Weather forecasting as practiced by humans is an example of having to make judgments in the presence of uncertainty. Many human forecasters use approaches based on the science of meteorology to deal with the many challenges they face when forecasting the weather (Doswell, 2004). Probability based forecasting is provided to users as a way of making a decision according to their needs. Many studies have indicated that there was a lack of agreement among the general public and even the weather forecasters themselves on what the probability of a weather event is, showing a variety of interpretations of a statement like this, “70% chance of showers tomorrow” (Elía & Laprise, 2005). Since many people have varying opinions on what the probability of a chance of rain is, they may make different choices regarding their day, like whether to bring out an umbrella, or to go out and have fun for the day.

Most people base their beliefs on what a “chance” of rain actually means on a few different things, that being how long it rains for, how much of an area it will cover, or how many days it will cover. If there was a forecast for a 30% chance of rain, some people might think “It will rain for 30% of the day tomorrow”, others might think the rain will cover 30% if the region that they live in, and lastly others might think “It will rain on 30% of days like tomorrow” (Gigerenzer et al., 2005). So it is difficult to pinpoint one general way that humans reason about weather forecasting, as many of us have different opinions and beliefs about what those probabilities really mean. If we were to generalize it, it would use the National Weather Service’s definition of what the PoP (Probability of Precipitation) is: the likelihood of occurrence (expressed as a percentage) of a measurable amount of liquid precipitation during a specified period of time at any given point in the forecast area (National Weather Service, n.d.). Basically, a 30% chance of rain tomorrow really means at least some amount of rain will fall the next day in 3 out of 10 cases at some point in the forecast area. With just saying 30% chance of rain, it implies to the general public that there is only a possibility that it will rain tomorrow, where with the time and region definitions, which is the true definition, forecasters mean that it will rain tomorrow for certain in a given place (Gigerenzer et al., 2005).

When looking more specifically at how reasoning and understanding probabilities in humans and as it relates to our project, one study found that humans often analyze things in terms of one or a few samples of different outcomes (Vul et al., 2014). This very idea counteracts some standard assumptions when thinking about optimality. Rather than considering the full distribution, people appear often to make decisions based on a posterior probability distribution, which is the revised probability of an event occurring after taking new information into account (Vul et al., 2014; Hayes, 2020). This means that for example when trying to decide if it might be a good day to go on a picnic like in our project, a person might think of several scenarios based on the weather forecast.

However an important question to ask is, how many samples should one consider in order to optimize their worst or best case reward over several different decisions? The study found that making many quick, but possibly suboptimal decisions based on a few samples over a long period of time is the most optimal strategy (Vul et al., 2014). In particular, the research found when looking at 2, 4, 8, 16, and 32 different discrete alternatives for unidimensional continuous choices, that a decision based on a very small set of samples is about the same as a decision on a full probability distribution (Vul et al., 2014). They also discovered that when the stakes are higher for a given problem, more sample alternatives should be considered (Vul et al., 2014). For our project, coming up with some weighting scheme of the most important weather conditions to a person on a given day should be implemented in the model. Asking the user what they are most comfortable with could also play a role in weighting various different decisions within our model world.

But exactly how much is a person coming up with several sample scenarios going to cost? That is something that needs to be defined for the task at hand. Usually time and effort is an important factor. Another key idea here to keep in mind is that oftentimes human decisions are continuous. These sample scenarios that are brought up in a person's mind might not always have one exact clear answer. Yet, the decisions we make based on the weather can often be very binary. This is why it is imperative that a strategy with the general idea of assessing, "is this going to put me closer to the optimal answer?" is used (Vul et al., 2014). Again, when looking at what our group is trying to model, this could be a very beneficial approach to try to determine the ultimate goal, deciding whether or not it is a good day to have a picnic.

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*Key Takeaways:*

- It is very difficult for the general public to understand weather information, especially percentages and probabilities
- Reasoning probabilities often involves humans thinking about just a few separate sample scenarios instead of considering the whole probability distribution
- Taking a weighted scenario based approach seems best
- Consider what is most important to the user
- Keep in mind that decisions involving probabilities are often continuous, but dealing with weather based decisions are mostly binary (for example, should class be cancelled because of the snow?) which can present several challenges
    - But, perhaps weighting the magnitude of the decision and considering more scenarios, might help for our project