51.120 --> 00:28:52.996 Again it just focuses on the minimum,

NOTE Confidence: 0.854460794

00:28:53.000 --> 00:28:55.023 the worst thing that can happen and

NOTE Confidence: 0.854460794

00:28:55.023 --> 00:28:57.667 so it also looks the same but in

NOTE Confidence: 0.854460794

00:28:57.667 --> 00:28:59.346 between in for intermediate values.

NOTE Confidence: 0.854460794

00:28:59.346 --> 00:29:01.794 Then you can see you can see you

NOTE Confidence: 0.854460794

00:29:01.794 --> 00:29:03.820 can again get evaluations of states.

NOTE Confidence: 0.854460794

00:29:03.820 --> 00:29:06.200 And in this instance it turns out

NOTE Confidence: 0.854460794

00:29:06.261 --> 00:29:08.451 that this NC bar mechanism here

NOTE Confidence: 0.854460794

00:29:08.451 --> 00:29:12.117 is a generally more risk averse,

NOTE Confidence: 0.854460794

00:29:12.120 --> 00:29:13.920 so the values are worse than

NOTE Confidence: 0.854460794

00:29:13.920 --> 00:29:15.640 the values for the PC bar.

NOTE Confidence: 0.854460794

00:29:15.640 --> 00:29:17.684 So that's not true in the Saint

NOTE Confidence: 0.854460794

00:29:17.684 --> 00:29:18.845 Petersburg paradox because in

NOTE Confidence: 0.854460794

00:29:18.845 --> 00:29:20.434 that problem the only way you get

NOTE Confidence: 0.854460794

00:29:20.434 --> 00:29:22.000 to carry on is by being lucky,

NOTE Confidence: 0.854460794

00:29:22.000 --> 00:29:23.918 whereas in this problem you can be

NOTE Confidence: 0.854460794

00:29:23.918 --> 00:29:26.037 lucky or unlucky as you as you carry on.

NOTE Confidence: 0.854460794

00:29:26.040 --> 00:29:28.343 And then in PC bar if you're

NOTE Confidence: 0.854460794

00:29:28.343 --> 00:29:30.279 unlucky then you become less,

NOTE Confidence: 0.854460794

00:29:30.280 --> 00:29:32.280 you become less risk averse.

NOTE Confidence: 0.854460794

00:29:32.280 --> 00:29:34.325 Whereas in the Saint Petersburg

NOTE Confidence: 0.854460794

00:29:34.325 --> 00:29:36.840 paradox or in the bot task,

NOTE Confidence: 0.854460794

00:29:36.840 --> 00:29:38.808 every time you continue you must

NOTE Confidence: 0.854460794

00:29:38.808 --> 00:29:40.963 have been lucky and therefore you

NOTE Confidence: 0.854460794

00:29:40.963 --> 00:29:43.452 become more risk averse and so

NOTE Confidence: 0.854460794

00:29:43.452 --> 00:29:45.600 therefore relatively you the there's

NOTE Confidence: 0.854460794

00:29:45.600 --> 00:29:47.280 a greater degree of risk aversion.

NOTE Confidence: 0.854460794

00:29:47.280 --> 00:29:48.072 It's Peterborough paradox.

NOTE Confidence: 0.854460794

00:29:48.072 --> 00:29:49.920 Whereas in these sorts of other problems,

NOTE Confidence: 0.854460794

00:29:49.920 --> 00:29:53.360 NC bar is is generally more risk averse.

NOTE Confidence: 0.854460794

00:29:53.360 --> 00:29:55.439 In these sorts of cases you see

NOTE Confidence: 0.854460794

00:29:55.439 --> 00:29:57.698 that by these values all being more

NOTE Confidence: 0.854460794

00:29:57.698 --> 00:30:00.040 red than the than the other ones.

NOTE Confidence: 0.854460794

00:30:00.040 --> 00:30:02.112 So and then you can work out

NOTE Confidence: 0.854460794

00:30:02.112 --> 00:30:04.465 the optimal policy has the same

NOTE Confidence: 0.854460794

00:30:04.465 --> 00:30:05.397 similar characteristics.

NOTE Confidence: 0.854460794

00:30:05.400 --> 00:30:05.790 OK,

NOTE Confidence: 0.854460794

00:30:05.790 --> 00:30:09.300 so let's come back to our lava pits where

NOTE Confidence: 0.854460794

00:30:09.396 --> 00:30:12.160 we had these these cases where we had,

NOTE Confidence: 0.854460794

00:30:12.160 --> 00:30:12.760 excuse me,

NOTE Confidence: 0.854460794

00:30:12.760 --> 00:30:14.315 where we where we gave

NOTE Confidence: 0.854460794

00:30:14.315 --> 00:30:15.559 our subjects this chance,

NOTE Confidence: 0.854460794

00:30:15.560 --> 00:30:17.060 we we showed them this and

NOTE Confidence: 0.854460794

00:30:17.060 --> 00:30:18.719 asked them how they would move.

NOTE Confidence: 0.854460794

00:30:18.720 --> 00:30:20.365 And so we designed this domain so

NOTE Confidence: 0.854460794

00:30:20.365 --> 00:30:22.133 that it would start to distinguish

NOTE Confidence: 0.854460794

00:30:22.133 --> 00:30:23.477 different values of alpha.

NOTE Confidence: 0.854460794

00:30:23.480 --> 00:30:25.279 So different values of risk aversion as

NOTE Confidence: 0.854460794

00:30:25.279 --> 00:30:27.053 a way of interrogating what subjects

NOTE Confidence: 0.854460794

00:30:27.053 --> 00:30:29.640 would be like in these in these cases.

NOTE Confidence: 0.854460794

00:30:29.640 --> 00:30:33.376 So it turns out that the this most direct

NOTE Confidence: 0.854460794

00:30:33.376 --> 00:30:36.400 path is associated with alpha equals one.

NOTE Confidence: 0.854460794

00:30:36.400 --> 00:30:38.911 So if you are risk neutral then you would

NOTE Confidence: 0.854460794

00:30:38.911 --> 00:30:42.120 take this what this this rather risky path.

NOTE Confidence: 0.854460794

00:30:42.120 --> 00:30:44.853 If your value of alpha is about 0.5,

NOTE Confidence: 0.854460794

00:30:44.853 --> 00:30:46.904 which means you just think about the

NOTE Confidence: 0.854460794

00:30:46.904 --> 00:30:48.368 bottom 50% of that distribution,

NOTE Confidence: 0.854460794

00:30:48.368 --> 00:30:50.120 then you take this intermediate path.

NOTE Confidence: 0.854460794

00:30:50.120 --> 00:30:51.956 You tend to take this intermediate

NOTE Confidence: 0.854460794

00:30:51.956 --> 00:30:53.780 path like this and then if you're

NOTE Confidence: 0.854460794

00:30:53.780 --> 00:30:54.680 much more risk averse,

NOTE Confidence: 0.854460794

00:30:54.680 --> 00:30:56.396 you care about the bottom 15%

NOTE Confidence: 0.854460794

00:30:56.400 --> 00:30:57.920 of the of the outcomes,

NOTE Confidence: 0.854460794

00:30:57.920 --> 00:30:59.032 then you take this,

NOTE Confidence: 0.854460794

00:30:59.032 --> 00:31:01.000 this much more extreme risk aversion here.

NOTE Confidence: 0.854460794

00:31:01.000 --> 00:31:02.335 And I think it's interesting

NOTE Confidence: 0.854460794

00:31:02.335 --> 00:31:03.670 as one of these cases

NOTE Confidence: 0.677287811818182

00:31:03.732 --> 00:31:06.135 where it's very hard when you see how

NOTE Confidence: 0.677287811818182

00:31:06.135 --> 00:31:08.490 somebody in your lab you know performs this.

NOTE Confidence: 0.677287811818182

00:31:08.490 --> 00:31:10.784 If you're a sort of 0.4 a person,

NOTE Confidence: 0.677287811818182

00:31:10.784 --> 00:31:12.272 it's very hard to imagine somebody

NOTE Confidence: 0.677287811818182

00:31:12.272 --> 00:31:13.935 who would be so risk of so risk

NOTE Confidence: 0.677287811818182

00:31:13.935 --> 00:31:15.719 seeking as to take the very short one.

NOTE Confidence: 0.677287811818182

00:31:15.720 --> 00:31:17.277 Or if you're the person who takes this very,

NOTE Confidence: 0.677287811818182

00:31:17.280 --> 00:31:18.848 very long path, you think it's you think

NOTE Confidence: 0.677287811818182

00:31:18.848 --> 00:31:20.440 you know how could anybody take these,

NOTE Confidence: 0.677287811818182

00:31:20.440 --> 00:31:22.360 these these short paths themselves.

NOTE Confidence: 0.677287811818182

00:31:22.360 --> 00:31:24.400 So I think there's some interesting

NOTE Confidence: 0.677287811818182

00:31:24.400 --> 00:31:26.320 phenomena that come up with this.

NOTE Confidence: 0.677287811818182

00:31:26.320 --> 00:31:30.184 So we administered 30 of these mazes to

NOTE Confidence: 0.677287811818182

00:31:30.184 --> 00:31:33.140 mazes like this to a a group of subjects

NOTE Confidence: 0.677287811818182

00:31:33.140 --> 00:31:34.880 and we designed them in order to,

NOTE Confidence: 0.677287811818182

00:31:34.880 --> 00:31:36.378 you know, in order to look at

NOTE Confidence: 0.677287811818182

00:31:36.378 --> 00:31:37.893 things like how consistent was an

NOTE Confidence: 0.677287811818182

00:31:37.893 --> 00:31:39.525 individual subject in the way that

NOTE Confidence: 0.677287811818182

00:31:39.525 --> 00:31:41.275 they would be risk averse in these,

NOTE Confidence: 0.677287811818182

00:31:41.280 --> 00:31:42.840 in these, in these domains.

NOTE Confidence: 0.677287811818182

00:31:42.840 --> 00:31:44.640 And we saw a very nice

NOTE Confidence: 0.677287811818182

00:31:44.640 --> 00:31:47.679 degree of of of consistency.

NOTE Confidence: 0.677287811818182

00:31:47.680 --> 00:31:48.552 So if it's here,

NOTE Confidence: 0.677287811818182

00:31:48.552 --> 00:31:50.177 you can see one another of these

NOTE Confidence: 0.677287811818182

00:31:50.177 --> 00:31:52.039 mazes where the start stage is here,

NOTE Confidence: 0.677287811818182

00:31:52.040 --> 00:31:53.100 the goal is here.

NOTE Confidence: 0.677287811818182

00:31:53.100 --> 00:31:56.013 And so again we have a very sort of a

NOTE Confidence: 0.677287811818182

00:31:56.013 --> 00:31:59.114 path which is for the people who are

NOTE Confidence: 0.677287811818182

00:31:59.114 --> 00:32:00.782 pretty risk neutral would take which

NOTE Confidence: 0.677287811818182

00:32:00.782 --> 00:32:02.557 gets close to these two lava pits.

NOTE Confidence: 0.677287811818182

00:32:02.560 --> 00:32:04.210 You have this intermediate path

NOTE Confidence: 0.677287811818182

00:32:04.210 --> 00:32:05.200 which is longer,

NOTE Confidence: 0.677287811818182

00:32:05.200 --> 00:32:06.960 which is why it would be less favoured,

NOTE Confidence: 0.677287811818182

00:32:06.960 --> 00:32:08.160 but only goes close to one

NOTE Confidence: 0.677287811818182

00:32:08.160 --> 00:32:08.960 of these lava pits.

NOTE Confidence: 0.677287811818182

00:32:08.960 --> 00:32:10.800 And then we have an an even

NOTE Confidence: 0.677287811818182

00:32:10.800 --> 00:32:11.840 longer path which looks,

NOTE Confidence: 0.677287811818182

00:32:11.840 --> 00:32:13.569 which goes all the way around here

NOTE Confidence: 0.677287811818182

00:32:13.569 --> 00:32:15.604 to get to the goal which really

NOTE Confidence: 0.677287811818182

00:32:15.604 --> 00:32:17.223 avoids these lava pits dramatically.

NOTE Confidence: 0.677287811818182

00:32:17.223 --> 00:32:19.521 And so these are three individual

NOTE Confidence: 0.677287811818182

00:32:19.521 --> 00:32:21.598 subjects and so these choices

NOTE Confidence: 0.677287811818182

00:32:21.598 --> 00:32:23.326 were themselves associated with

NOTE Confidence: 0.677287811818182

00:32:23.326 --> 00:32:25.480 three different values of alpha,

NOTE Confidence: 0.677287811818182

00:32:25.480 --> 00:32:25.795 point,

NOTE Confidence: 0.677287811818182

00:32:25.795 --> 00:32:28.819 you know like point 2.5 and point 2.9 or so.

NOTE Confidence: 0.677287811818182

00:32:28.819 --> 00:32:30.457 And then in another maze the

NOTE Confidence: 0.677287811818182

00:32:30.457 --> 00:32:32.517 the the behaviour of the same

NOTE Confidence: 0.677287811818182

00:32:32.517 --> 00:32:34.232 subject in a different maze.

NOTE Confidence: 0.677287811818182

00:32:34.240 --> 00:32:35.554 So here this is a bit like a Cliff.

NOTE Confidence: 0.677287811818182

00:32:35.560 --> 00:32:37.996 There's just two other pits here.

NOTE Confidence: 0.677287811818182

00:32:38.000 --> 00:32:39.500 The question is how far around

NOTE Confidence: 0.677287811818182

00:32:39.500 --> 00:32:41.039 you know around them do you go.

NOTE Confidence: 0.677287811818182

00:32:41.040 --> 00:32:43.008 So one option is just to go directly

NOTE Confidence: 0.677287811818182

00:32:43.008 --> 00:32:45.446 to the goal from the start say here to

NOTE Confidence: 0.677287811818182

00:32:45.446 --> 00:32:47.520 the goal that's most no risk neutral.

NOTE Confidence: 0.677287811818182

00:32:47.520 --> 00:32:48.780 Here's one which is a bit

NOTE Confidence: 0.677287811818182

00:32:48.780 --> 00:32:50.040 a bit more risk averse.

NOTE Confidence: 0.677287811818182

00:32:50.040 --> 00:32:51.872 You can think well how far away from

NOTE Confidence: 0.677287811818182

00:32:51.872 --> 00:32:53.627 the the Cliff you would you would

NOTE Confidence: 0.677287811818182

00:32:53.627 --> 00:32:55.400 you choose to be there yourself.

NOTE Confidence: 0.677287811818182

00:32:55.400 --> 00:32:55.816 And again,

NOTE Confidence: 0.677287811818182

00:32:55.816 --> 00:32:57.272 it's very hard if you're a sort

NOTE Confidence: 0.677287811818182

00:32:57.272 --> 00:32:58.879 of risk neutral person to think,

NOTE Confidence: 0.677287811818182

69

00:32:58.880 --> 00:32:59.137 well,

NOTE Confidence: 0.677287811818182

00:32:59.137 --> 00:33:01.193 how is it crazy to go so far

NOTE Confidence: 0.677287811818182

00:33:01.193 --> 00:33:03.036 away from the from the goal.

NOTE Confidence: 0.677287811818182

00:33:03.040 --> 00:33:05.760 We took these 30 mazes that we administered.

NOTE Confidence: 0.677287811818182

00:33:05.760 --> 00:33:08.105 We looked at the first half and

NOTE Confidence: 0.677287811818182

00:33:08.105 --> 00:33:09.478 the second-half inferred the

NOTE Confidence: 0.677287811818182

00:33:09.478 --> 00:33:11.308 values of alpha that our subjects

NOTE Confidence: 0.677287811818182

00:33:11.308 --> 00:33:13.579 had for those for those mazes by

NOTE Confidence: 0.677287811818182

00:33:13.579 --> 00:33:15.517 fitting the choices that they made.

NOTE Confidence: 0.677287811818182

00:33:15.520 --> 00:33:17.581 And you can see that we had a reasonable

NOTE Confidence: 0.677287811818182

00:33:17.581 --> 00:33:18.855 degree of consistency between the

NOTE Confidence: 0.677287811818182

00:33:18.855 --> 00:33:20.839 1st 15 mazes and the 2nd 15 mazes.

NOTE Confidence: 0.677287811818182

00:33:20.840 --> 00:33:23.120 So this shows the the alpha,

NOTE Confidence: 0.677287811818182

00:33:23.120 --> 00:33:23.656 the peak,

NOTE Confidence: 0.677287811818182

00:33:23.656 --> 00:33:24.996 the map out of the,

NOTE Confidence: 0.677287811818182

00:33:25.000 --> 00:33:26.700 the the the maximum likelihood

NOTE Confidence: 0.677287811818182

00:33:26.700 --> 00:33:28.400 alpha value for the first

NOTE Confidence: 0.773659392272727

00:33:28.400 --> 00:33:29.532 and second-half of mazes.

NOTE Confidence: 0.773659392272727

00:33:29.532 --> 00:33:31.626 So we see that they are reasonably

NOTE Confidence: 0.773659392272727

00:33:31.626 --> 00:33:33.971 well pinned and indeed the the means

NOTE Confidence: 0.773659392272727

00:33:33.971 --> 00:33:36.320 are fairly similar to and then if we

NOTE Confidence: 0.773659392272727

00:33:36.320 --> 00:33:38.520 look at the across all our subjects.

NOTE Confidence: 0.773659392272727

00:33:38.520 --> 00:33:39.920 So now this axis shows

NOTE Confidence: 0.773659392272727

00:33:39.920 --> 00:33:41.320 you the value of alpha.

NOTE Confidence: 0.773659392272727

00:33:41.320 --> 00:33:43.080 This is now the this is the the

NOTE Confidence: 0.713342685

00:33:45.320 --> 00:33:46.360 posterior value of alpha

NOTE Confidence: 0.713342685

00:33:46.360 --> 00:33:47.920 across all the toss we have.

NOTE Confidence: 0.713342685

00:33:47.920 --> 00:33:49.880 So you know, you know hierarchical fit.

NOTE Confidence: 0.713342685

00:33:49.880 --> 00:33:51.469 And then we just ordered the subjects

NOTE Confidence: 0.713342685

00:33:51.469 --> 00:33:53.145 by from alpha the people with the

NOTE Confidence: 0.713342685

00:33:53.145 --> 00:33:54.561 smallest value of alpha to people

NOTE Confidence: 0.713342685

00:33:54.612 --> 00:33:56.040 with the largest value of alpha.

NOTE Confidence: 0.713342685

00:33:56.040 --> 00:33:57.741 And you can see that we nicely

NOTE Confidence: 0.713342685

00:33:57.741 --> 00:33:59.318 cover the range of possible alphas

NOTE Confidence: 0.713342685

00:33:59.318 --> 00:34:01.166 in this in this domain and some

NOTE Confidence: 0.713342685

00:34:01.223 --> 00:34:03.106 people we can't infer alpha so well

NOTE Confidence: 0.713342685

00:34:03.106 --> 00:34:04.739 just from these these these plots.

NOTE Confidence: 0.713342685

00:34:04.739 --> 00:34:07.436 And so you can see that then we also in

NOTE Confidence: 0.713342685

00:34:07.436 --> 00:34:09.249 order to fit them, fit their behaviour.

NOTE Confidence: 0.713342685

00:34:09.249 --> 00:34:11.680 We have a couple of other statistics as well.

NOTE Confidence: 0.713342685

00:34:11.680 --> 00:34:13.000 We have they have a temperature,

NOTE Confidence: 0.713342685

00:34:13.000 --> 00:34:14.172 so an inverse temperature,

NOTE Confidence: 0.713342685

00:34:14.172 --> 00:34:16.180 or temperature, which is how noisy

NOTE Confidence: 0.713342685

00:34:16.180 --> 00:34:17.600 is their behaviour generally,

NOTE Confidence: 0.713342685

00:34:17.600 --> 00:34:19.312 and then a lapse rate which says that

NOTE Confidence: 0.713342685

00:34:19.312 --> 00:34:20.520 sometimes they try to, they know.

NOTE Confidence: 0.713342685

00:34:20.520 --> 00:34:22.280 We imagine they might try to go north,

00:34:22.280 --> 00:34:23.184 but perhaps they just,

00:34:23.184 --> 00:34:24.070 you know, by mistake,

00:34:24.070 --> 00:34:25.360 go in a different direction too.

00:34:25.360 --> 00:34:27.100 So these are very standard things

00:34:27.100 --> 00:34:29.298 you'd have in a model of their behaviour.

00:34:29.298 --> 00:34:30.792 But the thing we're focusing on

00:34:30.792 --> 00:34:32.280 indeed is this risk sensitivity,

00:34:32.280 --> 00:34:34.224 which is then just a histogram of the values

00:34:34.224 --> 00:34:36.158 that we can infer from there and ourselves.

00:34:36.160 --> 00:34:37.864 It's a nicely aligned,

00:34:37.864 --> 00:34:39.994 nicely arrayed across the different

00:34:39.994 --> 00:34:43.600 possible values of alpha as you can see.

00:34:43.600 --> 00:34:46.690 So we then try to interrogate our

00:34:46.690 --> 00:34:49.240 mechanism for changing values of alpha.

00:34:49.240 --> 00:34:52.480 And here we had what to us was a bit of

00:34:52.480 --> 00:34:54.480 a surprise in terms of what happened.

NOTE Confidence: 0.713342685

00:34:54.480 --> 00:34:57.176 So here what we're looking at is how

NOTE Confidence: 0.713342685

00:34:57.176 --> 00:34:59.839 did alpha change on if on one trial,

NOTE Confidence: 0.713342685

00:34:59.840 --> 00:35:00.578 one maze,

NOTE Confidence: 0.713342685

00:35:00.578 --> 00:35:03.530 you've got a you've got a win or

NOTE Confidence: 0.713342685

00:35:03.618 --> 00:35:06.000 the OR the OR or you've got a loss.

NOTE Confidence: 0.713342685

00:35:06.000 --> 00:35:08.196 So mostly So what this shows,

NOTE Confidence: 0.713342685

00:35:08.200 --> 00:35:10.168 as we said, if we then infer the

NOTE Confidence: 0.713342685

00:35:10.168 --> 00:35:11.800 value of alpha on one maze,

NOTE Confidence: 0.713342685

00:35:11.800 --> 00:35:13.116 if you then one on that maze,

NOTE Confidence: 0.713342685

00:35:13.120 --> 00:35:14.840 what happens to the next value of alpha?

NOTE Confidence: 0.713342685

00:35:14.840 --> 00:35:16.670 Are you more risk averse or

NOTE Confidence: 0.713342685

00:35:16.670 --> 00:35:18.599 more risk seeking on that case?

NOTE Confidence: 0.713342685

00:35:18.600 --> 00:35:20.328 And so from the PC bar

NOTE Confidence: 0.713342685

00:35:20.328 --> 00:35:21.480 mechanism I talked about,

NOTE Confidence: 0.713342685

00:35:21.480 --> 00:35:23.505 what we would have expected is if you are

NOTE Confidence: 0.713342685

00:35:23.505 --> 00:35:25.560 lucky on that case you didn't get the maze,

NOTE Confidence: 0.713342685

00:35:25.560 --> 00:35:26.880 you'd become more risk averse.

NOTE Confidence: 0.713342685

00:35:26.880 --> 00:35:28.956 Next what we actually saw was

NOTE Confidence: 0.713342685

00:35:28.956 --> 00:35:30.340 the opposite interestingly which

NOTE Confidence: 0.713342685

00:35:30.402 --> 00:35:31.800 is that after a lava pit,

NOTE Confidence: 0.713342685

00:35:31.800 --> 00:35:34.894 so after you saw a after you got trapped

NOTE Confidence: 0.713342685

00:35:34.894 --> 00:35:37.688 in one maze then in fact you became a

NOTE Confidence: 0.713342685

00:35:37.688 --> 00:35:40.232 bit more risk averse in the next maze.

NOTE Confidence: 0.713342685

00:35:40.240 --> 00:35:41.782 And so we're we're sort of

NOTE Confidence: 0.713342685

00:35:41.782 --> 00:35:43.000 contemplating why that might be.

NOTE Confidence: 0.713342685

00:35:43.000 --> 00:35:45.480 We did see A and and and we are also

NOTE Confidence: 0.713342685

00:35:45.551 --> 00:35:47.867 looking inside the choices you make

NOTE Confidence: 0.713342685

00:35:47.867 --> 00:35:50.678 inside a single maze because if you

NOTE Confidence: 0.713342685

00:35:50.678 --> 00:35:53.072 remember we have noisy actions so

NOTE Confidence: 0.713342685

00:35:53.072 --> 00:35:54.528 sometimes you're lucky or unlucky

NOTE Confidence: 0.713342685

00:35:54.528 --> 00:35:56.575 inside a single maze and they do see

NOTE Confidence: 0.713342685

00:35:56.575 --> 00:35:58.271 APC bar like effect which is that if

NOTE Confidence: 0.713342685

00:35:58.327 --> 00:36:00.056 you've been lucky then in the future

NOTE Confidence: 0.713342685

00:36:00.056 --> 00:36:01.768 you're more a little bit more risk

NOTE Confidence: 0.713342685

00:36:01.768 --> 00:36:03.220 averse and if you've been unlucky

NOTE Confidence: 0.713342685

00:36:03.272 --> 00:36:05.160 you've been a little bit less risk averse.

NOTE Confidence: 0.713342685

00:36:05.160 --> 00:36:06.885 So there's a conflict between

NOTE Confidence: 0.713342685

00:36:06.885 --> 00:36:08.610 different time scales of how

NOTE Confidence: 0.857840121333333

00:36:08.672 --> 00:36:10.157 of how this is operating.

NOTE Confidence: 0.857840121333333

00:36:10.160 --> 00:36:12.512 And that conflict also comes up a little

NOTE Confidence: 0.857840121333333

00:36:12.512 --> 00:36:14.999 bit when we look across the the the

NOTE Confidence: 0.857840121333333

00:36:14.999 --> 00:36:16.997 first and second-half of these mazes,

NOTE Confidence: 0.857840121333333

00:36:17.000 --> 00:36:19.637 the 1st 15 mazes versus the 2nd 15 mazes.

NOTE Confidence: 0.857840121333333

00:36:19.640 --> 00:36:22.678 Whereby if you had the more losses,

NOTE Confidence: 0.857840121333333

00:36:22.680 --> 00:36:25.119 if you had more losses in the first half,

NOTE Confidence: 0.857840121333333

00:36:25.120 --> 00:36:26.884 we can ask are you more risk averse and

NOTE Confidence: 0.857840121333333

00:36:26.884 --> 00:36:28.560 more risk seeking in the second-half.

NOTE Confidence: 0.857840121333333

00:36:28.560 --> 00:36:30.036 And there's some small evidence that

NOTE Confidence: 0.857840121333333

00:36:30.036 --> 00:36:32.054 in on average or a bit more risk

NOTE Confidence: 0.857840121333333

00:36:32.054 --> 00:36:33.530 seeking in the second-half and you've

NOTE Confidence: 0.857840121333333

00:36:33.580 --> 00:36:35.155 had more losses in the first half.

NOTE Confidence: 0.857840121333333

00:36:35.160 --> 00:36:37.014 So that suggests that this phenomenon

NOTE Confidence: 0.857840121333333

00:36:37.014 --> 00:36:39.796 which is a trial like a maze to maze

NOTE Confidence: 0.857840121333333

00:36:39.796 --> 00:36:41.683 effect may itself not completely generalise

NOTE Confidence: 0.857840121333333

00:36:41.683 --> 00:36:44.035 over the whole context of the mazes.

NOTE Confidence: 0.857840121333333

00:36:44.040 --> 00:36:46.788 So really some interesting things to

NOTE Confidence: 0.857840121333333

00:36:46.788 --> 00:36:49.639 investigate in this in this domain.

NOTE Confidence: 0.857840121333333

00:36:49.640 --> 00:36:51.120 OK it's an interim summary.

NOTE Confidence: 0.857840121333333

00:36:51.120 --> 00:36:52.092 So what we have,

NOTE Confidence: 0.857840121333333

00:36:52.092 --> 00:36:54.302 what I'll try to show you is this

NOTE Confidence: 0.857840121333333

00:36:54.302 --> 00:36:56.037 sort of parametric risk avoidant

NOTE Confidence: 0.857840121333333

00:36:56.037 --> 00:36:58.410 behaviour which can come from this pre

NOTE Confidence: 0.857840121333333

00:36:58.410 --> 00:37:00.318 committed PC bar and pre commitment.

NOTE Confidence: 0.857840121333333

00:37:00.320 --> 00:37:01.320 Is that you think,

NOTE Confidence: 0.857840121333333

00:37:01.320 --> 00:37:03.360 well how much risk am I willing?

NOTE Confidence: 0.857840121333333

00:37:03.360 --> 00:37:04.240 How much you know?

NOTE Confidence: 0.857840121333333

00:37:04.240 --> 00:37:05.340 Which part of this distribution

NOTE Confidence: 0.857840121333333

00:37:05.340 --> 00:37:06.983 am I willing to think about right

NOTE Confidence: 0.857840121333333

00:37:06.983 --> 00:37:07.673 from the beginning.

NOTE Confidence: 0.857840121333333

00:37:07.680 --> 00:37:09.020 And that requires you to

NOTE Confidence: 0.857840121333333

00:37:09.020 --> 00:37:10.186 have this gambler's fallacy.

NOTE Confidence: 0.857840121333333

00:37:10.186 --> 00:37:12.690 So change the value of alpha as you

NOTE Confidence: 0.857840121333333

00:37:12.757 --> 00:37:14.504 as as you are unlucky or unlucky.

NOTE Confidence: 0.857840121333333

00:37:14.504 --> 00:37:16.340 So obviously the inference is a

NOTE Confidence: 0.857840121333333

00:37:16.401 --> 00:37:18.236 little bit more complicated here,

NOTE Confidence: 0.857840121333333

00:37:18.240 --> 00:37:19.976 but in fact many ways almost every

NOTE Confidence: 0.857840121333333

00:37:19.976 --> 00:37:21.920 way that we have of thinking about

NOTE Confidence: 0.857840121333333

00:37:21.920 --> 00:37:23.636 risk in the sequential case is

NOTE Confidence: 0.857840121333333

00:37:23.690 --> 00:37:25.503 going to rely on a more complicated

NOTE Confidence: 0.857840121333333

00:37:25.503 --> 00:37:26.635 way of doing evaluation.

NOTE Confidence: 0.857840121333333

00:37:26.635 --> 00:37:29.120 Because you know for instance if you

NOTE Confidence: 0.857840121333333

00:37:29.120 --> 00:37:31.840 have a non linear a utility function,

NOTE Confidence: 0.857840121333333

00:37:31.840 --> 00:37:33.004 then if you think about my

NOTE Confidence: 0.857840121333333

00:37:33.004 --> 00:37:34.040 total utility on a path,

NOTE Confidence: 0.857840121333333

00:37:34.040 --> 00:37:35.860 you're going to have to monitor what

NOTE Confidence: 0.857840121333333

00:37:35.860 --> 00:37:37.483 that total utility you know which is

NOTE Confidence: 0.857840121333333

00:37:37.483 --> 00:37:39.200 how you which is the non linearity.

NOTE Confidence: 0.857840121333333

00:37:39.200 --> 00:37:40.320 Then you're going to have to monitor,

NOTE Confidence: 0.857840121333333

00:37:40.320 --> 00:37:41.517 you're going to have to modify your,

NOTE Confidence: 0.857840121333333

00:37:41.520 --> 00:37:43.739 you're going to have to monitor the

NOTE Confidence: 0.857840121333333

00:37:43.739 --> 00:37:45.979 total utility so that you can then

NOTE Confidence: 0.857840121333333

00:37:45.979 --> 00:37:48.120 manipulate it in this non linear way.

NOTE Confidence: 0.857840121333333

00:37:48.120 --> 00:37:50.064 You also see in prospect theory

NOTE Confidence: 0.857840121333333

00:37:50.064 --> 00:37:51.360 for instance as well,

NOTE Confidence: 0.857840121333333

00:37:51.360 --> 00:37:53.413 if we have this nested what

NOTE Confidence: 0.857840121333333

00:37:53.413 --> 00:37:54.878 we sometimes call NC bar,

NOTE Confidence: 0.857840121333333

00:37:54.880 --> 00:37:56.511 that's the one where we just fix

NOTE Confidence: 0.857840121333333

00:37:56.511 --> 00:37:58.111 the value alpha and just apply the

NOTE Confidence: 0.857840121333333

00:37:58.111 --> 00:37:59.879 same value as you go down and down,

NOTE Confidence: 0.857840121333333

00:37:59.880 --> 00:38:01.560 then in some cases you can

NOTE Confidence: 0.857840121333333

00:38:01.560 --> 00:38:02.680 get excessive risk aversion.

NOTE Confidence: 0.857840121333333

00:38:02.680 --> 00:38:05.183 So in the random walk that we saw

NOTE Confidence: 0.857840121333333

00:38:05.183 --> 00:38:07.290 there and then again we we can

NOTE Confidence: 0.857840121333333

00:38:07.366 --> 00:38:09.904 still think about that at different

NOTE Confidence: 0.857840121333333

00:38:09.904 --> 00:38:11.596 values of alpha itself.

NOTE Confidence: 0.857840121333333

00:38:11.600 --> 00:38:14.912 We think that there's we're now

NOTE Confidence: 0.857840121333333

00:38:14.912 --> 00:38:16.568 worrying about indeterminacy

NOTE Confidence: 0.857840121333333

00:38:16.568 --> 00:38:19.079 between your prior expectation,

NOTE Confidence: 0.857840121333333

00:38:19.080 --> 00:38:20.400 for instance getting caught in

NOTE Confidence: 0.857840121333333

00:38:20.400 --> 00:38:22.377 the maze by a lava pit versus

NOTE Confidence: 0.857840121333333

00:38:22.377 --> 00:38:23.877 the degree of risk aversion.

NOTE Confidence: 0.857840121333333

00:38:23.880 --> 00:38:26.368 And those two work opposite to each other

NOTE Confidence: 0.857840121333333

00:38:26.368 --> 00:38:28.676 in terms of the in terms of PC bar.

NOTE Confidence: 0.857840121333333

00:38:28.680 --> 00:38:29.852 So you get caught.

NOTE Confidence: 0.857840121333333

00:38:29.852 --> 00:38:31.610 That increases your prior to the

NOTE Confidence: 0.857840121333333

00:38:31.673 --> 00:38:33.397 possibility of getting caught,

NOTE Confidence: 0.857840121333333

00:38:33.400 --> 00:38:35.880 but it also increases the value of alpha,

NOTE Confidence: 0.857840121333333

00:38:35.880 --> 00:38:37.920 makes you a little bit less risk averse.

NOTE Confidence: 0.912421653333333

00:38:37.920 --> 00:38:39.492 And so those two things are

NOTE Confidence: 0.912421653333333

00:38:39.492 --> 00:38:41.083 fighting with each other we think

NOTE Confidence: 0.912421653333333

00:38:41.083 --> 00:38:42.553 in the context of these mazes.

NOTE Confidence: 0.912421653333333

00:38:42.560 --> 00:38:43.792 And of course it would be interesting

NOTE Confidence: 0.912421653333333

00:38:43.792 --> 00:38:45.318 to look at ambiguity as well as risk.

NOTE Confidence: 0.912421653333333

00:38:45.320 --> 00:38:47.032 So here all I did talked about is

NOTE Confidence: 0.912421653333333

00:38:47.032 --> 00:38:48.746 cases where you know the probabilities

NOTE Confidence: 0.912421653333333

00:38:48.746 --> 00:38:50.291 are frankly expressed as subjects

NOTE Confidence: 0.912421653333333

00:38:50.291 --> 00:38:51.717 know exactly what the probability

NOTE Confidence: 0.912421653333333

00:38:51.717 --> 00:38:53.622 is of getting caught by the the,

NOTE Confidence: 0.912421653333333

00:38:53.622 --> 00:38:55.434 the sorry, they know exactly probably

NOTE Confidence: 0.912421653333333

00:38:55.434 --> 00:38:57.634 of having a lapse in terms of the

NOTE Confidence: 0.912421653333333

00:38:57.634 --> 00:38:59.599 the way that they move in the maze.

NOTE Confidence: 0.912421653333333

00:38:59.600 --> 00:39:01.160 They know the values of everything.

NOTE Confidence: 0.912421653333333

00:39:01.160 --> 00:39:02.520 We didn't make it ambiguous.

NOTE Confidence: 0.912421653333333

00:39:02.520 --> 00:39:04.389 But of course ambiguity as a sort

NOTE Confidence: 0.912421653333333

00:39:04.389 --> 00:39:06.206 of 2nd order probability also makes

NOTE Confidence: 0.912421653333333

00:39:06.206 --> 00:39:08.439 you gives you an extra aspect of

NOTE Confidence: 0.912421653333333

00:39:08.502 --> 00:39:10.357 probability that you don't know.

NOTE Confidence: 0.912421653333333

00:39:10.360 --> 00:39:12.556 And so then if you think about the law,

NOTE Confidence: 0.912421653333333

00:39:12.560 --> 00:39:14.751 so a tale of those properties you

NOTE Confidence: 0.912421653333333

00:39:14.751 --> 00:39:17.223 don't know that's a way of inducing

NOTE Confidence: 0.912421653333333

00:39:17.223 --> 00:39:18.968 ambiguity aversion because of the of

NOTE Confidence: 0.912421653333333

00:39:18.968 --> 00:39:20.480 the extra uncertainty that you have,

NOTE Confidence: 0.912421653333333

00:39:20.480 --> 00:39:22.320 the 2nd order uncertainty you

NOTE Confidence: 0.912421653333333

00:39:22.320 --> 00:39:24.160 have in those cases too.

NOTE Confidence: 0.912421653333333

00:39:24.160 --> 00:39:26.800 From a psychiatric point of view,

NOTE Confidence: 0.912421653333333

00:39:26.800 --> 00:39:29.165 you what you can see is a sort of an aspect

NOTE Confidence: 0.912421653333333

00:39:29.165 --> 00:39:31.636 of sort of pathological avoidance right here.

NOTE Confidence: 0.912421653333333

00:39:31.640 --> 00:39:33.030 The way you're evaluating what

NOTE Confidence: 0.912421653333333

00:39:33.030 --> 00:39:34.735 could be a relatively benign world

NOTE Confidence: 0.912421653333333

00:39:34.735 --> 00:39:36.319 is you're thinking about all the

NOTE Confidence: 0.912421653333333

00:39:36.319 --> 00:39:37.679 nasty things that can happen.

NOTE Confidence: 0.912421653333333

00:39:37.680 --> 00:39:39.920 That's what that's what what what is

NOTE Confidence: 0.912421653333333

00:39:39.920 --> 00:39:41.072 becomes really critically important.

NOTE Confidence: 0.912421653333333

00:39:41.072 --> 00:39:42.800 And then if you're living in

NOTE Confidence: 0.912421653333333

00:39:42.850 --> 00:39:43.960 a stochastic environment,

NOTE Confidence: 0.912421653333333

00:39:43.960 --> 00:39:45.836 which of course we we all do,

NOTE Confidence: 0.912421653333333

00:39:45.840 --> 00:39:48.234 then if you're really extremely risk averse,

NOTE Confidence: 0.912421653333333

00:39:48.240 --> 00:39:49.997 so alpha is really near to zero,

NOTE Confidence: 0.912421653333333

00:39:50.000 --> 00:39:52.220 then that's a route to indifference

NOTE Confidence: 0.912421653333333

00:39:52.220 --> 00:39:52.960 or helplessness.

NOTE Confidence: 0.912421653333333

00:39:52.960 --> 00:39:55.237 Because it doesn't matter what you try to do,

NOTE Confidence: 0.912421653333333

00:39:55.240 --> 00:39:56.420 you're always worried about the

NOTE Confidence: 0.912421653333333

00:39:56.420 --> 00:39:57.600 nastiest thing that can happen.

NOTE Confidence: 0.912421653333333

00:39:57.600 --> 00:40:02.076 So that makes life super complicated.

NOTE Confidence: 0.912421653333333

00:40:02.080 --> 00:40:04.080 OK, so that's online behaviour.

NOTE Confidence: 0.912421653333333

00:40:04.080 --> 00:40:06.278 So, so here we think about planning.

NOTE Confidence: 0.912421653333333

00:40:06.280 --> 00:40:08.205 We won't imagine what are our subjects

NOTE Confidence: 0.912421653333333

00:40:08.205 --> 00:40:10.289 doing as they're thinking about how to move

NOTE Confidence: 0.912421653333333

00:40:10.289 --> 00:40:12.399 in that maze with the with the choices.

NOTE Confidence: 0.912421653333333

00:40:12.400 --> 00:40:14.104 So there we can do what as Phil

00:40:14.104 --> 00:40:15.538 mentioned at the beginning as sort

00:40:15.538 --> 00:40:17.586 of forms of something a bit like say

00:40:17.586 --> 00:40:18.730 model based reinforcement learning

00:40:18.730 --> 00:40:20.664 where we have a model of the world

00:40:20.664 --> 00:40:21.840 and we're planning in that model.

00:40:21.840 --> 00:40:23.934 We're thinking about the risk that

00:40:23.934 --> 00:40:25.661 accumulates along these paths and

00:40:25.661 --> 00:40:27.797 changing these values of alpha as we go.

00:40:27.800 --> 00:40:29.744 But there's a lot of interest at the

00:40:29.744 --> 00:40:31.751 moment in also thinking about offline

00:40:31.751 --> 00:40:34.160 processing that can happen during periods of,

00:40:34.160 --> 00:40:34.890 for instance,

00:40:34.890 --> 00:40:37.080 quiet wakefulness or sleep in animals.

00:40:37.080 --> 00:40:39.856 Also into in into trial intervals in in

00:40:39.856 --> 00:40:42.397 humans that we've been looking at too.

00:40:42.400 --> 00:40:44.584 And so the idea has been that

NOTE Confidence: 0.912421653333333

00:40:44.584 --> 00:40:45.520 there's a coordinate,

NOTE Confidence: 0.912421653333333

00:40:45.520 --> 00:40:47.600 that there's hippocampal and cortical

NOTE Confidence: 0.912421653333333

00:40:47.600 --> 00:40:49.680 replay which themselves are coordinated,

NOTE Confidence: 0.912421653333333

00:40:49.680 --> 00:40:52.224 which can be used to do

NOTE Confidence: 0.912421653333333

00:40:52.224 --> 00:40:53.920 aspects of offline planning.

NOTE Confidence: 0.912421653333333

00:40:53.920 --> 00:40:56.377 Which is to say that we normally

NOTE Confidence: 0.912421653333333

00:40:56.377 --> 00:40:58.385 think about a model of the world

NOTE Confidence: 0.912421653333333

00:40:58.385 --> 00:40:59.690 that's like a generative model

NOTE Confidence: 0.912421653333333

00:40:59.747 --> 00:41:01.077 of the of the environment.

NOTE Confidence: 0.912421653333333

00:41:01.080 --> 00:41:03.600 The inverse of that model is a policy.

NOTE Confidence: 0.912421653333333

00:41:03.600 --> 00:41:06.096 It's like what should I do in the

NOTE Confidence: 0.912421653333333

00:41:06.096 --> 00:41:07.712 environment in order to optimise

NOTE Confidence: 0.912421653333333

00:41:07.712 --> 00:41:09.854 my my return or optimise my C

NOTE Confidence: 0.800395791363636

00:41:09.923 --> 00:41:11.480 bar return? And so in that case,

NOTE Confidence: 0.800395791363636

00:41:11.480 --> 00:41:13.293 the inverse of the model is something

NOTE Confidence: 0.800395791363636

00:41:13.293 --> 00:41:14.827 you can calculate offline when you're

NOTE Confidence: 0.800395791363636

00:41:14.827 --> 00:41:16.885 not having to use the model to make your

NOTE Confidence: 0.800395791363636

00:41:16.885 --> 00:41:19.054 choices as it as it as it as it goes.

NOTE Confidence: 0.800395791363636

00:41:19.054 --> 00:41:21.256 And there's evidence in both rodents

NOTE Confidence: 0.800395791363636

00:41:21.256 --> 00:41:24.652 and also in humans in the last few

NOTE Confidence: 0.800395791363636

00:41:24.652 --> 00:41:27.545 years using typically using Meg that

NOTE Confidence: 0.800395791363636

00:41:27.545 --> 00:41:29.670 subjects are actually engaging in

NOTE Confidence: 0.800395791363636

00:41:29.670 --> 00:41:31.370 offline processing which actually

NOTE Confidence: 0.800395791363636

00:41:31.436 --> 00:41:33.242 has an impact on their behaviour

NOTE Confidence: 0.800395791363636

00:41:33.242 --> 00:41:35.160 when it happens in the future.

NOTE Confidence: 0.800395791363636

00:41:35.160 --> 00:41:37.236 So in the reinforcement learning world,

NOTE Confidence: 0.800395791363636

00:41:37.240 --> 00:41:39.034 this has been closely associated with

NOTE Confidence: 0.800395791363636

00:41:39.034 --> 00:41:41.412 an idea from Rich Sutton in the 90s

NOTE Confidence: 0.800395791363636

00:41:41.412 --> 00:41:43.104 called Dyna where he thought about

NOTE Confidence: 0.800395791363636

00:41:43.166 --> 00:41:45.121 offline processing this replay like

NOTE Confidence: 0.800395791363636

00:41:45.121 --> 00:41:47.076 processing to enable exploration and

NOTE Confidence: 0.800395791363636

00:41:47.080 --> 00:41:49.645 then got embedded in in in the sort of

NOTE Confidence: 0.800395791363636

00:41:49.645 --> 00:41:51.471 forms advanced forms of reinforcement

NOTE Confidence: 0.800395791363636

00:41:51.471 --> 00:41:54.114 learning for for in AI in replay

NOTE Confidence: 0.800395791363636

00:41:54.114 --> 00:41:56.280 buffers for things like the DQN.

NOTE Confidence: 0.800395791363636

00:41:56.280 --> 00:41:59.560 So deep Q learning the networks that for

NOTE Confidence: 0.800395791363636

00:41:59.560 --> 00:42:01.753 instance DeepMind used very successfully

NOTE Confidence: 0.800395791363636

00:42:01.753 --> 00:42:04.850 for things like Alphago to win it go.

NOTE Confidence: 0.800395791363636

00:42:04.850 --> 00:42:06.400 And then slightly more recently,

NOTE Confidence: 0.800395791363636

00:42:06.400 --> 00:42:08.914 there's a lovely paper from Marcelo

NOTE Confidence: 0.800395791363636

00:42:08.914 --> 00:42:11.519 Mata and Nathaniel Door which was

NOTE Confidence: 0.800395791363636

00:42:11.519 --> 00:42:13.673 was speculating that that the replay

NOTE Confidence: 0.800395791363636

00:42:13.673 --> 00:42:15.710 that we see in rodents might be

NOTE Confidence: 0.800395791363636

00:42:15.773 --> 00:42:17.849 optimised to improve the the way

NOTE Confidence: 0.800395791363636

00:42:17.849 --> 00:42:19.994 that that these rodents are planning

NOTE Confidence: 0.800395791363636

00:42:19.994 --> 00:42:21.719 in the in the environment.

NOTE Confidence: 0.800395791363636

00:42:21.720 --> 00:42:23.388 So given that they discover something

NOTE Confidence: 0.800395791363636

00:42:23.388 --> 00:42:25.073 about the world they discover like

NOTE Confidence: 0.800395791363636

00:42:25.073 --> 00:42:26.886 a reward they didn't know about or

NOTE Confidence: 0.800395791363636

00:42:26.886 --> 00:42:28.349 maybe they've forgotten then then

NOTE Confidence: 0.800395791363636

00:42:28.349 --> 00:42:30.077 they have to do some relearning.

NOTE Confidence: 0.800395791363636

00:42:30.080 --> 00:42:32.887 Then what Matter and Dole suggested is

NOTE Confidence: 0.800395791363636

00:42:32.887 --> 00:42:35.824 that the sequence of which the animal

NOTE Confidence: 0.800395791363636

00:42:35.824 --> 00:42:38.314 engages in replay well is informative,

NOTE Confidence: 0.800395791363636

00:42:38.320 --> 00:42:40.352 is chosen in order to optimize the way

NOTE Confidence: 0.800395791363636

00:42:40.352 --> 00:42:42.239 that the animals will then subsequently

NOTE Confidence: 0.800395791363636

00:42:42.239 --> 00:42:44.219 move through the world using a

NOTE Confidence: 0.800395791363636

00:42:44.276 --> 00:42:46.280 simpler way of making doing planning.

NOTE Confidence: 0.800395791363636

00:42:46.280 --> 00:42:48.432 And they pointed out that that you should

NOTE Confidence: 0.800395791363636

00:42:48.432 --> 00:42:50.338 choose to make updates to your model

NOTE Confidence: 0.800395791363636

00:42:50.338 --> 00:42:52.400 based on the product of 2 quantities,

NOTE Confidence: 0.800395791363636

00:42:52.400 --> 00:42:53.210 gain and need.

NOTE Confidence: 0.800395791363636

00:42:53.210 --> 00:42:56.163 So gain is if you were to do a replay

NOTE Confidence: 0.800395791363636

00:42:56.163 --> 00:42:58.480 at a particular location in the main,

NOTE Confidence: 0.800395791363636

00:42:58.480 --> 00:42:59.705 maybe somewhere where you're not

NOTE Confidence: 0.800395791363636

00:42:59.705 --> 00:43:01.253 you have this motion of distal

NOTE Confidence: 0.800395791363636

00:43:01.253 --> 00:43:02.638 replay near the Campbell world.

NOTE Confidence: 0.800395791363636

00:43:02.640 --> 00:43:05.504 Then the game is how much you would

NOTE Confidence: 0.800395791363636

00:43:05.504 --> 00:43:08.240 change your policy if you made an update.

NOTE Confidence: 0.800395791363636

00:43:08.240 --> 00:43:10.000 So there's no point in making an update.

NOTE Confidence: 0.800395791363636

00:43:10.000 --> 00:43:11.855 It is not going to change your

NOTE Confidence: 0.800395791363636

00:43:11.855 --> 00:43:13.524 actions because it will have no

NOTE Confidence: 0.800395791363636

00:43:13.524 --> 00:43:15.186 impact on your final return and

NOTE Confidence: 0.800395791363636

00:43:15.186 --> 00:43:17.022 the need is how frequently you're

NOTE Confidence: 0.800395791363636

00:43:17.022 --> 00:43:19.331 going to visit that state in the

NOTE Confidence: 0.800395791363636

00:43:19.331 --> 00:43:20.996 future given your current policy.

NOTE Confidence: 0.800395791363636

00:43:21.000 --> 00:43:23.115 So it turns out the product of those two

NOTE Confidence: 0.800395791363636

00:43:23.115 --> 00:43:24.796 governs the sequencing that you should

NOTE Confidence: 0.800395791363636

00:43:24.796 --> 00:43:26.879 apply to looking at states in the world.

NOTE Confidence: 0.800395791363636

00:43:26.880 --> 00:43:27.756 And so if you think about,

NOTE Confidence: 0.800395791363636

00:43:27.760 --> 00:43:29.240 you know you discover something,

NOTE Confidence: 0.800395791363636

00:43:29.240 --> 00:43:30.984 how should you go about planning

NOTE Confidence: 0.800395791363636

00:43:30.984 --> 00:43:32.360 using during this offline,

NOTE Confidence: 0.800395791363636

00:43:32.360 --> 00:43:34.420 during these offline cases.

NOTE Confidence: 0.800395791363636

00:43:34.420 --> 00:43:36.845 So we thought about, well,

NOTE Confidence: 0.800395791363636

00:43:36.845 --> 00:43:38.305 what does optimal planning

NOTE Confidence: 0.800395791363636

00:43:38.305 --> 00:43:39.662 look like for Seva?

NOTE Confidence: 0.800395791363636

00:43:39.662 --> 00:43:41.839 You have if you're risk risk averse.

NOTE Confidence: 0.800395791363636

00:43:41.840 --> 00:43:43.680 So here,

NOTE Confidence: 0.800395791363636

00:43:43.680 --> 00:43:44.236 excuse me,

NOTE Confidence: 0.800395791363636

00:43:44.236 --> 00:43:45.626 we're showing again another simple

NOTE Confidence: 0.800395791363636

00:43:45.626 --> 00:43:47.359 domain where you have a start state.

NOTE Confidence: 0.800395791363636

00:43:47.360 --> 00:43:48.810 There's just a single word

NOTE Confidence: 0.800395791363636

00:43:48.810 --> 00:43:50.260 at this location here and

NOTE Confidence: 0.743035424736842

00:43:50.323 --> 00:43:51.315 there's one of these

NOTE Confidence: 0.743035424736842

00:43:51.315 --> 00:43:52.844 lava pits at the at here.

NOTE Confidence: 0.743035424736842

00:43:52.844 --> 00:43:55.116 But what these numbers show is if all

NOTE Confidence: 0.743035424736842

00:43:55.116 --> 00:43:57.277 you know about is where you start,

NOTE Confidence: 0.743035424736842

00:43:57.280 --> 00:43:58.918 you have a model of the world,

NOTE Confidence: 0.743035424736842

00:43:58.920 --> 00:44:00.272 but you don't and you know about the

NOTE Confidence: 0.743035424736842

00:44:00.272 --> 00:44:01.797 law of a pit and the and the reward,

NOTE Confidence: 0.743035424736842

00:44:01.800 --> 00:44:02.717 but you don't know how to plan.

NOTE Confidence: 0.743035424736842

00:44:02.720 --> 00:44:04.475 You haven't got a plan of what to do.

NOTE Confidence: 0.743035424736842

00:44:04.480 --> 00:44:05.720 We're thinking of the replay

NOTE Confidence: 0.743035424736842

00:44:05.720 --> 00:44:06.960 in matter and door world.

NOTE Confidence: 0.743035424736842

00:44:06.960 --> 00:44:09.702 The replay is constructing that plan

NOTE Confidence: 0.743035424736842

00:44:09.702 --> 00:44:12.332 for you by by by essentially focusing

NOTE Confidence: 0.743035424736842

00:44:12.332 --> 00:44:14.997 on a state in the world and then

NOTE Confidence: 0.743035424736842

00:44:14.997 --> 00:44:17.157 doing a little little Bellman update.

NOTE Confidence: 0.743035424736842

00:44:17.160 --> 00:44:19.098 Just one step of reinforcement learning

NOTE Confidence: 0.743035424736842

00:44:19.098 --> 00:44:21.568 and the steps the the order of the

NOTE Confidence: 0.743035424736842

00:44:21.568 --> 00:44:23.236 steps is shown by these numbers.

NOTE Confidence: 0.743035424736842

00:44:23.240 --> 00:44:26.312 So it turns out that if you prioritise

NOTE Confidence: 0.743035424736842

00:44:26.312 --> 00:44:28.860 based on on being risk neutral and

NOTE Confidence: 0.743035424736842

00:44:28.860 --> 00:44:31.448 what I mean by prioritisation here is

NOTE Confidence: 0.743035424736842

00:44:31.448 --> 00:44:33.159 you're thinking about what planning

NOTE Confidence: 0.743035424736842

00:44:33.159 --> 00:44:35.310 should I do that has the most effect on

NOTE Confidence: 0.743035424736842

00:44:35.361 --> 00:44:37.209 the value of the start state because

NOTE Confidence: 0.743035424736842

00:44:37.209 --> 00:44:39.095 that's the value where you're you're

NOTE Confidence: 0.743035424736842

00:44:39.095 --> 00:44:40.835 where you're where you're beginning.

NOTE Confidence: 0.743035424736842

00:44:40.840 --> 00:44:43.585 So it turns out that in the if you

NOTE Confidence: 0.743035424736842

00:44:43.585 --> 00:44:45.695 prioritise based on this neutrality you

NOTE Confidence: 0.743035424736842

00:44:45.695 --> 00:44:48.946 for some reason you do one step at the

NOTE Confidence: 0.743035424736842

00:44:48.946 --> 00:44:52.117 this location away from the lava pit

NOTE Confidence: 0.743035424736842

00:44:52.120 --> 00:44:54.240 and then all the subsequent steps you do,

NOTE Confidence: 0.743035424736842

00:44:54.240 --> 00:44:56.544 in this case the subsequent 7 steps or

NOTE Confidence: 0.743035424736842

00:44:56.544 --> 00:44:58.698 seven six steps essentially plan in

NOTE Confidence: 0.743035424736842

00:44:58.698 --> 00:45:00.966 this instance backwards from the goal

NOTE Confidence: 0.743035424736842

00:45:01.035 --> 00:45:03.317 from the reward back to the beginning.

NOTE Confidence: 0.743035424736842

00:45:03.320 --> 00:45:05.978 And this notion about backward sequencing

NOTE Confidence: 0.743035424736842

00:45:05.978 --> 00:45:08.720 like reverse replay in in the in the

NOTE Confidence: 0.743035424736842

00:45:08.720 --> 00:45:11.121 in the hippocampal world is also seen

NOTE Confidence: 0.743035424736842

00:45:11.121 --> 00:45:13.479 in something called Prioritised sweeping,

NOTE Confidence: 0.743035424736842

00:45:13.480 --> 00:45:16.105 which is an old idea in Reinforcement

NOTE Confidence: 0.743035424736842

00:45:16.105 --> 00:45:18.042 Learning from Andrew Moore where

NOTE Confidence: 0.743035424736842

00:45:18.042 --> 00:45:20.625 you'd optimise the the sequence of of

NOTE Confidence: 0.743035424736842

00:45:20.625 --> 00:45:22.812 updates you would do if you prioritise

NOTE Confidence: 0.743035424736842

00:45:22.812 --> 00:45:25.080 instead based on a value of alpha,

NOTE Confidence: 0.743035424736842

00:45:25.080 --> 00:45:26.340 which is much lower,

NOTE Confidence: 0.743035424736842

00:45:26.340 --> 00:45:27.915 so much more risk averse.

NOTE Confidence: 0.743035424736842

00:45:27.920 --> 00:45:29.901 Now you can see that you spend

NOTE Confidence: 0.743035424736842

00:45:29.901 --> 00:45:31.693 all your planning time instead of

NOTE Confidence: 0.743035424736842

00:45:31.693 --> 00:45:33.751 planning how to get to the reward.

NOTE Confidence: 0.743035424736842

00:45:33.760 --> 00:45:36.160 You spend all your planning time

NOTE Confidence: 0.743035424736842

00:45:36.160 --> 00:45:38.264 thinking about the about the lava pit,

NOTE Confidence: 0.743035424736842

00:45:38.264 --> 00:45:39.394 thinking about where you can.

NOTE Confidence: 0.743035424736842

00:45:39.400 --> 00:45:40.352 You know how to avoid the lava

NOTE Confidence: 0.743035424736842

00:45:40.352 --> 00:45:41.159 pit if you were there,

NOTE Confidence: 0.743035424736842

00:45:41.160 --> 00:45:42.560 so the first is the same one,

NOTE Confidence: 0.743035424736842

00:45:42.560 --> 00:45:44.168 but then all the subsequent ones

NOTE Confidence: 0.743035424736842

00:45:44.168 --> 00:45:46.013 are all avoiding the lava pit and

NOTE Confidence: 0.743035424736842

00:45:46.013 --> 00:45:47.679 have nothing to do with getting to

NOTE Confidence: 0.743035424736842

00:45:47.734 --> 00:45:49.558 the reward So you can see how you're

NOTE Confidence: 0.743035424736842

00:45:49.560 --> 00:45:51.534 even the structure of of thinking

NOTE Confidence: 0.743035424736842

00:45:51.534 --> 00:45:53.929 offline is going to be really could

NOTE Confidence: 0.743035424736842

00:45:53.929 --> 00:45:55.957 could get really dominated by the

NOTE Confidence: 0.743035424736842

00:45:55.960 --> 00:45:57.717 by these nasty things that could by

NOTE Confidence: 0.743035424736842

00:45:57.717 --> 00:45:59.398 the nasty things that could happen.

NOTE Confidence: 0.743035424736842

00:45:59.400 --> 00:46:00.840 And if alpha equals 0,

NOTE Confidence: 0.743035424736842

00:46:00.840 --> 00:46:02.208 there's no point in doing planning

NOTE Confidence: 0.743035424736842

00:46:02.208 --> 00:46:03.611 at all because you can't mitigate

NOTE Confidence: 0.743035424736842

00:46:03.611 --> 00:46:05.151 the child the the risk of getting

NOTE Confidence: 0.743035424736842

00:46:05.151 --> 00:46:06.277 to the log pit as well.

NOTE Confidence: 0.743035424736842

00:46:06.280 --> 00:46:08.359 So you just sit there and do

NOTE Confidence: 0.743035424736842

00:46:08.360 --> 00:46:11.240 you just can't help yourself.

NOTE Confidence: 0.743035424736842

00:46:11.240 --> 00:46:12.216 So as I mentioned,

NOTE Confidence: 0.743035424736842

00:46:12.216 --> 00:46:13.680 this is not only for humans.

NOTE Confidence: 0.743035424736842

00:46:13.680 --> 00:46:15.306 So there's a lovely study that

NOTE Confidence: 0.743035424736842

00:46:15.306 --> 00:46:17.698 comes from the from Mitsuko Wataba,

NOTE Confidence: 0.743035424736842

00:46:17.698 --> 00:46:19.276 Yushida's Yushida's lab,

NOTE Confidence: 0.743035424736842

00:46:19.280 --> 00:46:21.944 where she's a very simple task

NOTE Confidence: 0.743035424736842

00:46:21.944 --> 00:46:23.960 for for for mice.

NOTE Confidence: 0.918624877142857

00:46:23.960 --> 00:46:27.040 So here she had a simple arena,

NOTE Confidence: 0.918624877142857

00:46:27.040 --> 00:46:29.032 just an open like an open

NOTE Confidence: 0.918624877142857

00:46:29.032 --> 00:46:30.360 field arena shown here.

NOTE Confidence: 0.918624877142857

00:46:30.360 --> 00:46:31.782 And then the mice were put

NOTE Confidence: 0.918624877142857

00:46:31.782 --> 00:46:33.240 in for a couple of days.

NOTE Confidence: 0.918624877142857

00:46:33.240 --> 00:46:34.086 There's nothing there.

NOTE Confidence: 0.918624877142857

00:46:34.086 --> 00:46:35.778 They had 25 minutes for a

NOTE Confidence: 0.918624877142857

00:46:35.778 --> 00:46:37.080 session just to run around.

NOTE Confidence: 0.918624877142857

00:46:37.080 --> 00:46:38.560 And here's some here's a path of a,

NOTE Confidence: 0.918624877142857

00:46:38.560 --> 00:46:40.594 of a, of a one of the mice just

NOTE Confidence: 0.918624877142857

00:46:40.594 --> 00:46:42.159 running around this this maze.

NOTE Confidence: 0.918624877142857

00:46:42.160 --> 00:46:45.440 Then on the third day after this habituation,

NOTE Confidence: 0.918624877142857

00:46:45.440 --> 00:46:47.558 Mitsuko put in a novel object,

NOTE Confidence: 0.918624877142857

00:46:47.560 --> 00:46:49.492 just basically a bunch of Lego

NOTE Confidence: 0.918624877142857

00:46:49.492 --> 00:46:51.567 blogs near to one corner of

NOTE Confidence: 0.918624877142857

00:46:51.567 --> 00:46:53.640 the of the environment and then

NOTE Confidence: 0.918624877142857

00:46:53.640 --> 00:46:54.920 monitored how the animals,

NOTE Confidence: 0.918624877142857

00:46:54.920 --> 00:46:56.408 then what what the animals then

NOTE Confidence: 0.918624877142857

00:46:56.408 --> 00:46:57.680 did over the subsequent days,

NOTE Confidence: 0.918624877142857

00:46:57.680 --> 00:46:59.260 so subsequent 4 days with

NOTE Confidence: 0.918624877142857

00:46:59.260 --> 00:47:01.210 this same novel object in the

NOTE Confidence: 0.918624877142857

00:47:01.210 --> 00:47:02.755 same location of the maze.

NOTE Confidence: 0.918624877142857

00:47:02.760 --> 00:47:05.210 And you can see even just eyeballing

NOTE Confidence: 0.918624877142857

00:47:05.210 --> 00:47:07.480 the the trajectories that the

NOTE Confidence: 0.918624877142857

00:47:07.480 --> 00:47:09.576 animal have this really interesting

NOTE Confidence: 0.918624877142857

00:47:09.576 --> 00:47:11.596 mix of essentially neophobia and

NOTE Confidence: 0.918624877142857

00:47:11.596 --> 00:47:13.346 neophilia and neophobia is much

NOTE Confidence: 0.918624877142857

00:47:13.346 --> 00:47:14.956 more much more apparent here.

NOTE Confidence: 0.918624877142857

00:47:14.960 --> 00:47:16.448 So it changes really the structure

NOTE Confidence: 0.918624877142857

00:47:16.448 --> 00:47:18.525 of the of the of the movement

NOTE Confidence: 0.918624877142857

00:47:18.525 --> 00:47:19.557 through the environment.

NOTE Confidence: 0.918624877142857

00:47:19.560 --> 00:47:21.232 So for various reasons,

NOTE Confidence: 0.918624877142857

00:47:21.232 --> 00:47:22.904 Mitsuko characterized being within

NOTE Confidence: 0.918624877142857

00:47:22.904 --> 00:47:25.256 7 centimetres of the object as being

NOTE Confidence: 0.918624877142857

00:47:25.256 --> 00:47:27.352 sort of a critical distance as where

NOTE Confidence: 0.918624877142857

00:47:27.352 --> 00:47:29.672 the animal is is sort of inspecting this,

NOTE Confidence: 0.918624877142857

00:47:29.680 --> 00:47:31.016 is inspecting this object.

NOTE Confidence: 0.918624877142857

00:47:31.016 --> 00:47:33.020 And then what what she's showing

NOTE Confidence: 0.918624877142857

00:47:33.081 --> 00:47:34.943 here is how much per minute of

NOTE Confidence: 0.918624877142857

00:47:34.943 --> 00:47:37.046 these 25 minutes in each of these

NOTE Confidence: 0.918624877142857

00:47:37.046 --> 00:47:38.601 sessions does the animals spend

NOTE Confidence: 0.918624877142857

00:47:38.601 --> 00:47:40.680 within 7 centimetres of the object.

NOTE Confidence: 0.918624877142857

00:47:40.680 --> 00:47:42.437 So in the habituation days is just

NOTE Confidence: 0.918624877142857

00:47:42.437 --> 00:47:43.919 within 7 centimetres of that circle.

NOTE Confidence: 0.918624877142857

00:47:43.920 --> 00:47:45.240 That's this circle shown here.

NOTE Confidence: 0.918624877142857

00:47:45.240 --> 00:47:46.640 And you see that that, you know,

NOTE Confidence: 0.918624877142857

00:47:46.640 --> 00:47:48.080 the animals spent some time there.

NOTE Confidence: 0.918624877142857

00:47:48.080 --> 00:47:49.160 But there's nothing,

NOTE Confidence: 0.918624877142857

00:47:49.160 --> 00:47:51.320 there's nothing failing those locations here.

NOTE Confidence: 0.918624877142857

00:47:51.320 --> 00:47:53.560 When she puts in the novel object,

NOTE Confidence: 0.918624877142857

00:47:53.560 --> 00:47:55.084 you can see that then that

NOTE Confidence: 0.918624877142857

00:47:55.084 --> 00:47:56.100 really dramatically changes the

NOTE Confidence: 0.918624877142857

00:47:56.150 --> 00:47:57.158 structure of behaviour.

NOTE Confidence: 0.918624877142857

00:47:57.160 --> 00:47:59.505 And here she's ordered the animals that

NOTE Confidence: 0.918624877142857

00:47:59.505 --> 00:48:02.006 like 26 animals by the amount of total

NOTE Confidence: 0.918624877142857

00:48:02.006 --> 00:48:04.479 time they spend near the near the object.

NOTE Confidence: 0.918624877142857

00:48:04.480 --> 00:48:05.419 So these animals,

NOTE Confidence: 0.918624877142857

00:48:05.419 --> 00:48:07.610 these early animals spend a sit barely

NOTE Confidence: 0.918624877142857

00:48:07.667 --> 00:48:09.395 anytime near the object at all.

NOTE Confidence: 0.918624877142857

00:48:09.400 --> 00:48:11.638 These animals which are late here,

00:48:11.640 --> 00:48:13.672 they spend much more time near to the

00:48:13.672 --> 00:48:15.635 object than the than the first ones do.

00:48:15.640 --> 00:48:17.348 And so there's a sense in which

00:48:17.348 --> 00:48:19.199 these are very risk averse animals.

00:48:19.200 --> 00:48:20.516 They had what we would think of

00:48:20.516 --> 00:48:21.917 as being this low value of alpha,

00:48:21.920 --> 00:48:23.756 whereas these animals are much more,

00:48:23.760 --> 00:48:24.864 much less risk averse,

00:48:24.864 --> 00:48:26.520 They're much more willing to go

00:48:26.520 --> 00:48:28.760 get close to the to the object.

00:48:28.760 --> 00:48:30.668 And so you can see that the way that

00:48:30.668 --> 00:48:32.795 they approach the object is also changes.

00:48:32.800 --> 00:48:34.280 So here you can see that in the

00:48:34.280 --> 00:48:35.557 first day of the object they

00:48:35.557 --> 00:48:36.632 what she's done is used.

00:48:36.640 --> 00:48:39.904 They use deep lab cut from the mathesis

NOTE Confidence: 0.918624877142857

00:48:39.904 --> 00:48:41.590 to classify whether the animal has

NOTE Confidence: 0.918624877142857

00:48:41.590 --> 00:48:43.130 his nose pointing to the object

NOTE Confidence: 0.918624877142857

00:48:43.130 --> 00:48:44.677 or the tail point of the object.

NOTE Confidence: 0.918624877142857

00:48:44.680 --> 00:48:47.200 You see in the early days the animal only

NOTE Confidence: 0.918624877142857

00:48:47.200 --> 00:48:49.160 has what they call cautious approach,

NOTE Confidence: 0.918624877142857

00:48:49.160 --> 00:48:51.020 so only approaches the object with

NOTE Confidence: 0.918624877142857

00:48:51.020 --> 00:48:53.517 its nose in front and its tail behind.

NOTE Confidence: 0.804344923333333

00:48:53.520 --> 00:48:54.962 Then over time the animals are then

NOTE Confidence: 0.804344923333333

00:48:54.962 --> 00:48:56.450 more willing or some of the animals

NOTE Confidence: 0.804344923333333

00:48:56.450 --> 00:48:57.962 are more willing to just engage the

NOTE Confidence: 0.804344923333333

00:48:57.962 --> 00:48:59.112 object that they're not protecting

NOTE Confidence: 0.804344923333333

00:48:59.112 --> 00:49:00.710 their tail in this particular way.

NOTE Confidence: 0.804344923333333

00:49:00.710 --> 00:49:02.050 Very appropriate for tail

NOTE Confidence: 0.804344923333333

00:49:02.050 --> 00:49:03.920 risk as you can imagine.

NOTE Confidence: 0.804344923333333

00:49:03.920 --> 00:49:06.755 So if we look at the frequency of approach,

00:49:06.760 --> 00:49:08.920 so frequency per minute of

00:49:08.920 --> 00:49:11.080 approach with the tail behind,

00:49:11.080 --> 00:49:13.536 you can see that the that the

00:49:13.536 --> 00:49:15.076 all the animals are here.

00:49:15.080 --> 00:49:17.078 Again this is set up segmented

00:49:17.078 --> 00:49:18.077 into these sessions.

00:49:18.080 --> 00:49:19.200 So all the animals start

00:49:19.200 --> 00:49:20.320 off with their tail behind.

00:49:20.320 --> 00:49:22.872 So this is this cautious approach and then

00:49:22.872 --> 00:49:24.760 again using the same sort of the animals,

00:49:24.760 --> 00:49:27.120 so the same sorting between one and 26.

00:49:27.120 --> 00:49:28.560 You can see that the animals who are timid,

00:49:28.560 --> 00:49:29.805 who don't approach the object

00:49:29.805 --> 00:49:31.302 they are or barely approach to

00:49:31.302 --> 00:49:32.716 spend any time near to the object.

00:49:32.720 --> 00:49:35.000 They also never risk their tail.

NOTE Confidence: 0.804344923333333

00:49:35.000 --> 00:49:36.816 So their tail is always but is always

NOTE Confidence: 0.804344923333333

00:49:36.816 --> 00:49:38.485 they they they're spending no time

NOTE Confidence: 0.804344923333333

00:49:38.485 --> 00:49:40.225 with their tail exposed whereas the

NOTE Confidence: 0.804344923333333

00:49:40.281 --> 00:49:42.038 brave animals these ones down at the

NOTE Confidence: 0.804344923333333

00:49:42.038 --> 00:49:43.828 bottom they not only spend more time

NOTE Confidence: 0.804344923333333

00:49:43.828 --> 00:49:45.958 near the object they also do it with

NOTE Confidence: 0.804344923333333

00:49:45.958 --> 00:49:47.799 their their tail exposed in this way.

NOTE Confidence: 0.804344923333333

00:49:47.800 --> 00:49:50.160 But we were very struck by this huge

NOTE Confidence: 0.804344923333333

00:49:50.160 --> 00:49:51.445 individual differences in the in

NOTE Confidence: 0.804344923333333

00:49:51.445 --> 00:49:52.950 the in the way that these animals

NOTE Confidence: 0.804344923333333

00:49:53.000 --> 00:49:54.560 approach the object and so we're

NOTE Confidence: 0.804344923333333

00:49:54.560 --> 00:49:56.388 interested in in in modelling that

NOTE Confidence: 0.804344923333333

00:49:56.388 --> 00:49:59.146 so at Kitty Egal they they they

NOTE Confidence: 0.804344923333333

00:49:59.146 --> 00:50:01.079 characterize various aspects of the

NOTE Confidence: 0.804344923333333

00:50:01.079 --> 00:50:03.697 of the behaviour so the fraction of

NOTE Confidence: 0.804344923333333

00:50:03.697 --> 00:50:05.755 time they're close to the object.

NOTE Confidence: 0.804344923333333

00:50:05.760 --> 00:50:07.482 I showed you that already here showing

NOTE Confidence: 0.804344923333333

00:50:07.482 --> 00:50:09.039 with confident and cautious approach.

NOTE Confidence: 0.804344923333333

00:50:09.040 --> 00:50:11.518 So cautious in green, confident in blue.

NOTE Confidence: 0.804344923333333

00:50:11.520 --> 00:50:12.766 And again you can see with their

NOTE Confidence: 0.804344923333333

00:50:12.766 --> 00:50:14.018 sort of the animals that there's

NOTE Confidence: 0.804344923333333

00:50:14.018 --> 00:50:15.579 only green at the top when there's

NOTE Confidence: 0.804344923333333

00:50:15.625 --> 00:50:16.600 some blue at the bottom.

NOTE Confidence: 0.804344923333333

00:50:16.600 --> 00:50:18.280 And this is only showing the days.

NOTE Confidence: 0.804344923333333

00:50:18.280 --> 00:50:20.260 Since the only showing the days

NOTE Confidence: 0.804344923333333

00:50:20.260 --> 00:50:22.639 off the object has been evaluated.

NOTE Confidence: 0.804344923333333

00:50:22.640 --> 00:50:24.408 You can look at the how long they

NOTE Confidence: 0.804344923333333

00:50:24.408 --> 00:50:26.168 spend near the object and again you

NOTE Confidence: 0.804344923333333

00:50:26.168 --> 00:50:27.751 can see that that's shown again

NOTE Confidence: 0.804344923333333

00:50:27.751 --> 00:50:28.839 shown by this colour.

NOTE Confidence: 0.804344923333333

00:50:28.840 --> 00:50:30.280 So the brave ones spend a lot of time,

00:50:30.280 --> 00:50:31.960 the the timid ones spend very little

00:50:31.960 --> 00:50:33.710 time and how frequently they visit

00:50:33.710 --> 00:50:35.732 the object, they they go there.

00:50:35.732 --> 00:50:38.253 And again the brave ones visit frequently

00:50:38.253 --> 00:50:41.718 the the timid ones are barely visited at all.

00:50:41.720 --> 00:50:43.239 So it goes a model of this,

00:50:43.240 --> 00:50:43.880 but I'm not going to,

00:50:43.880 --> 00:50:44.958 I haven't got time to go through

00:50:44.958 --> 00:50:45.878 all the details of the model,

00:50:45.880 --> 00:50:47.200 but just to just to give you the,

00:50:47.200 --> 00:50:49.195 the, the hint of what's inside it.

00:50:49.200 --> 00:50:50.676 So why do they visit the object at all?

00:50:50.680 --> 00:50:51.640 Well, that's Neophilia.

00:50:51.640 --> 00:50:52.280 They're interested.

00:50:52.280 --> 00:50:54.056 There's an exploration bonus we imagine

NOTE Confidence: 0.804344923333333

00:50:54.056 --> 00:50:56.145 which is associated with that and we

NOTE Confidence: 0.804344923333333

00:50:56.145 --> 00:50:57.575 imagine that this exploration bonus

NOTE Confidence: 0.804344923333333

00:50:57.575 --> 00:50:59.077 replenishes as if they don't know,

NOTE Confidence: 0.804344923333333

00:50:59.080 --> 00:51:00.760 they don't know that the object is not,

NOTE Confidence: 0.804344923333333

00:51:00.760 --> 00:51:01.402 is not,

NOTE Confidence: 0.804344923333333

00:51:01.402 --> 00:51:03.328 is not never actually gives them

NOTE Confidence: 0.804344923333333

00:51:03.328 --> 00:51:04.676 a real return, right.

NOTE Confidence: 0.804344923333333

00:51:04.676 --> 00:51:06.080 The object is just a bunch of Lego blocks.

NOTE Confidence: 0.804344923333333

00:51:06.080 --> 00:51:07.745 There's no food or anything

NOTE Confidence: 0.804344923333333

00:51:07.745 --> 00:51:09.077 positive associated with it

NOTE Confidence: 0.75158916875

00:51:09.080 --> 00:51:11.530 and we imagine that when the animals

NOTE Confidence: 0.75158916875

00:51:11.530 --> 00:51:13.340 have due confidence approach they

NOTE Confidence: 0.75158916875

00:51:13.340 --> 00:51:15.474 they can stay enjoy more than

NOTE Confidence: 0.75158916875

00:51:15.474 --> 00:51:17.359 they consume the reward faster.

NOTE Confidence: 0.75158916875

00:51:17.360 --> 00:51:18.878 Then we have a hazard function.

NOTE Confidence: 0.75158916875

00:51:18.880 --> 00:51:20.160 Why are they neo phobic?

NOTE Confidence: 0.75158916875

00:51:20.160 --> 00:51:22.043 Well they're why that maybe at some

NOTE Confidence: 0.75158916875

00:51:22.043 --> 00:51:23.685 point a predator or something is

NOTE Confidence: 0.75158916875

00:51:23.685 --> 00:51:25.498 going to jump out from this object

NOTE Confidence: 0.75158916875

00:51:25.553 --> 00:51:27.053 or something naughty might happen

NOTE Confidence: 0.75158916875

00:51:27.053 --> 00:51:28.897 and we imagine that that increases

NOTE Confidence: 0.75158916875

00:51:28.897 --> 00:51:30.919 over time spent near the object.

NOTE Confidence: 0.75158916875

00:51:30.920 --> 00:51:32.680 So the longer they spend near the object,

NOTE Confidence: 0.75158916875

00:51:32.680 --> 00:51:34.650 the more that they're worried

NOTE Confidence: 0.75158916875

00:51:34.650 --> 00:51:35.438 about predation.

NOTE Confidence: 0.75158916875

00:51:35.440 --> 00:51:37.384 And then that we imagine that that then

NOTE Confidence: 0.75158916875

00:51:37.384 --> 00:51:39.397 resets when they move away from the object.

NOTE Confidence: 0.75158916875

00:51:39.400 --> 00:51:40.906 And we imagine that it's less

NOTE Confidence: 0.75158916875

00:51:40.906 --> 00:51:42.264 dangerous when they do cautious

NOTE Confidence: 0.75158916875

00:51:42.264 --> 00:51:43.480 approach than confident approaches

NOTE Confidence: 0.75158916875

00:51:43.480 --> 00:51:45.554 of why they want to approach in

NOTE Confidence: 0.75158916875

00:51:45.554 --> 00:51:47.318 this cautious way in the 1st place.

NOTE Confidence: 0.75158916875

00:51:47.320 --> 00:51:49.784 And we critical to this is that

NOTE Confidence: 0.75158916875

00:51:49.784 --> 00:51:51.240 the uncertainty about that,

NOTE Confidence: 0.75158916875

00:51:51.240 --> 00:51:52.455 about their about whether there's

NOTE Confidence: 0.75158916875

00:51:52.455 --> 00:51:54.219 a predator or not only will reduce

NOTE Confidence: 0.75158916875

00:51:54.219 --> 00:51:55.719 if they actually visit the object.

NOTE Confidence: 0.75158916875

00:51:55.720 --> 00:51:56.920 If they don't visit the object

NOTE Confidence: 0.75158916875

00:51:56.920 --> 00:51:58.000 or don't spend time there,

NOTE Confidence: 0.75158916875

00:51:58.000 --> 00:51:59.498 they're not going to find out that

NOTE Confidence: 0.75158916875

00:51:59.498 --> 00:52:01.048 in fact the object is completely

NOTE Confidence: 0.75158916875

00:52:01.048 --> 00:52:02.473 benign and never hurts them.

NOTE Confidence: 0.75158916875

00:52:02.480 --> 00:52:03.880 And so we have this nice parcel,

NOTE Confidence: 0.75158916875

00:52:03.880 --> 00:52:05.885 this important path dependence whereby

NOTE Confidence: 0.75158916875

00:52:05.885 --> 00:52:08.479 the timid animals don't visit for long,

NOTE Confidence: 0.75158916875

00:52:08.480 --> 00:52:10.013 they don't find out the object is

NOTE Confidence: 0.75158916875

00:52:10.013 --> 00:52:11.383 safe and therefore they they carry

NOTE Confidence: 0.75158916875

00:52:11.383 --> 00:52:12.721 on not visiting for long because

NOTE Confidence: 0.75158916875

00:52:12.721 --> 00:52:13.958 they haven't found out this,

NOTE Confidence: 0.75158916875

00:52:13.960 --> 00:52:14.929 this safety itself.

NOTE Confidence: 0.75158916875

00:52:14.929 --> 00:52:17.190 And then we have this risk of

NOTE Confidence: 0.75158916875

00:52:17.264 --> 00:52:19.759 aversion 2 and then when we then

NOTE Confidence: 0.75158916875

00:52:19.759 --> 00:52:21.726 build a model of their behaviour.

NOTE Confidence: 0.75158916875

00:52:21.726 --> 00:52:23.178 So here I just characterised that

NOTE Confidence: 0.75158916875

00:52:23.178 --> 00:52:24.531 sort of abstracted away from

NOTE Confidence: 0.75158916875

00:52:24.531 --> 00:52:25.595 the animal data themselves.

NOTE Confidence: 0.75158916875

00:52:25.600 --> 00:52:26.776 You can see we sort of capture

NOTE Confidence: 0.75158916875

00:52:26.776 --> 00:52:27.746 the sort of the, the,

NOTE Confidence: 0.75158916875

00:52:27.746 --> 00:52:29.874 the general trends in the animal in the,

NOTE Confidence: 0.75158916875

00:52:29.880 --> 00:52:30.812 in the, in the.

NOTE Confidence: 0.75158916875

00:52:30.812 --> 00:52:31.977 With this abstraction you can

NOTE Confidence: 0.75158916875

00:52:31.977 --> 00:52:33.398 see we do a really good job.

NOTE Confidence: 0.75158916875

00:52:33.400 --> 00:52:35.160 We have quite a lot of parameters I must say.

NOTE Confidence: 0.75158916875

00:52:35.160 --> 00:52:36.976 We can do a really good job of

NOTE Confidence: 0.75158916875

00:52:36.976 --> 00:52:38.444 fitting their data by essentially

NOTE Confidence: 0.75158916875

00:52:38.444 --> 00:52:40.044 synergising the amount by which

NOTE Confidence: 0.75158916875

00:52:40.044 --> 00:52:42.077 they're to which they're risk averse,

NOTE Confidence: 0.75158916875

00:52:42.080 --> 00:52:44.390 this PC bar mechanism and also

NOTE Confidence: 0.75158916875

00:52:44.390 --> 00:52:46.991 the amount by which to which they

NOTE Confidence: 0.75158916875

00:52:46.991 --> 00:52:48.765 are with their prior over what

NOTE Confidence: 0.75158916875

00:52:48.765 --> 00:52:50.950 the object is like and that prior

NOTE Confidence: 0.75158916875

00:52:50.950 --> 00:52:52.635 is not not influenced enough.

NOTE Confidence: 0.75158916875

00:52:52.640 --> 00:52:53.756 If they don't visit the object,

NOTE Confidence: 0.75158916875

00:52:53.760 --> 00:52:54.880 they don't disturb the object.

NOTE Confidence: 0.75158916875

00:52:54.880 --> 00:52:58.435 It's it's safe in the way that I described.

NOTE Confidence: 0.75158916875

00:52:58.440 --> 00:52:58.640 OK.

NOTE Confidence: 0.75158916875

00:52:58.640 --> 00:53:00.040 So because I'm running out of time,

NOTE Confidence: 0.75158916875

00:53:00.040 --> 00:53:02.640 let me just go to the general discussion

NOTE Confidence: 0.75158916875

00:53:02.640 --> 00:53:05.000 that's really discussion about that.

NOTE Confidence: 0.75158916875

00:53:05.000 --> 00:53:08.193 So just to sum up then on this risk aversion,

NOTE Confidence: 0.75158916875

00:53:08.200 --> 00:53:08.884 I think we can,

NOTE Confidence: 0.75158916875

00:53:08.884 --> 00:53:10.546 it's nice to think from a sort of

NOTE Confidence: 0.75158916875

00:53:10.546 --> 00:53:11.845 computational psychiatric point of

NOTE Confidence: 0.75158916875

00:53:11.845 --> 00:53:14.078 view about the things that the thing,

NOTE Confidence: 0.75158916875

00:53:14.078 --> 00:53:15.752 the way that evaluation happens in

NOTE Confidence: 0.75158916875

00:53:15.752 --> 00:53:17.438 the context of this risk aversion.

NOTE Confidence: 0.75158916875

00:53:17.440 --> 00:53:19.844 So you think of sort of people who

NOTE Confidence: 0.75158916875

00:53:19.844 --> 00:53:21.398 are highly risk averse in some sense.

NOTE Confidence: 0.75158916875

00:53:21.400 --> 00:53:23.150 Maybe they're solving a different

NOTE Confidence: 0.75158916875

00:53:23.150 --> 00:53:24.200 problem from others.

NOTE Confidence: 0.75158916875

00:53:24.200 --> 00:53:25.742 And so here we've shown that

NOTE Confidence: 0.75158916875

00:53:25.742 --> 00:53:26.513 you that optimally,

NOTE Confidence: 0.75158916875

00:53:26.520 --> 00:53:28.179 if you have a really low value

NOTE Confidence: 0.75158916875

00:53:28.179 --> 00:53:29.778 of alpha or in some context

NOTE Confidence: 0.75158916875

00:53:29.778 --> 00:53:31.153 this this nested C bar,

NOTE Confidence: 0.75973713

00:53:31.160 --> 00:53:33.590 NC bar, then you'll see this

NOTE Confidence: 0.75973713

00:53:33.590 --> 00:53:34.400 dysfunctional avoidance.

NOTE Confidence: 0.75973713

00:53:34.400 --> 00:53:35.570 And also this rumination process

NOTE Confidence: 0.75973713

00:53:35.570 --> 00:53:37.216 in the sense that you'll keep on

NOTE Confidence: 0.75973713

00:53:37.216 --> 00:53:38.500 worrying about all the nasty things

NOTE Confidence: 0.75973713

00:53:38.500 --> 00:53:40.038 that can happen if alpha is near 0.

NOTE Confidence: 0.75973713

00:53:40.040 --> 00:53:41.099 You have action,

NOTE Confidence: 0.75973713

00:53:41.099 --> 00:53:42.158 indifference and helplessness,

NOTE Confidence: 0.75973713

00:53:42.160 --> 00:53:43.560 and that's the correct answer.

NOTE Confidence: 0.75973713

00:53:43.560 --> 00:53:45.318 That's the right thing to do.

NOTE Confidence: 0.75973713

00:53:45.320 --> 00:53:47.272 If your value of alpha is so low

NOTE Confidence: 0.75973713

00:53:47.272 --> 00:53:49.478 and you live in a stochastic world,

NOTE Confidence: 0.75973713

00:53:49.480 --> 00:53:51.358 how much rumination you should do?

NOTE Confidence: 0.75973713

00:53:51.360 --> 00:53:52.360 There's some sort of threshold.

00:53:52.360 --> 00:53:54.439 How much planning you want to to to do,

00:53:54.440 --> 00:53:56.352 how much improvement you need to have is

00:53:56.352 --> 00:53:58.076 something which again is under your control.

00:53:58.080 --> 00:53:59.706 Maybe you want to really squeeze

00:53:59.706 --> 00:54:00.519 out all possibilities.

00:54:00.520 --> 00:54:02.144 Then you're going to have to do an

00:54:02.144 --> 00:54:03.685 awful lot of rumination to worry

00:54:03.685 --> 00:54:05.317 about all the really low probability

00:54:05.366 --> 00:54:06.518 outcomes that can happen.

00:54:06.520 --> 00:54:08.072 And then for humans we have this problem

00:54:08.072 --> 00:54:09.836 that we live in a very complicated world.

00:54:09.840 --> 00:54:11.680 We can always imagine another

00:54:11.680 --> 00:54:13.152 catastrophe around the corner.

00:54:13.160 --> 00:54:14.847 If you pay a lot of attention

00:54:14.847 --> 00:54:16.080 to low probability outcomes,

00:54:16.080 --> 00:54:18.509 then we can always invent nasty low

00:54:18.509 --> 00:54:20.113 probability outcomes that will cause

00:54:20.113 --> 00:54:22.113 you to to to to to have problems.

00:54:22.120 --> 00:54:23.248 And then as then in the

00:54:23.248 --> 00:54:24.440 case of the the rodents,

00:54:24.440 --> 00:54:26.568 we can see there's an effect on this

00:54:26.568 --> 00:54:27.588 exploration exploitation trade off

00:54:27.588 --> 00:54:29.114 in the sense that the animals that

00:54:29.114 --> 00:54:30.648 don't explore can't find out about

00:54:30.648 --> 00:54:32.275 safety and therefore they can never,

00:54:32.275 --> 00:54:35.115 they will never be able to to to

00:54:35.120 --> 00:54:37.040 essentially treat the object in its

00:54:37.040 --> 00:54:39.010 natural way in terms of to another

00:54:39.010 --> 00:54:40.991 source of problems and risk in terms

00:54:40.991 --> 00:54:42.779 of evaluation is that maybe when

00:54:42.779 --> 00:54:44.599 we're thinking about this rumination,

NOTE Confidence: 0.75973713

00:54:44.600 --> 00:54:46.538 we think maybe there's some subjects

NOTE Confidence: 0.75973713

00:54:46.538 --> 00:54:49.519 who try to do this ruminative planning,

NOTE Confidence: 0.75973713

00:54:49.520 --> 00:54:50.554 they try to think, well, OK,

NOTE Confidence: 0.75973713

00:54:50.554 --> 00:54:51.958 if I'm at the native object,

NOTE Confidence: 0.75973713

00:54:51.960 --> 00:54:53.800 here's what I would do to go away from it.

NOTE Confidence: 0.75973713

00:54:53.800 --> 00:54:55.880 But it's so aggressive to think about it.

NOTE Confidence: 0.75973713

00:54:55.880 --> 00:54:57.758 They will never consummate that planning.

NOTE Confidence: 0.75973713

00:54:57.760 --> 00:54:59.225 They never stop doing that

NOTE Confidence: 0.75973713

00:54:59.225 --> 00:55:00.397 planning in this way.

NOTE Confidence: 0.75973713

00:55:00.400 --> 00:55:01.996 And so that's an idea that Quentin

NOTE Confidence: 0.75973713

00:55:01.996 --> 00:55:03.558 Hughes and I worked on a long,

NOTE Confidence: 0.75973713

00:55:03.560 --> 00:55:05.000 long time ago was that this,

NOTE Confidence: 0.75973713

00:55:05.000 --> 00:55:08.024 this is a sort of internal behavioural

NOTE Confidence: 0.75973713

00:55:08.024 --> 00:55:09.560 inhibition associated with a,

NOTE Confidence: 0.75973713

00:55:09.560 --> 00:55:10.058 with a thought,

NOTE Confidence: 0.75973713

00:55:10.058 --> 00:55:10.556 if you like,

NOTE Confidence: 0.75973713

00:55:10.560 --> 00:55:12.120 about a piece of planning.

NOTE Confidence: 0.75973713

00:55:12.120 --> 00:55:13.440 So maybe that leads you never

NOTE Confidence: 0.75973713

00:55:13.440 --> 00:55:14.320 to consummate the planning,

NOTE Confidence: 0.75973713

00:55:14.320 --> 00:55:15.454 which means you have to do

NOTE Confidence: 0.75973713

00:55:15.454 --> 00:55:16.679 it again and again and again.

NOTE Confidence: 0.75973713

00:55:16.680 --> 00:55:18.438 So again leading to a sort

NOTE Confidence: 0.75973713

00:55:18.438 --> 00:55:19.317 of rumination itself,

NOTE Confidence: 0.75973713

00:55:19.320 --> 00:55:21.072 you can imagine that you don't

NOTE Confidence: 0.75973713

00:55:21.072 --> 00:55:22.240 adjust for luck appropriately.

NOTE Confidence: 0.75973713

00:55:22.240 --> 00:55:23.752 So if you're unlucky you don't

NOTE Confidence: 0.75973713

00:55:23.752 --> 00:55:24.760 think that I'm now,

NOTE Confidence: 0.75973713

00:55:24.760 --> 00:55:26.596 I can now afford to be a bit more

NOTE Confidence: 0.75973713

00:55:26.596 --> 00:55:28.032 risk avert risk neutral again.

NOTE Confidence: 0.75973713

00:55:28.032 --> 00:55:29.928 So again you'll then have more

NOTE Confidence: 0.75973713

00:55:29.928 --> 00:55:30.560 negative evaluation,

NOTE Confidence: 0.75973713

00:55:30.560 --> 00:55:33.440 you should have itself and then in terms

NOTE Confidence: 0.75973713

00:55:33.440 --> 00:55:35.840 of the the maybe the environment you have,

NOTE Confidence: 0.75973713

00:55:35.840 --> 00:55:37.562 the way that you're evaluating risk is

NOTE Confidence: 0.75973713

00:55:37.562 --> 00:55:39.239 not appropriate the environment you have.

NOTE Confidence: 0.75973713

00:55:39.240 --> 00:55:40.563 I think one nice way to think

NOTE Confidence: 0.75973713

00:55:40.563 --> 00:55:42.524 about that is in terms of over

NOTE Confidence: 0.75973713

00:55:42.524 --> 00:55:43.198 generalizing representations.

NOTE Confidence: 0.75973713

00:55:43.200 --> 00:55:44.894 So with something again you see in

NOTE Confidence: 0.75973713

00:55:44.894 --> 00:55:46.345 depression which is I've shown you

NOTE Confidence: 0.75973713

00:55:46.345 --> 00:55:47.913 that this sort of infects states so

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00:55:47.967 --> 00:55:49.449 if you think that something nasty

NOTE Confidence: 0.707357337333333

00:55:49.449 --> 00:55:51.214 might happen then the value of that

NOTE Confidence: 0.707357337333333

00:55:51.214 --> 00:55:52.762 state gets associated with the nastiest

NOTE Confidence: 0.707357337333333

00:55:52.762 --> 00:55:54.158 thing that can possibly happen.

NOTE Confidence: 0.707357337333333

00:55:54.160 --> 00:55:55.815 So if you over generalize

NOTE Confidence: 0.707357337333333

00:55:55.815 --> 00:55:56.477 your representations,

NOTE Confidence: 0.707357337333333

00:55:56.480 --> 00:55:58.090 you're putting nice States and

NOTE Confidence: 0.707357337333333

00:55:58.090 --> 00:55:59.700 nasty states together and therefore

NOTE Confidence: 0.707357337333333

00:55:59.748 --> 00:56:01.554 the value of the nasty states over

NOTE Confidence: 0.707357337333333

00:56:01.554 --> 00:56:03.168 infects the values of the nice

NOTE Confidence: 0.707357337333333

00:56:03.168 --> 00:56:04.478 states you could possibly have.

NOTE Confidence: 0.707357337333333

00:56:04.480 --> 00:56:06.027 So lots of things to investigate in

NOTE Confidence: 0.707357337333333

00:56:06.027 --> 00:56:08.459 in in in risk in the in the future

NOTE Confidence: 0.707357337333333

00:56:08.459 --> 00:56:09.603 using hopefully these different

NOTE Confidence: 0.707357337333333

00:56:09.660 --> 00:56:11.320 aspects of sequential evaluation.

NOTE Confidence: 0.707357337333333

00:56:11.320 --> 00:56:14.000 So thank you very much.