# Prelude

[*Our characters, Achilles and the Tortoise, run into each other at the park late one evening.*]

*Achilles:* Hello, Mr. T!

*Tortoise:* Greetings, Achilles. What a splendid evening it is!

*Achilles:* I agree, and I've been cooped up all day. What do you say to playing ball for a few minutes?

*Tortoise:* You know how hard it is for me to catch and throw, Achilles! How about we play cards instead? We'd exercise our minds and see the sunset over the pond.

*Achilles:* I always mix up the rules to cards, Mr. T. Do you have any other proposals?

*Tortoise:* Hmm… each option has its merits and also some drawbacks. Why don't we try to list them out and see whether playing cards or playing ball comes out on top?

*Achilles:* That's a wonderful idea!

*Tortoise:* All right. I'll consider cards, which leaves thinking about playing ball for you.

*Achilles:* That sounds good to me. Let's meet up again in half an hour.

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*Tortoise:* Hello, again. Do you have the merits and drawbacks of playing ball prepared?

*Achilles:* I do! Would you like to hear them?

*Tortoise:* Certainly. Go on.

*Achilles:* Playing ball is good because we'll get to talk with each other, because it's exercise, because --

*Tortoise:* Wait a minute, Achilles! Sorry to interrupt, but why is talking with each other or getting exercise good?

*Achilles:* I never thought of it that way. I suppose getting exercise is good because it makes us healthier, and talking with each other is good because it's fun to catch up.

*Tortoise:* Then why is being healthy good?

*Achilles:* I suppose it will make us live longer.

*Tortoise:* And why is living longer good?

*Achilles:* I see the game you're playing! Living longer is good because it means more time to enjoy ourselves, and more time to enjoy ourselves is more time to be happy, and more time to be happy means we'll be happier for longer! I don't know if I can go any further than that, Mr. T.

*Tortoise:* That's an excellent analysis, Achilles, but are there other reasons getting exercise is good?

*Achilles*: I suppose by exercising today I'll also be peppier tomorrow, which means I'll be nicer to my friends, which will make them happier.

*Tortoise:* Do you think that every reason for playing ball will boil down to making people happy?

*Achilles:* That's a hard question. It seems to depend on whether we can distill happiness further, but I can't see what would compose happiness.

*Tortoise:* Until we figure that out, would you like to hear my reasons for playing cards?

*Achilles:* Absolutely!

*Tortoise:* I was going to say that we'd have time to play at all before it was dark if we started playing cards immediately.

*Achilles:* Oh my goodness, you're right, Mr. T! It's too dark for us to play cards or ball now.

*Tortoise:* Alas, maybe we should have begun by agreeing to think for only a few minutes so that we could play at all. Nonetheless, this conversation with you still made me very happy.

*Achilles:* You're too kind, Mr. T. I guess it's good night and until next time!

*Tortoise:* Good night, Achilles.

# Chorus

Life requires constant decisions. Some are trivial, such as whether to eat a plate of food you prepared for breakfast. There's a chance it's poisoned, but it's a chance that's safe to ignore. Other decisions are clearly wrong. After losing in a match of chess, it's easy to discard the idea of engaging with the winner in a fistfight. Decisions that are important and hard to resolve are the most interesting. For them, we need an Action Algorithm.

As illustrated by the dialogue, there are many ways to decide. All of them share, at their core, a way of listing what is good and what is bad about taking the action. For Achilles and the Tortoise, playing cards had the pro of intellectual stimulation and the con of Achilles fumbling with the rules. The Tortoise's approach went beyond a pure pros-versus-cons list, though. The Tortoise wanted to know why the consequences of the action were good or bad.

When the Tortoise asked Achilles, "Why," enough times, Achilles arrived at the same answer twice: it makes him or others happy. I will leave it to you, the reader, to decide what metric you want to use; in effect, as Achilles said, how you want to "distill happiness further." In lieu of a concrete ruler by which to measure repercussions of decisions, let the word metric denote whatever distillation of happiness you desire.

Now we have almost all the tools necessary to make decisions: listing to predict consequences and a metric to judge them. There's just one problem left to solve. Achilles and the Tortoise were less than halfway through applying their Action Algorithm when they realized that they had debated their choices for so long that it had gotten dark, and they wouldn't be able to play ball or cards anymore. A zeroth step, deciding how long to apply the algorithm, will complete it.

As you'll soon see, however, there are many pitfalls to this zeroth step. Before finding a duration ourselves, let's observe Achilles and the Tortoise using an incomplete Action Algorithm.

# Theme

[*Achilles and the Tortoise meet at a diner the next morning.*]

*Achilles:* It's great to see you again, Mr. T! I thought all night long about decision-making procedures.

*Tortoise, after a few seconds:* … as did I …

*Achilles:* I'm terribly hungry, Mr. T. Would you like to take a seat and continue our conversation there?

*Tortoise, after a slightly longer pause:* … yes, I would like to sit down …

*Achilles:* Mr. T, are you all right? Your face becomes slack before every time you speak.

*Tortoise, after a full minute:* … I'm only applying the same algorithm we explored yesterday at the park …

*Achilles:* But Mr. T, you can't always use the algorithm! Talking doesn't need endless analysis, at least not when you're talking to me. Life would be frightfully boring if everyone considered every word they spoke.

*Tortoise, after another minute-long pause:* … you're right, Achilles. I need to have some things that I know aren't worth considering.

*Achilles:* That's the spirit!

*Tortoise:* And I suppose I forgot in my stupor to say happy birthday, Achilles!

*Achilles:* Thank you! I'm excited for the party later this afternoon. Oh, and look! The waiter is coming.

*Waiter:* Howdy! What can I do for you two?

*Achilles:* I'd love to have an omelet with two pancakes on the side.

*Waiter:* And what about you, sir?

*Tortoise, after staring blankly for half a minute:* … I'd like the same, please.

*Waiter:* Thank you, gentlemen. I'll bring your food right out.

*Achilles:* Mr. T! You can't just disappear while you consider your options!

*Tortoise:* I could feel that I was taking too long to decide after a few seconds, but if I had applied the Action Algorithm again to find a more accurate duration, it would have taken even longer!

*Achilles:* Thinking about this makes my brain hurt. Why does the Action Algorithm need to solve every problem? Maybe we're asking too much of it.

*Tortoise:* Achilles, that's just it! I've figured out the conundrum. Instead of using the same Action Algorithm for every decision, we should use shorter ones for simpler decisions and longer ones for harder decisions.

*Achilles:* Don't tell me you're going to use another Action Algorithm to figure out whether a decision is easy or hard.

*Tortoise:* Not at all, my friend. I plan to use life experience.

*Achilles:* What's that?

*Tortoise:* Life experience is what you used to make decisions before we discovered our decision procedure. It already knows that chatting and ordering food don't warrant too much thought.

*Achilles:* That's genius, Mr. T! What exactly do you propose?

*Tortoise:* Let's use two steps. First we'll use life experience to determine how long to think. Then we'll use the Action Algorithm for that duration, which will tell us whether or not to take the action.

*Achilles:* That sounds great to me! Why don't we take it for a spin?

*Tortoise:* All right… Achilles, do you see that large oak tree outside the window?

*Achilles:* I do.

*Tortoise:* Would you climb it?

*Achilles:* Hmm, life experience tells me that climbing trees is sometimes dangerous and doesn't usually come with prizes. I'd better spend only a few seconds listing… oh! It occurs to me that you might have been planning that question for a while because of today being my birthday. But wait, why would you plan something dangerous for my birthday? I don't think it's a birthday surprise anymore, which means climbing the tree is just dangerous. I should start on my metric now… falling would mean breaking my arm, which would put me in the hospital, which would surely be bad for my happiness. I'd better not climb the tree, Mr. T.

*Tortoise:* That was superb! I see you decided to use happiness as your metric, and you gave a reasoned analysis that took fewer than fifteen seconds. I think we're on to something, Achilles.

*Achilles:* Yes, your idea to use life experience was brilliant! Oh, and look, the food is here.

*Waiter:* Here you are: an omelet with a side of two pancakes, doubled. Enjoy yourselves!

*Tortoise:* We will, thank you.

*Achilles:* Before we eat, let's make a toast to our new decision procedure.

*Together:* To the Action Algorithm!

# Chorus

Think of the Action Algorithm as a machine with a knob that represents how long it will run. When the knob is cranked to the lowest setting, the machine spends only a tenth of a second listing and using the metric, and it returns gibberish. When the knob is cranked to the highest setting, it runs for a whole year, finally returning a thoughtful answer. Too little time makes the machine malfunction, but it didn't need an entire year either. Choosing a good duration is finding the right level for the knob: the machine needs just enough time to get the best answer and no more. How does one find such a duration, remembering all the while that every second spent searching could have been spent on the Action Algorithm itself?

In light of the dialogue, many ways of finding such durations don't work. There are two specific traps to avoid when searching for a duration.

The Tortoise illustrated the first when he used the Action Algorithm to decide his words in a conversation with Achilles, taking far too long to respond. Certain decisions are unimportant or simple to resolve, and applying the Action Algorithm to them is a waste of time. As Achilles said, "you can't always use the algorithm!" There is a gray area between decisions that must be made by gut intuition and decisions that need systematic deliberation. Assuming the decision at hand requires the Action Algorithm, there is one more trap that needs careful treatment.

When the Tortoise ordered food, he might have thought, "finding a duration is a choice, the Action Algorithm solves choices, and therefore the Action Algorithm can find a duration." The Tortoise soon realized, however, that had he "applied the Action Algorithm again to find a more accurate duration, it would have taken even longer!" Algorithms that reference themselves are aptly called self-referencing. Such algorithms are powerful, but they also need a place to stop. Imagine using the Tortoise's self-referencing technique with no cutoff point. You apply the Action Algorithm to find the duration, but how long should this new Action Algorithm run? Easy, use another doubly new Action Algorithm. This new new Action Algorithm needs a duration of its own, though, and soon you find yourself spiraling to infinity.

The second trap can become boon if used properly. Because of the infinite options for when to stop the self-referencing, there are endless ways to find a duration. The Tortoise thought of the simplest in the dialogue, namely to forgo self-reference entirely. Given that the perfect amount of time changes for each decision, allocating five seconds or three minutes to each will overshoot for simple decisions and undershoot for complex ones. The duration needs to depend on the complexity and importance of the decision.

Here, the Tortoise chose life experience. While imperfect, its most compelling feature is that it can be refined. If life experience at some point dictated spending thirty seconds on a decision, but by the end it was clear that ten seconds would have been enough, life experience could be updated to be more accurate in the future. Choose whatever you find works best, be it life experience or anything else. Then, imitate the Tortoise by using no self-reference, or experiment with varying degrees of it.

Find a duration while avoiding the two traps, list out the relevant consequences, and judge the results with your metric. Armed with the Action Algorithm, go forth and weigh the decisions that are life.