Cold open:

Can remembering names be thought of as a PM task:

Jerry forgets girlfriend’s name: <https://www.youtube.com/watch?v=-LW0RikQ3mc>

Introduction

* Why does it matter?
  + “… this is what I’m talking about and this is why it’s interesting.”
* Explain PM cost
  + What is it?
  + How do we measure it?
    - Behaviorally
    - Neurally
  + Why does it matter?
* Is it possible to have monitoring without maintenance or maintenance without monitoring?

Hypotheses:

* Cost of both can be measured behaviorally with PM cost
* Higher PM cost with maintenance and monitoring compared to just monitoring

PM cost is useful for predicting errors. Because of this we wanted to tease apart PM cost for just maintaining and just monitoring before looking at them together. Following this train of thought, we were able to see if maintenance or monitoring on their own were useful for predicting performance or if it was the combination of the two that was necessary for prediction.

Methods

* Task design
  + Baseline
  + Maintenance
  + Monitoring
  + M&M

Results

* How do I compute PM cost here?
* Does maintenance cost predict combined performance?
* Does monitoring cost predict combined performance?
* Additive PM cost

What is driving performance???

***Analysis I still need to do:***

* By trial relationship between costs and performance
* Look into cost difference Seth mentioned in channel
  + How do eye movements explain some of the differences between maintenance and monitoring?

Up until this point, maintenance and monitoring have not necessarily been thought as individual, possibly dissociable processes. They are both understood to be part of the proactive component of prospective memory but the roles they play are not well understood.

Introduction

Forty-three people participated in the experiment. Two were removed because one didn’t have a PM cost as they didn’t always answer and one didn’t follow the instructions correctly so their input was not recorded correctly. This puts our n for analysis at 41. No one else was removed because I believe that part of the relationships I was looking at were driven by working memory capacity so if we removed the low performers, we would lose the data about how the processes of maintenance and monitoring might work in these low performers or conversely high performers.

**N = 41**

**Procedure**

Why a non-focal PM task?

In non-focal PM tasks, participants have to switch between the ongoing task and monitoring for the PM target. Because we really wanted to look at monitoring, we wanted to make sure that we made participants monitor as much as possible in the monitoring block and then make sure the task was similar in the other blocks in order to compare the blocks with one another.

What is prospective memory?

Proactive vs reactive control

Maintenance vs monitoring

PM cost

How did we calculate PM cost?

PM cost is a behavioral metric that looks at how much extra ‘effort’ but be exerted to complete the task at hand or the cost that comes in the form of reaction time. If a task has a higher ‘cost’, then it hypothetically should take you longer to do.

For Monitain, we calculated PM cost by subject by first finding what their baseline ‘cost’ was. This was the average RT for each trial in the baseline condition where they didn’t have any kind of PM goal to keep in mind. So now we have a value for each subject of their baseline cost. With this value we can then calculate a by trial PM cost for all of the other trials. For each trial, we look at the middle ongoing task probes, and take an average of the reaction time for the probes they answered correctly. Then the participant’s baseline cost value is subtracted from this average OG RT for the trial, giving us this trial’s PM cost. If the non-baseline RT is greater than the baseline RT, then we can assume it’s because of the extra cognitive effort that is required to maintain, monitor, or both in the combined block. On maintenance only trials, this will be referred to as maintenance cost. On monitoring only trials, this will be referred to as monitoring cost.

Slides:

* Break down PM cost – show graphic that is specific to word/non word

Questions I want to ask:

* Can intention decoding be broken into the:
  + WM **maintenance** of a goal
  + **Monitoring** for goal relevant information
* How do these two components of working memory impact prospective memory costs?

More broadly, I desired to find out if there is a difference between maintenance and monitoring. If so, is it possible to disentangle the two are or they just two ways of defining the same thing?

1. Is there a difference between maintenance and monitoring?
   1. Yes!
   2. This is most obviously shown in the differences they have on PM cost and combined accuracy.
2. How do each affect PM cost?
   1. Maintenance does not seem to be captured by PM cost.
   2. Monitoring doesn’t seem to explain all of PM cost, but definitely more than maintenance does. From here, I believe that there is something else at play that when combined with monitoring can better explain PM performance.

One of the original questions I wanted to ask was how does the PM cost for maintenance and monitoring combined compare to the cost for just maintenance or just monitoring. My original hypothesis was that there will be a higher PM cost for maintenance AND monitoring then when compared to just maintenance or just monitoring. I was able to answer this one really quickly.

Figures:

* Maintenance cost vs monitoring cost vs maintenance + monitoring cost vs MnM cost
* Maintenance cost + Monitoring vs MnM cost by subject

I started off thinking about this as a ‘linear’ or additive issue of this plus this equals this. However, while it appears that this kind of explains this, I believe that it’s just incidental because when you tease a part the two, things get more fuzzy.

Something Seth has hit on that I am even more convinced of now is that PM cost, when calculated as task with PM RT – task without PM (baseline) RT, is not the most accurate measure of prospective memory costs. I think part of this comes from the fact that this supports the idea that effects or components are additive. For example, if maintenance and monitoring effect PM cost, adding maintenance cost to monitoring cost should give us a measure close to PM cost. Then if there is “more” monitoring which leads to greater monitoring cost, then we have more PM cost. However, we’re not seeing this. I don’t believe that is simply a linear relationship that as you monitor or maintain more, you have a greater PM cost. Thus, it cannot be accurately reflected by just looking at PM cost.

So what else do I feel like needs to be done?

Well, first off, I think some other measure needs to be calculated to look at the cost of prospective memory other than what we know of as PM cost, or the reaction time cost. This seems to get at monitoring, kinda, but doesn’t capture maintenance at all. Maintenance almost appears to be a parallel process, happening along side monitoring but not necessarily affecting it, or resulting in this plus that equals what we’re looking for. Currently, we have fMRI which does a pretty good job at looking at maintenance at a neuroimaging level but behaviorally, I’m not sure what the answer is.

I believe that there are two possible ways we could further amplify maintenance and monitoring separately.

1. Make the maintenance block a different task so that it is a focal task. This would make it so that we could not directly compare it to the monitoring block. In this case we would need a focal maintenance and focal MnM block and then a nonfocal monitoring block and a nonfocal MnM block. We wouldn’t be able to compare maintenance to monitoring as much but we could compare maintenance on its own to regular PM and monitoring on its own to regular PM.
2. Add an unrelated block that purely looks at shifting to try to tease out shifting and how that relates to monitoring and overall performance. This could also be related back to maintenance to see how shifting influences maintenance of the PM intention.

As far as how we can break down PM cost, I don’t think maintenance plus monitoring is the answer. I think monitoring is a big part and to get at some of the other factors that sit alongside it, I would be interested in looking into the literature on task switching. In a 2016 paper from Sascha Zuber and others at the University of Geneva, it appears that focal and nonfocal PM tasks can be seen as two distinct but related constructs. I think the findings from this could really get at something we could try. For example, they found that shifting was significantly correlated with nonfocal PM performance but not with focal PM performance. Shifting is the ability to disengage from one strategy or task and engage in another (Zuber et al., 2016). Remember, the big difference between nonfocal and focal is the increased need for monitoring in nonfocal. Because of this, I think if we should look more at individual shifting costs and see how that correlates with performance. Are those that are better at shifting better at PM tasks?

The Zuber paper had two tasks designed to measure shifting. The first task was a shifting task adopted from Koch and Allport (2006) called the number-switch task. In the magnitude judgment portion, participants were presented with digits between 1 and 9, not including 9 and then were asked to answer, as quickly as possible, if the digit currently presented was less than or greater than 5. In the parity judgment portion, participants had to answer if the digit was even or odd. They did the magnitude judgment for a series of trials and then the parity judgment for a separate series of trials. Then there was a series of trials were both types of judgment could be assessed and randomly varied between trials.

The second task was a perceptual-switch task where letters were presented in gray or red. For a capitalization judgment, participants had to decide if the letter presented was a lower case or uppercase letter. For a color judgment, they had to decide if the color was gray or red. The two were assessed separately and then mixed together, similar to the first task.

Switching cost was found by subtracting mean RT in switch trials from mean RT in non-switch trials. The slippery slope with this, is this is the same idea as PM cost, which is something we may be wanting to move away from. However, I think the ability to switch combined with an the ability to monitor may give us a cleared picture of what factors go into prospective memory costs.