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Erickson’s Practice for Crews: What About Coping to the Situation with Zen?

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WHAT ABOUT COPING TO THE SITUATION WITH ZEN?

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Hypnosis has already been used in very long flights by Bertrand Piccard, one of the two Solar Impulse pilots, to manage fatigue and rest periods. It is also used by navigators like Armel Le Cléac'h during solo races. For this reason we consider it is worth to look at such technics to cope with the constraints of long flights. A study was done in order to explore what kind of benefits hypnosis could bring to cope better with multitask activities constraints like time pressure, good performance demands... We used Multi-Attribute Task Battery II (MATB-II) software to induce different workloads, time pressure and consecutively fatigue sensations. Participants were mostly aeronautical engineers. For each participant, the scenarios were repeated and separated by 3 types of break. Three break conditions of fifteen minutes were then used to differentiate the group of people: "Static rest" or "Exercise" or "Hypnosis" breaks. The hypothesis was that depending on the break condition and the scenario intensity level, variations on performance and participants' feeling could appear. The methodology used task performance index, fatigue and workload subjective scales, eye-tracking data, plus debriefing inputs. The results show that "hypnosis" and "exercise" breaks had interesting effects on fatigue and performance. Unexpected results were underlined by participants' in debriefing about "stressless" effect and calm after using hypnosis to cope with the situation.

Keywords: hypnosis, fatigue, stress.

Crew fatigue is recognized as a safety risk and has been classified by NTSB as a "most wanted" improvement. For the purpose of our work, we will use that the definition of fatigue as "*biological drive for recuperative rest*" (Williamson & al., 2011). Levels of fatigue and levels of confidence impact self-monitoring performances and risk, with a nonlinear relationship between risk and alertness or performance (Folkard & Akerstedt, 2004). The difficulty is mainly due to complex links between objective results and subjective metacognition models that impact the level of one's own activity control loop. Considering the recent example of the Solar Impulse, with pilots using alternative techniques like the Erickson hypnosis techniques for recuperation seems interesting to explore(e.g., solar impulse website). B. Piccard used autohypnosis to manage his resources and lack of sleep during the very long flight and simulation (72 hours). The aircraft does not have an autopilot system to take over part of the tasks, except for wing stabilization (only for periods of twenty minutes). This small window of time allows pilots to take naps or regulate their fatigue. Video testimonies are available; for Bertrand Piccard's 72 hours simulation. During this simulation he slept only 2 or 3 hours out of 24 hours (based on EEG measurements) and he was managing his resources with hypnosis for the rest of the time. He declared that he felt even better when using autohypnosis. The present exploratory work aims at shed light on cognitive resources recovery via hypnosis compared to other short break types.

In related works, Hammer (1954) showed that on highly suggestible students -besides effects on motivation-, hypnosis suggestion improved their performance during a test related to schoolwork. Following this pioneer study, many research teams used the Stroop task; for instance Kaiser & al. (1997) who have shown that the Stroop effect appeared to be enhanced. Other research, like Raz & al. (2002), Landry & al. (2017), Lifshitz & al. (2013), concluded that post-hypnotic suggestion can cancel the Stroop effect by inducing transient alexia. Those studies showed that there are two potential impacts: one coming from the hypnotic state effect itself, and the other from the suggestions that have been induced. The effect of hypnotic suggestion on several well-documented cognitive mechanisms has been studied by Landry & al. (2017). All are considered as automatic processes because they occur outside conscious control and they do not need to be learned. In another direction, sport psychology studied the effect of sport on cognition performance and it appears that effects of physical exercise on cognitive abilities could follow the Yerkes and Dodson's Law of Arousal (Yerkes & Dodson 1908). This means that cognitive performances could be improved following a moderate to high intensity exercise on short to medium duration (less than 1 hour), whereas they decreased for very high intensity or long lasting activity (Tomporowski 2003).

Human Recovery Resource Methodology (HRR 1 & 2)

The exploratory work consist in two successive studies. The first experiment HRR1 was done to investigate if there was any interest in a short break hypnosis session to recover, while experiment HRR2 aimed at replicating the experiment and deepening the analysis to check the rest efficiency with a higher fatigue level. Our assumption, using previous research, was that there will be a better recovery from fatigue using "hypnosis" and "exercise" than "static rest" breaks.

Participants were volunteers' engineers with strong knowledge in Aeronautic tasks. Instructions were: they will assess the effect of a break and that they have to perform as well as they can. Participants had to perform a Multi-Attribute Task Battery (NASA MATBII) mimicking a piloting situation. MATBII was composed of 4 sub-tasks including system monitoring (SYSM), tracking (TRCK), communication (COMM), resources management (RMAN) that are configurable in difficulty, numbers and concomitance. All tasks were used and planned in order to vary the efforts and the consecutive fatigue. The main differences between scenarios were the duration and the level of tasks' demanded: HRR1 repeated scenario was 10mn long with 55 events while HRR2 scenario was double the duration with 30% of tasks' events increase (150 events in 20 minutes: 57 events SYSM, 42 COMM, 31 TRCK and 20 RMAN). The purpose was to vary the workload, resources consumption and consequently the fatigue.

For performing the task, they were seated in front of a computer screen in a windowless room (constant lightening necessary for eye tracker). Thrusmaster T.FlightStick X Joystick was used to perform the tracking task, plus a keyboard or a mouse for other tasks. Adjustments were at operator discretion. Eye activity was registered via a Tobii X1 Light fixed under the screen and the Ogama software. Participants were trained and aware of the performances calculations and constraints. Each sub-task was analyzed with a time spent in abnormal situation (Splawn, 2013) separately and then additionned in global performance index. Difference of performance between scenarios (same scenario) before and after break was always calculated as: Performance after break minus performance before break.

At the end of each MAT-B scenario, a Workload Rating Scale based on the NASA-TLX is prompted on the screen (Hart, S. G., & Staveland, L. E., 1988). NASA-TLX classifies workload in six categories: mental, physical, temporal, performance, effort and frustration. Participants had to rate their global workload on these six scales from "low" to "high" (0/100) except for the performance category "good" to "poor". A subjective global fatigue assessment scale (scored from 1 to 10) was also presented 4 times to participants (Beaulieu-Bonneau, 2012): at arrival (reference), after scenario 1, after break, after scenario 2.

The first experiment -HRR1- involved 19 participants (10 women, 9 men; age range: 23-55 years old) randomly allocated to "Static rest" and "Exercise" breaks, and performed tasks just after having lunch (between 12:30 and 15:00). For the "Hypnosis" break situation, participants were preselected as highly suggestible, using the Standford Modified Scale of Paris Revised Form (Michaud & al., 2007). The second experiment HRR2, involved a different population of 45 volunteers, 15 per group (17 women, 28 men, Mean age = 40 years, 31-49 years, 6 left-handed). Participants were balanced in the three groups regarding their training score for ensuring comparable group performance level. As we increased the workload and the fatigue in the scenario, we judged not necessary to keep the after lunch period as a constraint and extended it at different moment of the day from 08:00 to 18:00 within each group (with a similar distribution between groups). For the HRR2 experiment, an electrooculography (EOG) using 6 electrodes was added to the Tobii (BioSemi). During the test, the hypnosis technic employed was inspired from "Erickson" practice. The script (hypnotherapist verbalizations) was based on 'positive energy' thinking incomes when breath in, 'tensions' outcomes when breath out, plus memory of success reliving associated positive emotions. We used the word -reliving- as it was demonstrated by Faymonville & al (2006) with magnetic resonance images that hypnosis induces a state with a "reliving of the situation" meaning the brain areas active as if the subject was living the situation. Positive emotions related to memory of success were enhanced by hypnotherapist proposed words for related emotions (suggestion): "energy", "joy", "pride", "pleasure", "strength", "enthusiasm" plus "one's own resources mobilization". Those emotions induced a well-known effect on cognition (Fredrickson, 1998), and potentially on motivation, engagement and effort (resources involvement) that participants could involve for their activity (Jonc 2001, Lautrey 2003). A post-hypnotic suggestion was added while getting out the participant from the hypnotic state: "to be here in top form".

Human Resources Recovery Main Results (HRR 1 & HRR 2)

In each experiment, participants increased both their performance and their fatigue rating. In the first experiment, performance increase was slightly better for "Hypnosis" (+7.7%) than for "Exercise" (+6.8%) and "Static" rest (+6.5%). Surprisingly, in the second experiment, participants from the "Static" rest (+7.64%) and the "Hypnosis" (+7.24%) groups were slightly better performers than the "Exercise" group (+5.95%). In both experiments "Hypnosis" showed a small performance increase while Exercise and Static rest exchanges their performance level.

Eye tracker and EOG measurements showed no statistical significant evidence for "static rest" and "hypnosis" groups in arousal increase while it was significant for saccade movements in favor of "exercise" group in the second experiment. Nevertheless, the static rest group showed a higher scoring in blinks than the two others.

Workload scale quotation showed a decrease of general workload (mean group difference) after second scenario in both experiments but more pronounced in HRR1 than in HRR2. HRR1 showed: "Hypnosis" (-18.2), "Exercise"(-13.7), "Rest"(-6.3), while HRR2 showed: "Hypnosis"(-3.9), "Rest"(-2.7), "Exercise"(-1.1).

Fatigue rating showed differences between groups even if not statistically significant in HRR1: Anova, ($F(2,60)=1.723$, $p=0.187$) and group ($F(3,60)=1.076$, $p=0.366$) and for interaction time*group ($F(6,60)=1.034$, $p=0.412$). The absence of significant effect may be explained by the low number (n=6) of participants per group. For that purpose, the HRR2 experiment was performed with increased numbers of participants.

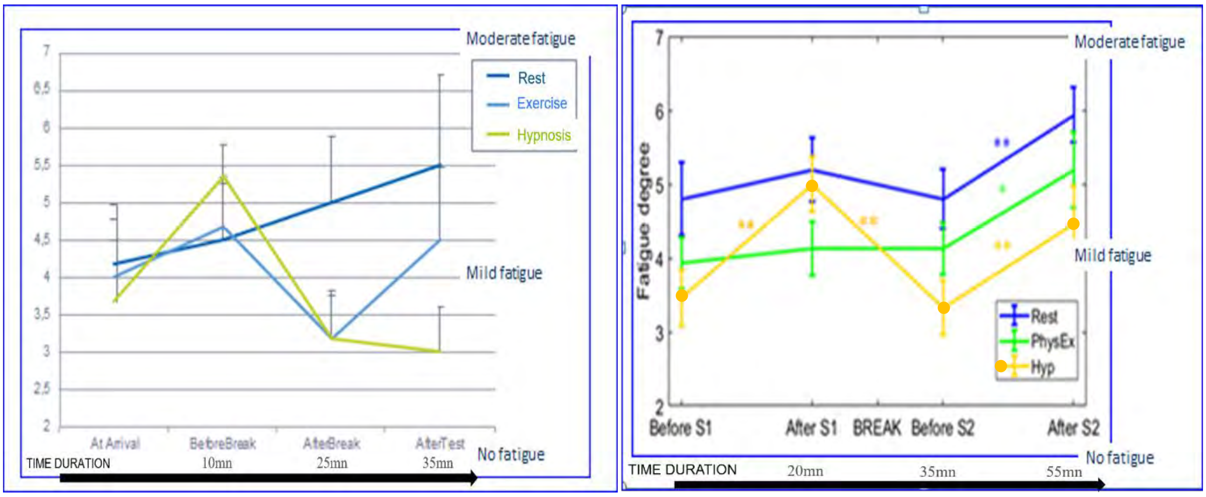

Figure 1&2: *HRR1 & HRR2 self-assessed fatigue*

The most interesting rating in HRR1 is that participants felt less tired at the end of the experiment than at any time before, even at arrival. The second experiment assessment was done in a more demanding situation (mimicking abnormal cockpit workload). In the HRR2 figure, asterisks represent significance to a paired Wilcoxon test intra group after correction for multiple comparisons; * $p<0.05$; ** $p<0.005$. At the end of the second scenario, all participants reported higher fatigue than before the test (rest and hypnosis group $p<0.005$; physical exercise $p<0.05$). The effect of the break is statistically significant, mostly for the "Hypnosis" group (Wilcoxon sign rank paired test, $p=0.0024$, after correction for multiple comparisons, $p=0.0072$). When comparing "after scenario 1" to "before scenario 2" (after break), the Kruskal & Wallis test appears to be statistically significant for all groups ($H(2,N=45)=14,41558$ $p=0.0007$). When comparing, this time, the groups 2 by 2, only "Exercise" break group and "Hypnosis" break group were significant together and none of them was significant when compared with the "Rest" break group. In both experiments, the "Hypnosis" group rated their fatigue lesser than the other groups at the end of the experiment. They also rated with a higher increase at the end of the first scenario than the two other groups in both studies.

The debriefing showed that the second experiment was judged as requiring a significant effort while performing and induced more fatigue. All participants found strategies to cope with this demanding situation in order to perform better. "Rest" and "Exercise" break groups reported that a break allows strategy adjustment, step back effect and eye relaxation. We did not expect in our assumption the "Hypnosis" break participants' feedback about acting the second scenario without any stress, with a gain in motivation and with less time pressure sensation.

Human Resources Recovery Discussion and Conclusion

In our experiments, fatigue was produces by creating mental workload. The effect of hypnosis we were assessing here was significant on fatigue. Hypnosis was also effective on stress and motivation as debriefed by participants. Our experiments illustrated well the fact that, even with consequent workload and complex multitasks, operators were able to maintain their performance while producing fatigue. The effect on performance was here less marked but could be interesting to deeper study in further experiments as Oakley & Halligan (2009) indicates that hypnosis triggers changes such as motivation, relaxation, and mental absorption. Moreover, Cegarra (2012) states that cognitive resources are used faster when coping with stress. The stressless effect after hypnosis practice, underlined by subjects in debriefings, might help to cope with less resources involved in emotional management and consequently a better performance and less fatigue. This “calm and stressless effect” induced by a hypnotic state was also explained physiologically by subjects’ oxytocin hormone increase, DeVries & al.(2003), Uvnäs-Moberg & al.(2004), Varga & al.(2014).

We have to clarify a generic confusion between the hypnotic physiological state that comes naturally (not induced by the subject or a hypnotherapist) and the practice, as they are both commonly called “Hypnosis”. Hypnosis as a natural state is described by E. Rossi (1982) as an ultradian cycle of “natural periods of quietness and receptivity” being the natural “common everyday trance”, that the body uses naturally to recover. Assuming that hypnotic trance as a natural state exists, hypnosis is the term used by medical and psychology fields for this mechanism but a neurophysiology concept called “mind wandering” seems to correspond to this natural trance state. Mind wandering is defined as “*shifts in attention from outward, stimulus-based processing to inward, introspective cognition*” (Mittner & al. 2014) which is very close to Rossi’s definition. This concept provides physiological description about this “common everyday trance” hypnotic state mechanism. This “natural state”, which is coming without the will of the subject, is very interesting to investigate as this state has an effect on cognitive activity (Mittner & al. 2014). The practice of self-hypnosis is a way to recognize this “mind wandering” or “common everyday trance” when occurring without the subject’s will. The self-practice in aviation could be interesting as it allows the operator to stop or induce the state on demand, at the best moment for him, in order to take the maximum profit. The practice allows to produce different effects such as fatigue recovery (our script example), going faster and deeper into sleep while being in crew rest for instance and much more. Due to the large choice of effects that might be scoped, the practice need to be further investigated with airlines and authorities in order to determine the best integration option in operational conditions.

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