Checklist Registered Report

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Adult-Age Differences in Remembering Gain- and Loss-Related Intentions: A Motivational Perspective

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"Ten Questions to Build the Engine of a Stage 1 Registered Report"

1. **What is the main question being addressed in your study? Why is it important to answer that question? What is the big picture?**
    - *Lifespan motivational research indicates that motivational orientation shifts across adulthood from a predominant orientation of promoting gains in younger adulthood towards an increased importance of maintenance and loss avoidance in middle and older adulthood. Based on this theorizing and on a motivated-cognition perspective (which holds that motivational orientation guides perception, attention, and higher-order cognitive processes), we assume that motivational orientation impacts memory systematically. We investigate whether the relative impact of negative over positive information on adults' remembering increases with age.*
    - *In the proposed study, we focus on people's memory for intended actions (prospective memory; PM) because motivation is assumed to play a central role in PM. PM always involves the formation and retrieval of an intention as part of a goal-directed, declarative plan. However, the role of motivational influence on PM is hardly understood so far.*
    - *Our central thesis is that there are systematic age differences in PM for gain-related and loss-related intentions. The proposed study addresses the following key question: With increasing age, are intentions associated with prevention of loss better remembered than intentions associated with promotion of gains?*
    - *The planned study allows us to better understand the cognition-motivation interplay in the domain of PM. It will conceptually drive the field forward by synthesizing separated perspectives from cognitive, motivational, and aging*

research. The research findings may also help to design instructional interventions to improve PM.

2. **Describe the key independent and dependent variables, specifying how they will be measured. Ensure that they are defined precisely.**
    - *Our planned laboratory study includes two key independent variables: (a) participants' chronological age and (b) instructional framing condition: To induce performance-contingent gains and losses, participants in the gain-frame condition will be informed that they could earn up to a certain amount of x CHF, contingent on the proportion of PM targets they would respond to correctly. Participants in the loss-frame condition will be initially endowed with a certain amount of x CHF, from which losses can be deducted. Participants in this condition will be informed that they can maintain this starting amount, but that they would lose up to x CHF, contingent on the proportion of PM targets they would miss (PM misses). In addition, a control group will not experience any performance contingent consequences.*
    - *The main dependent variables are event-based PM performance (PM accuracy, defined as the proportion of correct PM responses to target events) and ongoing-task performance (accuracy and response time in an ongoing lexical-decision task).*
3. **What are your hypotheses? Ensure that your predictions are defined precisely in terms of the specific IVs and DVs.**
    - *Regarding PM performance, we expect relative advantage for gain-related over loss-related framing in younger adults and a relative advantage for loss-related over gain-related framing in older adults. We thus hypothesize motivational valence × age interactions (H1). We further hypothesize age-related differences in PM performance: older adults in an event-based laboratory PM tasks are expected to show lower PM performance than younger adults (H2). Notably, this also implies that adult-age differences in PM are smaller for loss- than gain-related intentions (H3). Finally, we expect that PM will be higher in groups with performance-contingent payoffs than in a control group in which payoffs are not tied to performance (H4).*

- *Regarding ongoing-task performance, we expect age-related slowing (H5): older adults respond slower in an ongoing task (lexical-decision task) than younger adults.*

4. **How many and which conditions will participants/samples be assigned to? Where applicable be sure to include details of randomisation, blinding and counterbalancing. Make it clear whether the design is within-subjects, between-subjects, mixed, or other.**
    - *The design includes the between-subject factor instructional framing group (gain/loss/control) and participants' chronological age as continuous predictor variable. Participants will be randomly assigned to each of the framing groups with equal probability. The PM task will be a so-called nonfocal PM task (in which PM target events are defined as specific letters that occur on words and nonwords of a lexical decision task as ongoing activity.)*
5. **How many observations will be collected and what rule will you use to terminate data collection? Ensure that your stopping rule takes into account any data exclusions. If adopting null hypothesis significance testing, what power will your study achieve? What effect size will you target and why? Remember that you are choosing the smallest effect size of theoretical or applied interest, or the smallest you can feasibly detect. For an actual RR you can use pilot data to help motivate this estimate, but you shouldn't rely on pilot data alone because it is vulnerable to bias.**
    - *We aim at detecting medium-sized effects in PM performance (the main dependent variable) with a statistical power of at least 0.90. Specifically, to detect effects of size r = .25 of the predictor variables (and their interactions) in the regression model with an alpha level of .05, we plan to collect data from N = 180 participants. These estimates of the required total sample size of the planned study are based on power analyses with G*Power3 (Faul et al., 2007).*
    - *Slightly larger effects sizes have been reported the meta analyses about age differences in the type of laboratory PM tasks that we plan to implement in the current study (Cohen ds ranging from d = .72 to 1.13); moreover, the available PM literature using incentive paradigms (similar to the proposed design; Cook et al., 2015; Cohen d = .80) also reports slightly larger effect sizes than the ones we can detect in the planned design with a power of .90.*

- *If a participant's data cannot be used for analysis (see below for exclusion criteria), their data will be replaced (before hypothesis testing) by collecting data from a further participant to achieve the planned sample size (see below for exclusion criteria).*

6. **What are your study inclusion criteria? How will participants/samples be recruited/included and under what specific rules?**
    - *Participants must be native speakers of German with no cognitive impairments (e.g., dementia or stroke). Participants must be older than 18 years and we will collect equally large samples of younger (18-35 years), middle-aged (36-65 years), and older adults (66-85 years). We will collect data from community-dwelling older adults, younger adults, and students, through campus recruitment, and databases. Participants will receive credit points or a flat fee for participation plus a performance-contingent bonus.*
7. **What are your data exclusion criteria? State rules for excluding data both at the level of samples/participants (within groups) and at the level of raw data (within samples/participants), e.g. conditions involving data quality, completeness and outliers. Remember to be comprehensive: exclusion criteria are very difficult to change after data collection has commenced because doing so risks introducing bias. Think about previous experiments you have done and all the reasons you have ever thrown out a data set or data point.**
    - *We exclude data from participants who perform (a) at chance level in the ongoing task (if ongoing-task accuracy, averaged across trials, is statistically indistinguishable from chance). Moreover, we exclude participants (b) who never respond to any PM target event and additionally cannot indicate in a post-task instructional check the PM key they were asked to press (upon target encounter). In addition, we exclude single ongoing-task trials from data analysis with extreme response times (i.e., trials with RTs more or less than 2.5 SDs from an individual's mean in a condition or fast guesses lower than 200ms). These exclusion criteria are common in PM research to ensure that participants are adequately engaged in an ongoing activity and that PM failure is not simply attributable to forgetting the required action or the PM instructions.*
8. **What positive controls or quality checks will confirm that the obtained results are able to provide a fair test of the stated hypothesis? (A positive control tests the**

existence of phenomena that would confirm that the IV, DV or instrumentation was used correctly and is therefore capable of testing the main study predictions. … Where a positive control isn't possible, think of what quality checks or verifications you would build into your design before results are known to convince a skeptic that you had conducted the experiment to a sufficient standard (e.g. noise within certain limits etc.). Make sure these are independent of your main hypothesis tests. Where a positive control (e.g. manipulation check) or quality check (e.g. lack of floor or ceiling effects in data) requires a statistical test, ensure that the test is adequately powered or sampled.

- *First, we will include an additional control group in our design in which participants will not experience any external gain- or loss-related consequences (i.e., the standard situation in many previous cognitive PM experiments, in which only a fixed reimbursement was provided). This will allow us to evaluate baseline PM performance and to contrast people's intrinsic motivation to remember PM tasks across the lifespan with conditions in which external monetary consequences occur. Second, the analysis of ongoing-task performance will allow us to check whether participants perform the tasks with sufficient accuracy (whether their performance is significantly above chance; the power for this check is sufficiently large, > .90, in each group). Third, we will test whether PM performance is significantly above floor (>10% accuracy) and below ceiling level (<90% accuracy). We will only test our hypotheses and make further conclusions if these checks are passed.*

9. **Specify exactly which analyses you will conduct to examine the main questions/hypotheses. Ensure that there is an exact correspondence between each scientific hypothesis and each statistical test. (Failure to precisely specify these links is one of the main reasons RRs are rejected.) … In the event of a negative result, would you be happy to conclude that there "was no evidence of a difference" between conditions, or would you instead want to be able to make the stronger claim that "there is evidence of no difference between conditions"? The first inference is limited to absence of evidence while the second (stronger) one refers to evidence of absence. If you want to make the stronger inference, you will need Bayesian inferential methods or frequentist equivalence testing.**

- *Following the experimental design in our study, we test our hypotheses regarding PM and ongoing performance in the following way: We will test our hypotheses in the following way: Regarding PM performance (proportion of correct PM responses on target events) as dependent criterion variable, we will specify a linear multiple regression model with motivational valence (gain, loss, control) as effect-coded predictor and age as mean-centered continuous predictor. The corresponding regression weights can then be evaluated with standard t-tests: To test hypothesis H1, the valence × age interaction in the regression model is examined; in case of a significant interaction ($p < .05$), follow-up tests within each age group will be used to examine whether gains have a relative advantage over losses or vice versa. Hypothesis H2 is supported if the main effect of age in the model is significant. Hypothesis H3 can be tested by examining effects of age separately for gain and loss conditions. Finally, a planned contrast between both treatment groups and the control group (as reference category) can test hypothesis H4. Regarding ongoing-task performance, we will specify a linear multiple regression model with participants' median response time (aggregated across trials of each person) as dependent criterion variable. Again, motivational valence (gain, loss, control) and age will be entered as categorical and continuous predictors, respectively. If there is age-related slowing in ongoing-task performance (hypothesis H5), then the main effect of age in the regression model must be significant.*

10. Are you proposing to collect new data or analyze existing data? If the proposal involves existing data, what steps will you take to ensure that your analysis plan isn't biased by any prior observation you have had of the data?

- *We plan to collect new data in the event-based PM paradigm in a controlled laboratory setting after in principle acceptance of the project. A laboratory setting helps to make sure that participants understand the instructions (particularly older participants may need help to understand task instructions, and may benefit greatly from the presence of a research assistant who can answer their questions) and to verify demographic participant characteristics.*