The role of coping, relaxation, and age on stress and task performance with new technology

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K. Dijkstra, N. Charness, R. Yordon, J. Price, The role of coping, relaxation, and age on stress and task performance with new technology. Gerontechnology 2015;13(4):388-395; doi:10.4017/gt.2015.13.4.003.00 **Background** This study examined the efficacy of coping and relaxation interventions on learning technology-driven tasks in younger and older adults. Both interventions were assumed to reduce levels of stress, particularly in older adults and to improve performance on a challenging task involving new technology relative to a control task. Moreover, older adults were expected to benefit relatively more from these interventions. **Method** 119 Younger and 108 older adults participated in the study. They were randomly assigned to one of four conditions: relaxation only, coping only, both relaxation and coping, and a control condition. They performed two tasks with a novel technology, either PDA or webcam device on day 1 and two tasks with the other device on day 2. The order of tasks and devices was counterbalanced. Physiological and subjective stress levels were assessed at different points in time: before, during, and after the task. Performance was measured as the percentage of steps completed during a task and the amount of help needed from the experimenter during the task. **Results and discussion** The results indicated that particularly the coping intervention helped to reduce physiological and subjective indicators of stress. Benefits for performance occurred for the interventions involving relaxation for some of the tasks. Older adults needed less help with webcam tasks in the combined coping/relaxation intervention than younger adults. These findings provide insight into techniques that optimize learning conditions for complex tasks involving new technology.

Keywords: ageing, technology, stress, relaxation, coping

Older adults are taking greater advantage of technological advances in and outside the workplace[1-4]. The majority of those advances have already been incorporated in daily and work-related tasks. Word processing, data compilation, and retrieving information from the Internet typically involve the use of desktop or laptop computers. Handheld devices such as tablets and smart phones have become common devices for scheduling appointments and storing contact information, and increasingly, for accessing the Internet. However, the use of these electronic devices is not generally accepted among older adults[3]. Moreover, conditions for learning how to use these novel technologies are generally unfavorable for older adults[5].

One reason for these unfavorable conditions may be that older adults did not grow up with these novel technologies, and as adults, did not interact with them in their work environment. Computers, PDA's and webcams were not around when they were young, nor were these devices an essential component of their work or leisure time activities. Another reason why learning new technology for older adults is difficult is that they tend to have lower self-efficacy regarding their ability to deal with new technology and a slower pace of learning[2,6].

Technology use and stress

Uncertainty during a first encounter with new technology may be expressed in the form of stress. Acute psychological stress encompasses the negative cognitive and emotional states that occur when a demand placed upon a person is perceived as exceeding the ability to cope with the situation[7]. Elevated levels of psychosocial stress negatively affect performance on cognitive tasks[7-9]. The underlying mechanism for performance impairments due to stress is that acute stress impedes the necessary allocation of cognitive resources to a complex task. Insufficient cognitive resources may lead to slower and less accurate task performance[10].

If age-related changes in cognitive abilities, such as declines in processing speed and limited available cognitive resources to perform a complex task[11] already put older adults at a disadvantage for learning novel tasks, it can be expected that this disadvantage will be exacerbated if the task also involves new technology that induces a stress response. On top of that, older adults appear to deal differently with stress than younger adults. They seem more affected by stressors such as time constraints[12] and use different and possibly less effective coping strategies for the task than younger adults[13].

Specifically, older adults are more likely to use passive ways of coping, such as avoidance and denial, rather than active coping strategies[14]. Passive ways of coping are considered emotion-focused coping strategies, strategies in which one changes the feelings or attitude towards accomplishment or lack of accomplishment on a task. An example of an emotion-focused coping strategy is the attempt to control internal stress by reappraising aversive situations in a more positive manner. Other emotion-focused coping strategies are to avoid the stressful situation or to give up on a task that is perceived as difficult or impossible to complete.

Such coping strategies may be effective when dealing with age-related changes or circumstances over which one does not have control, such as declines in physical strength and serious illness, such as terminal cancer. They may, however, not be particularly useful in learning situations involving novel technology for which there is no easy substitute. Avoidance and denial coping strategies are not likely to be helpful in the mastery of these devices. Task-based coping strategies are more effective in such situations.

Problem-focused coping techniques deal with the part of the task that cannot be solved head-on and focus on finding different workable solutions for the problem at hand. A person who is having difficulty with a computer may read the manual, use a different order of steps than attempted previously, or ask an expert. Problem-focused coping may be a more effective coping method than emotion-focused coping when dealing with stress and performing a task involving new technology because there is a certain level of confidence that a solution can be generated eventually. The lack of control that is associated with emotion-focused coping strategies in a learning situation can be a risk factor for depression[15]. Results of a study on the effect of age on coping indicated that age as well as coping mediators, such as self-efficacy and perceived stress, affected whether emotion-focused or problem-focused coping strategies were used. Specifically, the use of problem-focused coping was predicted by self-efficacy and higher social support satisfaction whereas the use of emotion-focused coping was predicted by lower social support satisfaction and higher perceived stress[15].

These findings are relevant for predicting how a problem-focused intervention may affect stress levels and performance in younger and older adults when dealing with technology-driven tasks. Exposure to such an intervention in the form of a video explaining a task procedure with new technology step-by-step may help reduce stress levels among younger and older adults when having to perform a similar task with the same technology relative to a control condition.

Technology use and relaxation

Another factor that may be beneficial for performance on technology-driven tasks and that may reduce stress is relaxation. Beneficial effects of meditation and relaxation to reduce stress and improve performance have recently been demonstrated[16]. Meditation and relaxation may contribute to enhanced attentional capacities[16] and more effective consolidation of newly processed information in memory[17].

So far, positive effects of meditation have been demonstrated after extensive training in meditation techniques in meditation experts[18- 20]. However, benefits have also been shown after shorter training programs with novices[21] and after a single session with massage therapy[22]. We anticipated therefore beneficial effects of an even shorter relaxation procedure that would be administered prior to performing a potentially stressful task. This could reduce physiological and subjective levels of stress and anxiety, and help performance on technology-driven tasks.

The present study assessed the potential benefits of a relaxation intervention and the use of problem-focused coping strategies on task performance involving novel technology among younger and older adults, specifically PDA and webcam videoconferencing technology. The hypotheses were that the interventions would reduce stress levels, particularly in older adults, and the interventions would be associated with improvements in performance. There were no specific predictions about which intervention, relaxation or coping strategy modeling, would be most effective because no research as of yet has compared these interventions. Nor is it possible to predict whether the combination of the two interventions would be more effective than a single intervention.

Methods

Participants

There were 119Y (younger) (M=19.3, SD=2.16, range=17-37, 60% female, mean education level=4.1, SD=1.04, equivalent to some college) and 108O (older) participants (M=72.6, SD=7.27, range=60-92, 52% female, mean education level=6.0, SD=1.3, at least completed a bachelor's degree). They were recruited from student and community participant pools. None of the participants reported previous experiences with PDA (personal digital assistant) or webcam videoconferencing technologies.

Measures

The following self-report measures were used:
(i) PANAS. The positive and negative affect scale is a 20-item mood state measure that includes both a positive and negative scale[23]. Each item is rated on a 5-point scale from very slightly or not at all (1) to extremely (5) based on how the respondent felt during the defined time frame. Cronbach's alpha for various time reference points varies from 0.86 to 0.90 for positive affect and from 0.84 to 0.87 for negative affect[24]. Evidence for the validity of PANAS is based on correlations with general distress and dysfunction, depression, and state anxiety. Correlations for the current sample of PANAS positive and negative scales with State-Trait Anxiety Inventory – State scale (STAI-S: see below) were all significant.
(ii) STAI-S. The State-Trait Anxiety Inventory Questionnaire[24] makes a distinction between a general propensity to be anxious (trait anxiety) and a temporary state of anxiety (state anxiety). The latter was used here. There are 20 questions for each type of anxiety on 4-point Likert scales. Higher scores (range is 20-80) reflect higher anxiety. With regard to the validity of the STAI, traits scores were found to correlate (between 0.73 and 0.85) with the Anxiety Scale Questionnaire and with the Manifest Anxiety Scales[24]
(iii) NASA Task Load Index[25] is an index of perceived workload based on six items that address mental, physical, and temporal demands of a particular task. An estimation of performance level, effort, and frustration is provided as well on a scale from low to high on a horizontal line with 21 gradations. Validation studies have indicated that convergent validity is high based on correlations (>0.90) with other measures of task load (SWAT: Subjective Workload Assessment Technique and WP: Workload profile[26]).

Procedures

Following the securing of informed consent with an IRB-approved procedure, participants were given the CREATE pre-screen interview[27] over the phone to screen out individuals with mild to moderate cognitive impairment according to their score on the Short Portable Mental State Questionnaire (SPMSQ), low education level (less than 6th grade), problems with fluency in English, difficulty in writing, or severe vision or hearing impairment. All prospective participants passed this screening. After they qualified, participants took part in two sessions that were spaced a week apart and that lasted about 1.5 hours. In each session, participants were trained to complete two tasks (PDA: editing a contact & setting a recurring appointment; webcam: recording a short video & videoconferencing). They used a Dell Axim X30 PDA for the PDA task and a Microsoft LifeCamVX-3000 for the webcam task. Device use was counterbalanced across sessions.

Participants within each age group were randomly assigned to one of four different conditions, keeping age and gender similar across conditions. The first condition, control, was a no relaxation/no coping (28Y, 28O) condition. Participants learned to use novel technological devices without exposure to a relaxation or coping manipulation. The second condition, coping, involved just exposure to a coping without relaxation (18Y, 28O) condition. In the third condition (35Y, 29O), relaxation, (without coping), participants were exposed to a relaxation procedure at the beginning and end of the session but they did not receive a coping manipulation. The last condition involved exposure to both a relaxation + coping manipulation (38Y, 23O).

The (problem-focused) coping manipulation included exposure to two videos modeling a less-effective avoidance coping strategy when trying to perform a task with new technology first, followed by a more effective problem-focused coping strategy. This was coupled with an explanation of why one strategy would be better than the other to trouble-shoot problems during a task. Each video contained a scenario for one type of technology, webcam and PDA. The relaxation manipulation involved a 9-minute audio/video recording played in a dimmed testing room. During the first part, participants were guided through a deep breathing/centering exercise. This was followed by a second part that included a mental walk on a beach at sunset with accompanying sunset slides and an ocean background track. The procedure for the experiment is explained in more detail below.

Session 1

Pre-training. Upon entry into the lab, the participant was fitted with a Polar heart rate monitor (S610i model initially, later participants used the RS800 model) around the chest to measure heart rate in real time. To minimize data loss, heart rate data were collected with two devices. At baseline, participants' blood pressure and pulse were measured using an Omron HEM-780 blood pressure monitor. They then filled out STAI-S and PANAS questionnaires for baseline measures of state anxiety as well as positive and negative affect. Prior to receiving training in the problem-solving coping conditions, participants watched a video that presented a similar (but not identical) task to the one they were about to be trained on.

Training task 1. All participants took part in a training session consisting of a PowerPoint presentation that led the participant through the specific task that they were going to perform. As described above, there were four tasks distributed over two novel technologies: webcam and PDA. Participants were given 10 minutes (of which they had to spend at least 5 minutes) to go through the presentation for a particular task at their own pace and were instructed to ask the experimenter any questions they had about the task at hand (which were answered fully). Participants were allowed to move in any direction and repeat the presentation as many times as needed during the 10 minute time period. The goal was to generalize to technology use in real life where people can seek help in the form of manuals, tutorials, and other technical support resources. After the training phase for task 1, blood pressure and pulse were assessed.

Task 1. The experimenter kept track of participants' progress throughout the task with a checklist. Emulating typical problem solving situations with technology, participants were permitted to ask questions and this behavior was tracked. If the participant had a question during the task, the experimenter provided assistance in the following manner. First, a general cue was provided, then the cues became more explicit if more assistance was needed (for instance, general: what you are looking for is in this region of the deviceà specific: you are trying to do this à more specific: do this). Assistance was recorded on the checklist next to the step for which it was needed. After completion of the task, blood pressure, pulse, STAI-S and PANAS assessments were administered. In addition, participants completed the NASA-TLX to gauge the perceived mental, physical, and temporal demands on the task and effort; and frustration levels for the task. Participants in the coping conditions watched a second video showing an effective coping strategy to perform the task. A different scenario similar to the next task was presented in this video. The other participants proceeded with training task 2.

Training task 2. Training for task 2 was identical to that of the first task except that a different task with the same technology was trained. The procedure for task 2 was identical to that of task 1.

Session 2

The procedure for session 2, conducted on a different day, was identical to that of session 1, except that training and testing with another technology was done (if a PDA was used on day 1, then a webcam was used on day 2, and vice versa). Participants remained in the same control, relaxation, coping, or relaxation + coping conditions they were in during session 1. Participants received credit hours (younger adults) or payment (older adults) for their involvement in the study at the end of the session.

Statistical analyses

Repeated Measures ANOVA's were conducted based on the mixed design of the study that consisted of stress variables, interventions, and age group. The between factors were the type of intervention (control, coping, relaxation, and coping + relaxation) and age group (young versus old). The within factor was time (the stress variable measured before and after the task). Reported interactions were analyzed further with planned comparisons. Alpha level was set at 0.05.

Results

Stress levels

We predicted lower physiological stress levels when performing novel technology tasks in the relaxation and coping conditions relative to the control condition and over time (before to after the task). In addition, an interaction with age group was predicted. Only interactions are discussed because they indicate effects of the interventions and age.

Blood pressure

With regard to systolic blood pressure, there was a time of assessment by condition interaction, $F(3,219)=3.22$, $p<0.05$, $\eta^2=0.042$, and an age group by condition interaction, $F(3,219)=3.80$, $p<0.05$, $\eta^2=0.050$. In young adults, there was a reduction in blood pressure before to after the task in the control condition ($t(27)=2.58$, $p<0.05$), coping condition, ($t(17)=3.39$, $p<0.01$), and combined intervention, ($t(37)=3.50$, $p<0.01$). In older adults, such reductions were also seen in the control ($t(27)=2.21$, $p<0.05$), coping condition ($t(27)=4.24$, $p<0.011$, and the combined intervention, ($t(27)=2.28$, $p<0.05$). The decrease in blood pressure in the coping condition was larger, $t(45)=5.21$, $p<0.001$ than in the control condition, $t(56)=3.56$, $p=0.001$, and the combined intervention. $t(64)=3.93$, $p<0.001$ (*Figure 1*).

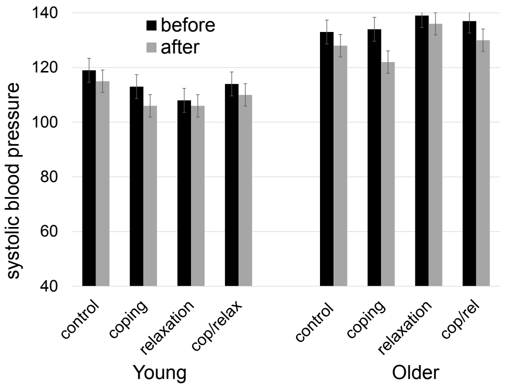

Figure 1. Systolic blood pressure before and after the task; Error bars represent 1 Standard Error

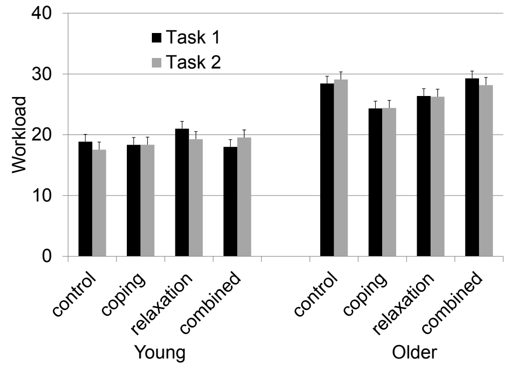

Figure 2. Experienced workload after Task 1 and Task 2; Error bars represent 1 Standard Error

Heart rate/pulse

Pulse data were used for the analyses because of missing data from the heart rate monitor. There was a time of assessment by age group interaction, $F(1,218)=6.66$, $p<0.01$, $\eta^2=0.030$, indicating a significant reduction in heart rate throughout the experiment among older adults only, $t(107)=4.94$, $p<0.011$.

The interventions involving coping contributed to a decrease in systolic blood pressure over the course of the experiment. However, this occurred in both age groups and in the control condition as well. Heart rate decreased only in older adults over time but this decrease could not be attributed to a specific intervention.

Psychosocial measures

Affect

For negative affect, a time of assessment by age interaction, was found $F(1,216)=5.08$, $p<0.005$, $\eta^2=0.032$. There was only a significant decrease in negative affect in the younger age group but not the older age group, $t(116)=4.56$, $p<0.001$. For positive affect, there was an interaction of age group by condition, $F(3,218)=4.54$, $p<0.01$, $\eta^2=0.059$. Older adults maintained relatively high positive affect across all conditions, and higher than younger adults. The coping only intervention contributed to higher positive affect before and after the task in young adults than the relaxation only, $t(25)=2.58$ and $3=2.98$, $p<0.05$, respectively, and the combined intervention conditions , $t(25)=2.58$ and 2.38, $p<0.05$, respectively. There were no effects with regard to anxiety; therefore the variable was omitted from further analyses.

Workload

Perceived workload was assessed after completion of task 1 and task 2 because it is a task-related outcome measure. With respect to this perceived workload there was a three-way interaction of condition and age group with time of assessment, $F(3,218)=3.20$, $p<0.01$, $\eta^2=0.042$. Perceived workload remained relatively high and stable in the older group whereas it fluctuated in the younger group across conditions. Perceived workload in the relaxation condition among younger adults decreased from task 1 to task 2, $t(34)=2.62$, $p<0.05$. In contrast, it increased from task 1 to task 2 in the combined intervention condition, $t(37)=2.99$, $p<0.01$ (*Figure 2*).

The psychosocial indicators of affect and workload support the benefit of the coping intervention for positive affect and the relaxation intervention for workload. However, these results were found for younger adults only. Older adults maintain high levels of positive affect and low levels of negative affect but high levels of workload throughout the experiment. The age-differential stress reduction for the interventions was thus only observed in the younger group.

Task performance

We predicted improvements on task performance as a result of the interventions. Task performance was computed as the percentage of steps completed (with a minimum of 13 and a maximum of 24 steps) correctly for a given task. Also, the percentage of help requested during the execution of a task was a performance indicator. All participants received training for technology-driven tasks because it was not possible to successfully perform these tasks otherwise. Relaxation and coping conditions were expected to yield higher performance than the control condition because participants would feel more at ease (as a result of a relaxation procedure) or better prepared (as a result of a coping intervention) to deal with these complex technological tasks. A second prediction was that older adults would benefit more from the interventions than their younger counterparts as these novel tasks would be relatively more difficult for them be-

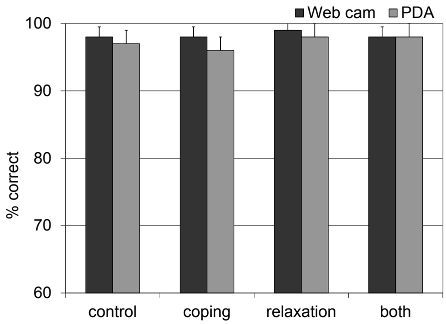

Figure 3. Percentage correct on technology-driven tasks by condition; Error bars represent 1 Standard Error

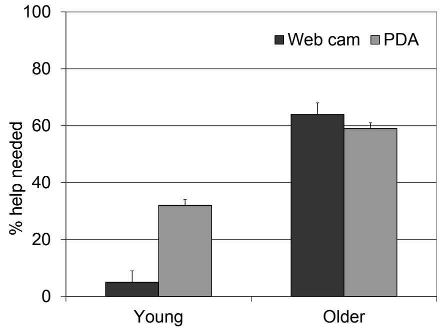

Figure 4. Percentage of help needed in younger or older adults per task; Error bars represent 1 Standard Error

cause of their inexperience with novel technology. Task instruction was effective and resulted in high performance for all conditions at or above 90% accuracy. This, however, made it more difficult to detect effects of our manipulations.

A Repeated Measures ANOVA with condition and age group as between subjects factors and type of device as within subjects factor yielded a device by condition interaction, $F(3,206)= 2.84$, $p<0.05$, $\eta=0.040$ on task performance. Post hoc tests indicated that performance in the coping only condition was worse compared to the relaxation and combined intervention conditions (*Figure 3*). There were no effects for age group. With regard to help needed on the task the analysis showed a device by age group interaction, $F(1,204)= 34.04$, $p<0.001$, $\eta=0.143$. More help was needed on the webcam task relative to the PDA task, $t(215)=7.91$, $p<0.001$, and to a greater extent by older than younger adults, $t(109)=11.94$, $p<0.001$ for the webcam and $t(113)=14.52$, $p<0.001$ for the PDA (Correction based on Levine's test of equality of variance). There was no interaction with condition (*Figure 4*).

When needed help was analyzed separately per device, the ANOVA on help needed with the webcam task indicated an age group by condition interaction, $F(3,210)= 2.71$, $p<0.05$, $\eta=0.037$. Relative to younger adults, older adults needed the least help in the coping/relaxation combined intervention condition relative to the control condition, $t(48)=2.53$, $p<0.05$. There were no such effects for help needed on the PDA task.

The results support the prediction that some of the interventions made a difference for task performance. Interventions involving relaxation worked better than the coping intervention. Age was not a factor with regard to performing the different steps but mattered much more with regard to the help needed during the tasks. Older adults needed more help in order to be able to complete the tasks, but relatively less for the webcam task in the combined intervention condition than the control condition, whereas no such pattern was found for younger adults.

Discussion

This study assessed the impact of different interventions on physiological and subjective levels of stress, affect, and perceived work load and task performance in conjunction with age. Earlier research demonstrated increases in physiological and subjective measures of arousal when performing a stressful task in both younger and older adults[8]. The aim of this study was to assess whether coping and relaxation manipulations could reduce physiological and subjective arousal over the course of the experiment when performing novel technology-driven tasks and possibly benefit performance. As older adults are less familiar with new technology, have lower self-efficacy regarding working with new technology, and are more likely to experience stress when executing tasks involving new technology, they could benefit from these interventions in the form of reduced stress and improved performance.

Some of the interventions indeed helped to reduce stress and supported elements of performance on novel technological tasks but this benefit was not more pronounced for older adults. The coping intervention particularly helped to reduce blood pressure in both age groups and positive affect in younger adults. This may reflect improved coping skills to perform a task involving new technology as a result of the intervention. The interventions including relaxation yielded the best results for task performance and the help needed during the task. For performance, the coping condition yielded worse results compared to the other interventions. This is surprising as this intervention resulted in lower physiological and subjective measures of stress. Possibly, this intervention did not provide the necessary problem-solving skills to improve performance substantially beyond what participants learned during the training phase. In conjunction with a relaxation procedure, however, coping did seem to have an additional benefit. It is possible that the relaxed state enhanced processing capacity to take in additional information from the coping intervention.

There were no age effects with regard to performance on the task but substantial age differences in the help needed with the tasks. Therefore the hypothesis regarding the higher benefits of the interventions for older adults on task performance was not confirmed. A possible reason that the interventions did not result in higher task performance is that it was difficult to select tasks and training to keep younger and older adults at similar levels of performance. Future research should therefore aim at generating mid-level accuracy in the control condition in order to provide a more sensitive test of the relative effectiveness of the different interventions on performance.

Older adults needed much more help during the tasks than the younger adults. Interestingly, for the webcam tasks, the biggest age difference was found in the combined intervention condition where younger adults needed more and older adults needed less help. It appears that there are different training needs for the different tasks and age group.

Overall, older adults seem to appreciate and utilize the availability of a person providing assistance, regardless of the device involved (webcam or PDA). In contrast, younger adults are more selective and only ask for help (with the PDA device), when they cannot succeed otherwise. Younger adults may think they can learn with little support whereas older adults lack such self-confidence. This self-confidence could be due to more experience and knowledge of IT, for example when using social media (We thank an anonymous reviewer for this suggestion). Studies demonstrating benefits of live feedback on task performance for older adults[3], support this assumption. The importance of providing one-on-one feedback for older adults when learning new technology has been discussed in several other studies as well[28].

Overall, the relaxation intervention contributed to decreases in indicators of stress levels and to increases in task performance for one of the four tasks. The effect of the coping intervention, separate from relaxation, was limited to decreases in physiological indicators of stress, perceived workload, and smaller increases in anxiety over time relative to other conditions. Replication and extension of such interventions using continuous monitoring of multiple indicators and more sensitive experiment designs should provide a more transparent picture of the time course of stress and its effects on performance among participants of different age groups.

Future studies could look more closely into the benefits of interventions depending on age group and task. For performance, interventions involving relaxation appear most helpful when training older adults to learn to use new technology. The available help during the task may have substantially aided older adults in their performance for these tasks. Therefore, relaxation in conjunction with one-on-one training or feedback after help-requests could be particularly effective in this group. The impact of these components in the context of learning new technology has not been demonstrated as of yet.

The current study was the first of its kind to explore benefits of interventions for novel tasks involving new technology. Such an approach, however, could provide a relatively simple and effective way to improve performance on stressful and demanding tasks in general. New technology is developed constantly and eventually adopted by the ever growing population of older adults. Knowing what learning strategies and conditions for learning are best for this population may enable older adults to adapt more successfully to living in a technologically advanced society.

Acknowledgments

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References

1. Johnson RW. Trends in job demands among older workers, 1992-2002. Monthly Labor Review 2004;48-56
2. Fisk AD, Rogers WA, Charness N, Czaja SJ, Sharit J. Designing for older adults: Principles and creative human factors approaches. 2nd edition. Boca Raton, FL: CRC Press; 2009
3. Mitzner T, Dijkstra K. E-health for older adults: Assessing and evaluating user centered design with subjective methods. In: Ziefle M, Röcker C, editors, Human-centered design of e-health technologies: Concepts, methods and applications. Hershey: IGI Global; 2011; pp 1-21
4. Ford R, Orel N. Older adult learners in the workforce: New dimensions to workforce training needs. Journal of Career Development 2010;32(..):139-152; doi:10.1177/0894845305279165
5. Czaja SJ, Sharit J. Designing training and instructional programs for older adults. Boca Raton: CRC Press; 2012

6. Czaja SJ, Charness N, Fisk AD, Hertzog C, Nair SN, Rogers WA, Sharit J. Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). Psychology & Aging 2006;21(2):333-352; doi:10.1037/0882-7974.21.2.333
7. Folkman S. Positive psychological states and coping with severe stress. Social Science Medicine 1997;45(8):1207-1221; doi:10.1016/S0277-9536(97)00040-3
8. Lupien SJ, Gaudreau S, Tchiteya BM, Maheu F, Sharma S, Nair NP, Hauger RL, McEwen BS, Meaney MJ. 2006. Stress-induced declarative memory impairment in healthy elderly subjects: Relationship to cortisol reactivity. Journal of Clinical Endocrinology and Metabolism 2006;82(7):2070-2075; doi:10.1210/jc.82.7.2070
9. Wolf OT, Kudielka BM, Hellhammer DH, Hellhammer J, Kirschbaum C. The relationship between stress induced cortisol levels and memory differs between men and women. Psychoneuroendocrinology 1998;26(7):711-720; doi:10.1016/S0306-4530(01)00025-7
10. Keinan G, Friedland N, Even-Haim G. The effect of stress and self-esteem on social stereotyping. Journal of Social and Clinical Psychology 2000;19(2):206-219; doi:10.1521/jscp.2000.19.2.206
11. Mayr U, Kliegl R. Sequential and coordinative complexity: Age-based processing limitations in figural transformations. Journal of Experimental Psychology: Learning, Memory, and Cognition 1993;19(6):1297-1320; doi:10.1037/0278-7393.19.6.1297
12. Hale S, Myerson J. 50 Years older, 50 percent slower: Meta-analytic regression models and semantic context effects. Aging and Cognition 1995;2(2):132-145
13. Blanchard-Fields F, Jahnke HC, Camp C. Age differences in problem-solving style – The role of emotional salience. Psychology & Aging 1995;10(2):173-180; doi:10.1037//0882-7974.10.2.173
14. Diehl M, Coyle N, Labouvie-Vief G. Age and sex differences in strategies of coping and defense across the life span. Psychology & Aging 1996;11(1):127-139; doi:10.1037//0882-7974.11.1.127
15. Trouillet R, Gana K, Lourel M, Fort I. Predictive value of age for coping: the role of self-efficacy, social support satisfaction, and perceived stress. Aging & Mental Health 2009;13(3):357-366; doi:10.1080/13607860802626223
16. Cahn BR, Polich J. Meditation (Vipassana) and the P3a event-related brain potential. International Journal of Psychophysiology 2009;72(1):51-60; doi:10.1016/j.ijpsycho.2008.03.013
17. Aftanas L, Golosheykin S. Impact of regular meditation practice on EEG activity at rest and during evoked negative emotions. International Journal of Neuroscience 2005;115(6):893-909; doi:10.1080/00207450590897969
18. Jha AP, Stanley EA, Kiyonaga A, Wong L, Gelfand L. Examining the protective effects of mindfulness training on working memory capacity and affective experience. Emotion 2010;10(1):54-64; doi:10.1037/a0018438
19. Slagter HA, Lutz A, Greischar LL, Francis AD, Nieuwenhuis S, Davis JM, Davidson RJ. Mental Training Affects Distribution of Limited Brain Resources. PLOS Biology 2007;5(6):1228-1235; doi: 10.1371/journal.pbio.0050138
20. Srinivasan N, Baijal S. Concentrative meditation enhances preattentive processing: A mismatch negativity study. NeuroReport 2007;18(16):1709-1712; doi:10.1097/WNR.0b013e3282f0d2d8
21. Galvin JA, Benson H, Deckro GR, Fricchione GL, Dusek JA. The relaxation response: Reducing stress and improving cognition in healthy aging adults. Complementary Therapies in Clinical Practice 2006;12(3):186-191
22. Sliz D, Smith A, Wiebking C, Northoff G, Hayley S. Neural Correlates of a single-session massage treatment. Brain Imaging and Behavior 2012;6(1):77-87; doi: 10.1007/s11682-011-9146-z
23. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: The PANAS scales. Journal of Personality and Social Psychology 1998;54(6):1063-1070; doi:10.1037//0022-3514.54.6.1063
24. Spielberger C. Measuring the intensity of emotional states and of individual differences in personality traits: Anxiety, anger, curiosity, and depression. International Journal of Psychology 2000;35(3-4):187-187
25. Hart SG, Staveland LG. Development of NASA-TLX (Task Load Index): Results of empirical and theoretical. In: Hancock PA, Meshkati N, editors, Human mental workload. Advances in Psychology 1988;52:139-183
26. Rubio S, Diaz E, Martin J, Puente J. Evaluation of subjective mental workload: A comparison of SWAT, NASA-TLX and Workload profile methods. Applied Psychology: An International Review 2004;53(1):61-86; doi:10.1111/j.1464-0597.2004.00161.x
27. Czaja SJ, Charness N, Dijkstra K, Fisk AD, Rogers WA, Sharit J. Demographic and Background Questionnaire. CREATE Technical Report 'CREATE-2006-02'; 2006
28. Mitzner TL, Boron JB, Fausset CB, Adams AE, Charness N, Czaja SJ, Dijkstra K, Fisk AD, Rogers WA, Sharit J. Older adults talk technology: Their usage and attitudes. Computers in Human Behavior 2010;26(6):1710-1721; doi: 10.1016/j.chb.2010.06.020