Confirmatory Factor Analysis of Mystical (Religious) Experience in Freediving

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ABSTRACT:

Aim:

The aim of the research was to investigate accounts of mystical/religious experience in breath-hold freediving.

Inspiration:

Rumors about life-changing dives, making Freedivers to immediately quit addictions, attaining harmonious meaningful happy life, lucidity, compassion, improved efficiency in coping with adversity and pain, all that after feeling universal love and timeless unity underwater.

Definitions and Trivia:

Mystical Experience is a construct defined by 4 factors: unity, noetic quality, sacredness; positive mood; transcendence of time/space; and ineffability (the 4 are described in the Mystical Experience Questionnaire MEQ30). The experience is known for long lasting positive effects, coping with addictions, fear, PTSD, etc.

Freediving is a recreational activity and an extreme sport, consisting of holding breath while diving as deep as possible along a weighted rope, and resurfacing without blacking out. Relaxing body and mind is key in freediving.

Experiment and Findings:

Confirmatory Factor Analysis proved Mystical Experience (ME) to happen in Freediving. Mystical Experience Questionnaire "MEQ30" was validated for use in Freediving. MEQ30 was submitted online to Freedivers. The total score of ME in 482 self-selection-biased anonymous freedivers has a bell-shape distribution from full mystical experience to a low one. [Annex 1 for a short one-picture overview of the findings].

DATA AVAILABILITY:

Raw data collected is open for downloading from Harvard Dataverse.

KEYWORDS:

mystical experience; freediving; hypercapnia; compassion; efficiency in sport and business; ethical dilemma;

Literature

Mystical Experience

By definition, Mystical Experience (ME) has 4 facets or factors, which can be described in short as following: 1) feeling peaceful love and intuitive belief in the sacred unity within the universe; 2) joy; 3) literally perceived exit out of material space and time; 4) inability to describe it using words. Mystical Experience despite stirring public controversy is a relatively well studied psychological construct, manifested by these 4 factors. Please see “MEQ30” in the Annex 2 for a strict detailed description of the Mystical Experience construct.

A full ME is subjectively perceived as important as the birth of one's first baby or the death of one's parents (MacLean et al., 2012). Mystical or meta-religious experience is motivating to learn ethics, it helps to make better life choices in Ethical Dilemmas, thus reducing stress and improving happiness by avoiding painful or frustrating errors (Keller, 2010).

One single advent of ME is reported to cure alcohol and tobacco addictions, suicidal post-traumatic stress disorder (PTSD), and fear of death (Griffiths, 2013) (Griffiths et al., 2016). Advanced stages of clinical trials are underway (Mithoefer, 2018) (Fultinavičiūtė, 2022) for ME to be used for these conditions, as unhappiness is deemed to touch 10-15% of the industrialized countries population (*Gallup Poll Social Series: Mood Of The Nation*, 2022), including 46.000 suicides in year 2020 in all social groups in the USA alone (*Facts About Suicide*, 2022). For now ME is the only known way to immediately improve or fully reveal one's Big5's personality trait Openness (correlated with IQ) and Agreeableness (correlated with Compassion). These positive changes in personality are long-lasting (Griffiths et al., 2011) (Griffiths et al., 2006).

Mystical experience is induced and researched through psychedelic 5HT2a-agonists (Doblin, 1991), (Paloutzian & Park, 2013), (Hood et al., 2018). Another source of mystical experience in research is Buddhist meditation (Barrett et al., 2017).

Besides the use of 5HT2a-agonists, ME is also *anecdotally* reported in a variety of different cases: sensory deprivation (Kjellgren et al., 2009), compassion (defined as a feeling and a will to help a sufferer (Safina, 2020)), or grief in scenic wilderness (Davidson, 1980) or in war, seizures (Ramachandran & Blakeslee, 1998), heroic altruism (Marlantes, 2011) (Marsh, 2016), deep dives with skipped breathing or breath-holds (US Department of Defense, 2011) (Littlemore, 2007), in Meduna Mixture inhaling (Meduna, 1958). Because Mystical Experience and Near Death Experience (NDE) have similarities (Greyson, 1983) (Timmermann et al., 2018) (Greyson, 2014), we can extend the *anecdotal* ME list into such NDE sources as blood loss and lung failure and cardiac arrest (Charland-Verville et al., 2015) (Lommel, 2010) (Doty, 2016). A rich throng of NDE/ME feelings while drowning are collected by (Holden & Avramidis, 2015). They estimate that up to a million people yearly are getting this drowning experience worldwide. In a similar order of magnitude, about 5% of the entire US population are estimated by (Holden et al., 2009) to be NDE experiencers. Obviously Freediving cases are a drop in the bucket of ME or NDE as Freediving has not that many practitioners.

For researchers, an advantage of mystical experience compared to near death experience, is that ME can be induced in experimental settings. But early research on ME induced by 5HT2a-agonists, attracted controversy and politicization in the 1960s with Dr Tim Leary promoting LSD for public use in order to make the world a better place (Leary, 1999). Hippies and anti-war and anti-consumerism street actions resulted in a complete ban of the research worldwide. In 1991 Professor Roland Griffiths from Johns Hopkins managed to overcome this ban on Mystical Experience induced by psychedelics for research (Griffiths, 2013), and his team is pioneering this mystical research work, along with the team of Dr Nutt at Imperial College (Carhart-Harris et al., 2017) and more researchers getting involved (despite lengthy approval formalities, related to the controlled substances list). Researchers are carefully staying within scientific methodology and ethics, and they are advancing with caution into this politically sensible area.

Psychedelics may induce negative experiences. To avoid it, i.e. for the ME to happen, there is a prerequisite, the so called "mindset-and-setting". In short it means the subject's mindset should be confident and open to what will follow, and the surrounding setting should *appear* safe and soothing (Cosimano & Richards, 2013) (Griffiths et al., 2016).

An improved Questionnaire for Mystical Experience was fine-tuned (MacLean et al., 2012) (Barrett et al., 2015) and it is called "MEQ30". The statistical method of Factor Analysis was used for this purpose. Factor Analysis as a method was initially elaborated by (Spearman, 1904) to investigate intelligence as a "psychological construct hidden inside the mind" (as we can only investigate such an inner construct by it's external manifestation). Roughly speaking, the method consists of detecting clusters of correlations among the quantified statements from experiencers. It is possible to compare cluster (aka factor) Structures between groups of experiencers (Psilocibin Users vs. Freedivers in our case). A fortuitous coincidence in factor structures being very improbable, it's a way to prove that objectively an identical subjective experience occurred in both sets of experiencers (in 5HT2a-agonists users or religious followers, and in Freedivers).

Freediving

Freediving is an extreme sport and a leisure activity consisting of holding breath in the water, thus inducing in the body an extreme deficit of O2 (hypoxia) and an excess of CO2 (hypercapnia). This and subsequent paragraphs are based on documents from (AIDA International, n.d.), and on two freediving manuals by (Molchanova, 2019) and by (Lemaître, 2019).

One declared goal in freediving is different from other underwater activities: "scuba-divers dive into the Ocean, while freedivers dive into Self, to discover who we truly are".

Among freediving compitative disciplines there is the "static apnea" discipline when motionlessly lying face down on the surface of the water as long as possible without loosing consciousness (i.e. avoiding "a blackout"). There is the "constant weight" discipline, a more athletic one, it consists in going as deep as possible and swimming back to the surface. In this latter discipline, freedivers report vivid descriptions of narcosis (Néry & Vaillant, 2016), whether it is CO2 or N2 narcosis due to high partial pressure of the gas, or a combination of both.

Freedivers must have a safety partner/buddy, to rescue them from drowning in case of losing consciousness. This is why it is an extreme sport with a set of safety precautions.

During freediving, sensory receptors on the face feel the water and induce a Diving Reflex (Michael Panneton, 2013), helping to save oxygen. In particular this reflex slows the heart, and redirects oxygenated blood-flow to the lungs and the brain, away from the extremities, (so freedivers wear a wetsuit for comfort even in a relatively hot water, to avoid freezing). To save oxygen, freedivers learn to relax the face, the whole body, and they learn mindfulness to calm down their emotions and thoughts. During a couple of minutes before a dive, freedivers exhale more slowly than they inhale. This *allegedly* activates their soothing parasympathetic nervous system, furthermore relaxing them in order to save oxygen. Besides practicing mindfulness, some freedivers try to live a compassionate grateful lifestyle to reduce stress, *allegedly* keeping their parasympathetic system more active. Between training sessions this provides a better rest and recuperation, thus making the whole training more efficient.

Experiment and results

Freedivers' online survey setup

30 questions of the Mystical Experience Questionnaire (MEQ30) were randomly intermixed with 60 or 70 "cover-up" questions (in English and in Russian consequently) about the general experience of one memorable freedive (thermocline, safety buddy attitude on that memorable dive, etc.) in order to somehow dissimulate the mystical orientation of the survey. Though in the call for participation it was called "a study of Oceanic Feeling", this title has an ambiguity since freedivers do dive in the ocean by definition. Thus we hoped the call for participation would not tip-off the theme either. The cover-up questions went by pairs, formulated negatively and positively (e.g. "was the water cold?" vs. "was the water temperature comfortable?"). Unfortunately we did not ask for any demographic information at this stage. Google Forms was used for both language versions of the survey. Freediving champion Natalia Molchanova formulated and endorsed the call for participation, capitalizing on her authority among freedivers [Annex 4: call for survey participation]. Facebook pages of freediving champions Guillaume Nery, Natalia Molchanova, Natalia Avseenko, Alexey Molchanov, Marianna Krupnitskaya, etc., plus the Facebook page of Федерация Фридайвинга (i.e. Freediving Federation), and websites of Freediving Federation and Deeper Blue were repeatedly posting the call for participation from the end 2014 to the beginning of 2016. The survey was anonymous, without any possibility to sign-in one's name or any additional data.

Freedivers' online survey statistics and results

The survey Google Form URLs resulted in being clicked by an order of 10k people and was completed online in Russian language by 166 freedivers and in English language by 316 freedivers, which seemed to be enough for the confirmatory factor analysis (MacCallum et al., 2001) (Mundfrom et al., 2005). It took a year and several repeated calls for participation to attain these numbers.

First we reviewed the plausibility of several models of the first "Mystical" factor, containing in turn 4 second order sub-factors.

Model 1. Unchanged 4-subfactors model from MEQ30. All 4 subfactors may correlate freely.

subfactor 1: Internal Unity, items numbers 35; 41; 54; 77; 83; 12 as numbered in the 2012 seminal K.MacLean et al. paper on MEQ30.

subfactor 2: External Unity, items 14; 47; 74;

subfactor 3: Noetic Quality, items 9; 22; 69;

subfactor 4: Sacredness, items 36, 55, 73;

Model 2. Similar to 1, except for modified loading of item 36, it belongs better into subfactor 1.

Model 3. One-subfactor model, i.e. one of the subfactors defines the remaining three.

Model 4. A second-order model over model No 2.

Model 5. A second-order model over model No 1.

Table 1. Reliability of sub-scales of "Mystical" in Russian and in English

Sub-scales of the first (mystical) factor	Alpha Cronbach	
	Russian	English
Subfactor1 initial MEQ30 IU (without 36)	0,909	0,889
Subfactor1 new Internal Unity (with 36)	0,908	0,905
Subfactor2 External Unity	0,879	0,800
Subfactor3 Noetic Quality	0,859	0,784
Subfactor4 new Sacredness (without 36)	0,728	0,679
Subfactor4 initial MEQ30 Sacr. (with 36)	0,672	0,765

For all models, the items load significantly within their sub-factors.

Table 2. Goodness of Fit for different models of Mystical, both surveys (Eng, Rus)

	Model	AIC	CAIC	chi-square	degrees of freedom	CFI	RMSEA	CI 95% RMSEA
Russian	1	12,247	-333,664	180,247	84	0,945	0,083	(0,066, 0,099)
	2	-6,145	-352,057	161,855	84	0,955	0,075	(0,057, 0,092)
	3	76,561	-294,058	256,561	90	0,904	0,106	(0,090, 0,120)
	4	-6,979	-361,127	165,021	86	0,955	0,074	(0,057, 0,091)
	5	12,582	-341,565	184,582	86	0,943	0,083	(0,066, 0,099)
English	1	47,651	-351,831	215,651	84	0,953	0,071	(0,059, 0,082)
	2	41,292	-358,19	209,292	84	0,955	0,069	(0,057, 0,080)
	3	114,88	-313,136	294,881	90	0,926	0,085	(0,074, 0,096)
	4	50,999	-357,995	222,999	86	0,951	0,071	(0,060, 0,082)
	5	55,521	-353,473	227,521	86	0,949	0,072	(0,061, 0,084)

Examining models and their fit indexes, we would say that the best model for Russian is 4 and for the English is 2. So for both languages we prefer item 36 to belong to the first sub-factor though for Russian all sub-factors are more consistent in one factor.

Next, i.e. after reviewing the sub-factors, we analyzed models for all 30 items of the MEQ30 in Freediving. Doing that, we added-up the first factor's 15 items scores into 4 sum-scores.

Comparing the models we included the new "item-36"-subscales 1 and 4 in the factor 1, as well as an interconnection of end-members for items 2 and 15 (loss of usual sense of time, ..space) possibly due to similar wording in these items.

Table 3. Reliability of the scales

Scales	Alpha Cronbach	
	Russian	English
Scale1-initial: Mystical	0,902	0,886
Scale1-new: 36-th-item-modified Mystical	0,915	0,912
Scale 2: Positive mood	0,814	0,760
Scale 3: Transcendence of Time and Space	0,801	0,775
Scale 4: Ineffability	0,813	0,769

Table 4. Goodness of Fit : from different models, two languages, all scales

	AIC	CAIC	chi-sq.	deg. of freedom	CFI	RMSEA	CI 95% RMSEA
Russian	10.07	-587.037	300.072	145	0.911	0.080	(0.067, 0.093)
English	152.904	-536.679	442.904	145	0.896	0.081	(0.072, 0.089)

Table 5. Factor loadings, correlations between factors for two languages' mystical surveys in Freediving

items MEQ30 No	Russian questionnaire	English questionnaire	Sign. of differences
F1 Mystical			
Internal Unity new	0.927	0.974	0.012
External Unity	0.862	0.827	0.045
Noetic Quality	0.827	0.766	0.010
Sacredness new	0.825	0.839	0.034
F2 Positive mood			
5	0.451	0.623	0.174
18	0.721	0.550	0.159
30	0.600	0.619	0.307
43	0.699	0.596	0.101
80	0.796	0.631	0.010
87	0.620	0.613	0.678
F3 Transcendence of Time and Space			
65	0.727	0.667	0.010
48	0.732	0.687	0.616
2	0.574	0.642	0.130
29	0.483	0.306	0.038
34	0.702	0.758	0.509
15	0.449	0.449	0.410
F4 Ineffability			
23	0.715	0.755	0.757
86	0.741	0.604	0.226
6	0.877	0.827	0.152
Correlations			
Positive mood, Mystical	0.888	0.751	0.087
Transcendence of Time and Space, Mystical	0.858	0.778	0.172
Transcendence of Time and Space, Positive mood	0.742	0.772	0.062
Ineffability, Mystical	0.687	0.545	0.216
Ineffability, Positive mood	0.701	0.678	0.575
Ineffability, Transcendence of Time and Space	0.661	0.665	0.403

Discussion

Differences in correlations between factors of the data from MEQ30 freediving survey in two languages are practically insignificant. Most differences are in the first factor, but they are not unidirectional, some are bigger, some are smaller. On the remaining 3 factors the loadings from the survey in Russian are bigger than the loadings from the English survey version. Overall the differences are minor ones, thus we tend to conclude a similar factor structure of Russian and English Freediving versions of the survey, and both are similar to the initial MEQ30 factor structure, which in turns leads to a *conclusion* that the mystical experience in freediving is similar to the one in religious practices and in psilocybin use and in religion (from where the MEQ30 originated).

There were mostly two types of objections in discussing our findings.

One type of objections came from people unfamiliar with surveys and/or with factor analysis. Even psychology graduates were not immune to this. Such objections could *sometimes* be dealt with by explaining the basics of the methodology.

Second type of objections was induced to an apparent absurdity and ineffability of Mystical Experience from any common sense or everyday perspective. The objectors were even more suspicious, because despite decades of Navy research in CO₂ poisoning, nobody investigated it's subjective manifestations or mystical experience underwater. Scientific curiosity might help researchers to take mystical freediving accounts in the first degree, not as metaphors.

After we found publications on high dose of dimethyltryptamine (DMT) endogenous synthesis in hypoxic lungs, and discussed of searching for DMT metabolites in the blood during freediving competitions, Dr. Attila Szabo suggested an easier search in the urines. Gas chromatography tandem mass spectrometry (GC-MS/MS) methodology for detecting a DMT-NO metabolite is already described in literature (McIlhenny et al., 2011). GC-MS/MS urine tests are already part of doping-test protocol in freediving competitions. Persuading an anti-doping lab (*List of WADA-Accredited Laboratories*, 2022) to add the DMT-NO to the 500+ already tested substances can be an interesting way to investigate this possible mechanism of ME underwater in Freedivers, in Drowning accidents, in pathologies like blood-loss, strokes, impaired breathing.

How biased were our self-selected respondents? Would mystical experience be accessible to each and every freediver? Unfortunately we did not collect any demographics in the mystical survey. We attempted a follow-up anonymous online survey, including demographics' items plus seven psychological scales, to correlate life experiences and personality traits to mystical experience. It yielded ~1800 views, 85 respondents for 190 items [Annex 9: follow-up survey]; plus ~1400 views, 97 respondents in a short test survey of only 4 items to assess self-selection bias. Thus there was a similar proportion of self-selected respondents in both cases: one group of respondents generously contributing personal time for the 190 items survey, and a second group, contributing to just a 4 items short and easy survey. Thus the proportion of biased participants *seems* independent of the amount of time/effort asked for. This may indicate a strong bias into naturally agreeable selfless respondents (DellaVigna et al., 2012). Raw data from the 190 follow-up survey are open to download from Harvard Dataverse for further investigation.

What about the (in)accessibility of ME underwater to each and every freediver? Mindset-and-setting is supposed to be an important prerequisite for mystical experience in freediving. We did not investigate this mindset-and-setting aspect. Though the positivity and optimism transpiring through the “cover-up” questions' scores might provide a clue on respondents' mindset-and-setting bias in our case.

Several champions and freediving instructors pointed out two major obstacles to a relaxed reassuring *mindset-and-setting* in freediving (which mindset-and-setting is a prerequisite to ME).

One obstacle is that freedivers become goal-oriented seekers of sport performance (Annex 6). Popular belief in achieving goals through grit is inline with such an attitude. This goal-fixation *allegedly* hinders the onset of mystical experience even in deepest dives with higher CO₂ partial pressure. Some instructors teach mindfulness meditation (or a similar wide-attention-span “deconcentration of attention” training) which *allegedly* reduces egocentric goal-fixation. Freedivers report two attitudes or personalities in champions: process-oriented vs. goal-fixated ones.

Another obstacle to the “letting go” “feeling safe” mindset-and-setting, *seem* to be related to high neuroticism (a Big Five trait), or related to a reluctance to openness or letting go, or a manifestation of a strong desire to control everything out of fear of narcosis or whatever monsters would be lurking from the abyss to harm the freediver. Especially it might be the case if the freediver is skipping steps of progress out of greed or pride, or when diving into murky waters. Nevertheless many freedivers do accept the need to “let go”, because any psychological tension is *supposedly* bad for saving oxygen. Compassionate meditation was suggested as a way to improve the relaxed mindset of freedivers. Yet for now most freedivers are only advised to keep a slow secure pace in increasing depth.

Conclusion

Known for its benefits in terms of coping with stress or addictions, and of attaining a happy meaningful life, and helping to solve ethical dilemmas, *Mystical Experience is confirmed to sometimes occur in Freediving*. It is the same experience known to happen under psychedelics or in western religious practice or in buddhist meditation.

Further Research

Further proof is needed to verify if the relaxed mindset and a calm setting in freediving are helping to achieve Mystical Experience (ME), while competitive goal-fixation in freediving would be hindering ME.

A possible link of mystical experience to the endogenous DMT during freediving hypoxia or hypercapnia is yet to be investigated using GC-MS/MS. Also in this regard the Greyson's NDE Scale along with MEQ30 might be used to eventually differentiate the impact of freedivers' blackouts, if any.

A survey of Freedivers with the NDE Scale is also interesting to conduct.

A potential practical application from Technical Freediving, i.e. O₂-inhaled freediving, is interesting to investigate in a shallow pool static apnea, as a possible way of getting mystical experience for non-freedivers (thus as a way of coping with stress or adversity). If confirmed as a source of ME, such Technical Freediving may benefit to distressed persecuted minorities, to PTSD sufferers, to money-making business executives dealing with stressful

conflicts and *ethical dilemmas*, to addicts, to healthy individuals in search of a meaningful life, to artists in search of inspiration, etc.

Since ME improves one's expression of compassion, and compassion is correlated with business-executives efficiency in money-making, such hypothetical application of mystical freediving to improve managerial money-efficiency is interesting to verify (while at the same time giving researchers a justification for getting funds to do so).

Who did what and acknowledgments

The research was not funded, all contributors are volunteers.

We are most grateful to all Freedivers across the World who responded to the survey and volunteered their time and shared their insights. Thanks to Stephan Whelan, Alexey Molchanov, Natalia Avseenko, Guillaume Néry, Marianna Krupnitskaya, Sara Campbell for endorsing and reposting the call for participation; to all researchers and freedivers for their helpful and (sometimes long) discussions and critique of this research. In particular we'd like to thank S.Campbell, H.Nitsch, Dr.N.Avseenko, U.Dextegen, A.Molchanov, J.Apokotos, A.Duvivier, I.Azhikin, A.Matveenkov, T.Zemskikh, E.Sychev, E.Fattah, Dr.O.Rysakova, Dr.R.Griffiths, Dr.F.Barrett, Dr.D.Nutt, Dr.R.Vann, Dr.N.V.Cozzi, Dr.K.Maclean, Dr.N.Kruglov, Dr.S.Dolenko, Dr.A.Efitorov, S.Lourenco, MD.A.Grousset, Dr.I.Zabkov, N.Zabkova, Dr.K.Lussier, MD.E.Butov, MD.D.Komissarov, Dr.G.Tutrina, Dr.Y.Tutrin, Y.Tutrina, G.Serova, T.Soboleva, O.Freedman, D.A.Cordova, B.Denys, Dr.E.Frecska, Dr.A.Szabo, Dr.O.Roques, F.Lecaer, Dr.F.Lemaitre, F.Geffroy, A.Solomons, R.Escalante, J.Carr, O.Voronina, V.Korsun, MD.S.Knyazeva, S.Zimin, K.Kriworuczko, Ilia-X, Eugene-X, Ivan-X, Y.Shmatko, A.Guseva, N.Vassilieva.

For the issue of our deceased co-author (Teixeira da Silva & Dobranszki, 2015), at our best knowledge late Natalia Molchanova would sign the paper, though she might have insisted on a more strict academic style. Alongside Andy Tutrin she was involved for several years in this research. Besides the very final version of the statistical analysis (consistent with previous drafts), she was fully aware of all the findings, and she was a major contributor to this research.

Olga Mitina and her PhD student Mir Mirsaidov did the final confirmatory factor analysis.

Natalia Molchanova initially validated the overall design of the research, checked and corrected the online questionnaire, rallied the freediving community for participation.

Andy Tutrin came up with the endogenous CO₂-narcosis hypothesis and the idea of MEQ30 in freediving, self-tested O₂/CO₂ and air/CO₂ versions of Meduna mix on couch and in pool as a feasibility study, set up the online survey at Google Forms, coordinated the project, and compiled this paper. Several freedivers also self-tested Meduna mix or O₂-assisted apneas.

The Johns Hopkins team (R.Griffiths, F.Barrett) and the Skobeltsin Nuclear Physics team (S.Dolenko, A.Efitorov) generously helped and inspired and commented this work, F.Barrett did a draft factor analysis, though all declined further involvement.

Andre Grousset (from the Medical Commission of the South branch of the non-for-profit French Federation FFESSM) encouraged us to finalize this paper and paid for the trip of Andy Tutrin to report the results at the 22 Hyperbaric Medicine Conference in Toulon, France (“vingt-deuxieme journée toulonnaise de médecine de plongée”).

At our best knowledge there are no conflicts of interest in this research project.

Annex 1: one-page recap

482 freedivers survey loadings compared
to the original MEQ30 survey of 1602 people

MEQ30 in freediving, total scores distribution

Factor loadings, mystical surveys in Freediving

items MEQ30 No	Russian questionnaire	English questionnaire
F1 Mystical		
Internal Unity new	0.927	0.974
External Unity	0.862	0.827
Noetic Quality	0.827	0.766
Sacredness new	0.825	0.839
F2 Positive mood		
5	0.451	0.623
18	0.721	0.550
30	0.600	0.619
43	0.699	0.596
80	0.796	0.631
87	0.620	0.613
F3 Transcendence of Time and Space		
65	0.727	0.667
48	0.732	0.687
2	0.574	0.642
29	0.483	0.306
34	0.702	0.758
15	0.449	0.449
F4 Ineffability		
23	0.715	0.755
86	0.741	0.604
6	0.877	0.827

Factor loadings (psilocybin survey, MacLean et al, 2012)

Item 83	.86	-.01	.01	.00
Item 69	.82	-.12	-.09	.10
Item 22	.79	-.15	-.01	.14
Item 77	.74	-.04	.16	-.09
Item 47	.74	.11	.00	-.03
Item 35	.68	.12	.05	.00
Item 41	.68	.14	.06	.01
Item 73	.68	.14	-.07	.00
Item 36	.67	.15	-.08	.03
Item 54	.65	.08	.10	-.05
Item 9	.60	.01	-.07	.17
Item 12	.59	-.08	.34	-.03
Item 74	.52	.26	-.02	.04
Item 14	.45	.27	.05	-.02
Item 55	.45	.28	-.02	-.04
Item 87	-.06	.92	-.02	.02
Item 43	.03	.76	.10	-.03
Item 30	.15	.71	-.05	-.09
Item 18	.12	.57	.02	-.07
Item 80	.15	.56	.04	.15
Item 5	-.03	.48	.02	.33
Item 15	-.10	.03	.74	.01
Item 65	.13	.11	.73	.01
Item 2	-.15	.07	.64	.15
Item 29	-.11	-.10	.64	.06
Item 34	.40	-.07	.57	.00
Item 48	.46	-.03	.52	-.10
Item 6	-.02	.03	.05	.85
Item 23	.09	.00	-.01	.83
Item 86	.06	.08	.05	.66

Annex 2: Personal accounts from a deep freediver and from commercial divers

Quotes were picked-up and translated from various publicly available media. Quotes are grouped by mystical experience factors.

Mystical Experience Questionnaire MEQ30	quotes from interviews with N.Molchanova [collected and translated from youtube and molchanova.ru]	BBC documentary, depths up to 180 m, He+O ₂ , i.e. N ₂ - narcosis excluded (Littlemore, 2007)
<u>Factor 1: Mystical</u> Internal Unity 35. Freedom from the limitations of your personal self and feeling a unity or bond with what was felt to be greater than your personal self. 41. Experience of pure being and pure awareness (beyond the world of sense impressions). 54. Experience of oneness in relation to an "inner world" within. 77. Experience of the fusion of your personal self into a larger whole. 83. Experience of unity with ultimate reality. 12. Feeling that you experienced eternity or infinity.	..dissolve one's consciousness; ..first (my) thoughts are swirling, chasing one another, I try to slow them. Any process of (conscious) thinking would finally stop; ..(some of) the consciousness should however be kept, when it starts to fade away, (one) must start the ascend;	.. you can hear your own breathing;
External Unity 14. Experience of oneness or unity with objects and/or persons perceived in your surroundings. 47. Experience of the insight that "all is One". 74. Awareness of the life or living presence in all things. Sacredness 36. Sense of being at a spiritual height. 55. Sense of reverence. 73. Feeling that you experienced something profoundly sacred and holy.		
Noetic Quality 9. Gain of insightful knowledge experienced at an intuitive level. 22. Certainty of encounter with ultimate reality (in the sense of being able to "know" and "see" what is really real at some point during your experience. 69. You are convinced now, as you look back on your experience, that in it you encountered ultimate reality (i.e., that you "knew" and "saw" what was really real).	..something profound and ontological revealed itself in my soul; and.. it brings-in an amazing feeling of another reality; ..after 35 m came a sensation as if all became unreal. I still do not understand and cope with how this happened; a sensation of unearthly life;	
<u>Factor 2: Positive Mood</u> 5. Experience of amazement. 18. Feelings of tenderness and gentleness. 30. Feelings of peace and tranquility. 43. Experience of ecstasy. 80. Sense of awe or awesomeness. 87. Feelings of joy.	Freediving drove me away from everyday fuss. Any exasperation is gone from my life. .. unforgettable pleasure and incomparable emotions. ..state of euphoria;	it's very calm very quiet down there.. very serene.. it's very calm; the feeling of being weightless;

	<p>..., a feeling that the World is cuddling you gently, an absolute bliss;</p> <p>At 35 m euphoria kicked-in, in no other place I felt like this;</p>	
<p><u>Factor 3: Transcendence of Time and Space</u></p> <p>2. Loss of your usual sense of time. 15. Loss of your usual sense of space. 29. Loss of usual awareness of where you were. 34. Sense of being "outside of" time, beyond past and future. 48. Being in a realm with no space boundaries. 65. Experience of timelessness.</p>	<p>You are kind of out-of-time, the time disappears, it is swallowed away; Any space kind of disappears, it becomes concealed, hidden;</p> <p>...from 40 to the ultimate 80 m I was like soaring in weightlessness! I relaxed and was don't know were;</p> <p>..a feeling of dissolving oneself in space.</p>	<p>it's eh.. very like what it is on the moon I suppose.</p>
<p><u>Factor 4: Ineffability</u></p> <p>6. Sense that the experience cannot be described adequately in words. 23. Feeling that you could not do justice to your experience by describing it in words. 86. Feeling that it would be difficult to communicate your own experience to others who have not had similar experiences.</p>	<p>(I only try to express it in poems and videos)</p>	<p>It's .. eh.. hard to explain</p>

Annex 3: Account of mystical experiences during O2-assisted dry apnea and static apnea.

Translated into English from Igor Azhikin Facebook page (April 12, 2015).

..to try an O2-static apnea. Usually freedivers have no such experience, but I gave it a try (translator note: they were planning a stunt for a trade show). First I rehearsed it on-land, one week prior to the trade show. Breathe oxygen for 14 minutes (to flush all useless nitrogen from the lungs), and did a 10 minutes breath-hold on a bench in the locker room of my club. The bench was not comfortable, so I put a towel under my head. Knees bent, nose pinched with a freediving nose clip. After 9 minutes I was thrown into some sort of altered consciousness. Stayed in it for 1 minute and decided to stop. At the trade show in the water it was exactly the same, but I stayed longer. I guess it was CO2-narcosis. Feels like a strong drunken state, but I was able to keep self-control, keep track of the reality, asking myself questions kind of "what's my name?" "what I am doing here?". But in parallel to this, the head was filled with out-of-nowhere ideas about the existence in general, about me being part of the universe, the purpose of me coming to planet Earth, and plenty of such stuff and all simultaneously. Curiously there was no dialogue, no words, but some kind of conceptual insights, pictures, feelings/perceptions, and a distant-emotional background. At minute 10 at the beginning of it I was happy as a child to feel it, later I managed to somehow start to observe it from a distance and get rid of bodily sensations. Another great thing: bodily discomfort and diaphragm spasms stopped bothering me, they became of no importance, and I went into a great state of absolute relaxation. I was just aware: aware of my state and of the surrounding crowd. At minute 11 safety tried to pull me of the water, but I managed to signal them I was in full control and managed to get rid of them! All the time from minute 10 my state was stable, no deterioration or urge to breathe whatsoever! I stopped controlling the time stopped looking at the timer, and finally pulled myself out of water just because of a cautious taught that it might be 15 or 16 minute and I should not go to my limit at this first time. Although I believe I could have stayed longer. Indeed Tom Sietas did 22 minutes. Don't know his conditions, but mines where not perfect: I was on my feet the 4 hours before the dive, making different arrangement on the show, managing the event, helping those who went to their dives before me, so I was not really relaxing my mind, my legs where pretty tired, I could not do any breath-holding warm-up before the attempt, I was not introspected, did no breathing exercises. On the positive side I did 20 minutes of pure oxygen breathing before the dive, so it provided me with some relaxation of mind and body. Also next time would be great to register a trend from a heart monitor, and blood oxygenation. I went out not blue at all. Blood oxygenation is indeed a reliable parameter of how extreme is the breath-hold. We don't want any self-harm here! The safety should be well briefed: they should be experienced in managing such a dive, monitoring and providing guidance, knowing what to do and eventually when the freediver should come out of the water. (etc.. thanks to.. etc.. skipped in translation).

[source in Russian: www.facebook.com/azhikin/posts/832654370138000]

Annex 4: Online call for participation (message from freediving world champion Natalia Molchanova,

endorsed and relayed by several others big names of the freediving community):

Dearest Freedivers!

Diving give us an opportunity to experience something difficult to put into words, something hidden in space and time. Share your personal feelings of your dives, it will let us speak clearly about this sort of oceanic feeling in freediving. Please contribute a little of your time to this anonymous questionnaire:

(link url)

Annex 5: hypercapnia stays below narcosis threshold at sea level freedive (in a pool)

An extraordinary long 200 m pool dive yielding 45.2 mm Hg CO2 hypercapnia, corresponds to a partial pressure of only about 6% CO2 inhalation, not enough to get a CO2 narcosis (dives by the champion Alexey Molchanov) (Molchanova et al., 2013)

Even longer 300+ m record pool dives should be investigated though.

distance underwater, m	Pet CO ₂ , mm Hg	PetO ₂ , mm Hg
50	32.4	108.7
100	28.5	112.8
150	35.1	106.3
200	45.2	65.9

= Annex 6: goal-oriented vs process-oriented mindset in freediving

[data collected online by A.Tutrin from national freediving federations' websites]

Statistics from National freediving competitions (Russia, France, 2014-2016), Men, dynamic apnea with fins (DYN)

mindset and setting

"vanity" goals?

"let go" vs. ego

Annex 7: Raw Data. Freedivers' mystical experience survey. Raw data containing the MEQ 30 items, plus the 60 or 70 cover-up questions, 5-points Likert scale. Both versions (Russian and English) of the survey data are available online at Dataverse Harvard along with the responses collected from anonymous freedivers (Molchanova & Tutrin, 2020).

Annex 8: Raw Data. Beginner Freedivers' motivation to learn freediving at Molchanovs' courses. This sample contains raw data from 427 people. It was randomly chosen and digitalized from a bigger number of disclaimer forms initially signed by beginners in the years 2000s and 2010s. Contains motivation (multiple choice standard options plus a free text field), static apnea breath-hold time (after two warmup attempts along with soothing breathing), distance freedived with and without fins in a pool at the end of a pool session, all at the beginning of a one-week course. Downloadable from Dataverse Harvard (Molchanova, 2020).

Annex 9: Raw Data. Follow-up survey

This survey in Russian was posted in the Freediving Federation official group on Facebook (approximately 5k members), and included 50 cover-up questions about different more or less desirable features of the Freediving Federation activity, plus seven scales (5 points Likert): self-compassion scale (Neff, 2003), Big Five personality traits (John et al., 2008), satisfaction with life (Diener et al., 1985), 15 items from MEQ30 (MacLean et al., 2012), 6 items out of the tobacco GATS survey and similarly formulated legal alkaloids use questions (World Health Organization, 2007), social desirability scale shortened to 19 items out of 33 (Crowne & Marlowe, 1960), 10 yes/no items of adverse childhood experience (World Health Organization, 2014), and 11 items on demographics. Raw data and translation into English is available online at Dataverse Harvard (Tutrin, 2020).

Annex 10: Further Research - Brainstorming, Anecdotal evidences, Literature

There is obviously some vulgarization in this paper as an attempt to suggest to multi-discipline researchers to push further into this controversial mystical/religious physiology, psychology and sociology fields. Indeed an important source of new discoveries is the communication between scientific disciplines across terminological barriers and against compartmentalization of science (A. Jackson, 2014). This being said, we try to avoid falling into propaganda (Pratkanis, 1995).

Inspiration and anecdotes from Freediving

Mystical Experience in Freediving is sometimes shared anecdotally, and it is usually reported to spontaneously happen around at least 40 - 50 meters of depth. To go that deep, a beginner freediver has to learn an advanced technique of pressure equalization in the ears, to improve his or her capacity to relax muscles and mind, and to learn a long enough breath hold. This research is inspired by accounts of such freedives along with a similar account from professional divers breathing a He-O₂ mixture (thus eliminating N₂-narcosis and leaving endogenous CO₂ as a possible narcotic in case of slow breathing or skip-breathing) [Annex 2: BBC documentary and N.Molchanova interviews on mystical experience].

A relatively new and sometimes controversial "technical freediving" is using oxygen-enriched inhales for staying longer underwater [E.Fattah, personal communication]. In this case a narcotic concentration of endogenous CO₂ may be reached at a lesser depth or even in static apnea at the surface. [Annex 3: I.Azhikin account of mystical experience in O₂-assisted static apnea, plus personal communication]

Mindset-and-setting is not always perfectly soothing in freediving. Some high consciousness (Big Five trait) and/or very egocentric competitive freedivers anecdotally report feeling insecure or aggressive or goal-oriented, which hinders the mindset-and-setting required for mystical experience. One high consciousness champion freediver subjected by us to the tearjerker "Little Match Girl" story by Andersen reported thinking of failed social support for the Girl, and feeling anger and frustration, instead of selfless compassion (towards which a dramatic story is aimed for). In pool competitions when swimming underwater the longest distance possible, some freedivers stay goal-oriented, probably pursuing selfish vanity goals [Annex 6: freediving pool national competitions results, frequency graph]. After reviewing a randomly selected 427 signed forms of beginner freedivers taking courses at Molchanovs, we found that nobody reported any altruistic motivation about learning freediving in these liability waiver forms (in a blank line under a suggested selection of a few selfish options) [Annex 8]. Such egocentric attitudes are also contrary to the mindset-and-setting prerequisite for mystical experience.

The problem with learning about mystical experiences in freediving is that not all big champions had it in its fullest form, and freedivers rarely talk about it, and mostly people don't take such accounts literally. For example when in "The Big Blue" movie by Luc Besson the hero played by Jean Reno surfaced as a changed man after near drowning and apparently having had a mystical experience, moviegoers just take it as cinema. Bits of what seem to be partial or full mystical experiences are found in books or accounts from champions: (Nitsch, 2017), (Mathieu, 2018), Jessea Lu interview about her full mystical near-drowning experience in a 2018 documentary (French, 2018), Sara Campbell interview (Wilkinson, 2009), etc.

Late Dr Natalia Molchanova the co-author of this research was the world's most decorated freediver, with 41 world records and 23 world champion titles in freediving (Ap for CNN, 2015). She started training and competing in freediving in her 40s. Although she never made any secrets of publishing and sharing her training routines or underwater experiences, she felt that mystical is "too personal to share it openly, especially before having any scientific proof of it", so her mystical experiences were only expressed in poetry or videoclips or by small bits in interviews [Annex 2: BBC documentary and N.Molchanova interviews on mystical experience compared].

Feasibility self-experimentation

Before we learned the existence of MEQ30 and the methodology of the psilocybin anonymous online survey, we self-experimented replicating ME in freediving as a mystical experience feasibility test with O₂/CO₂-assisted breath-holds (on a couch and in a pool). A flawed design in our self-experimentation with CO₂- and O₂-assisted breath-holds lead to some success and mostly to failures in reaching Mystical Experience. Indeed at the time we had no idea about the importance of a reassuring mindset-and-setting, so a majority of breath-holds with added CO₂ or O₂, or breathing up to 50% of CO₂ yield nothing but an urge to breathe and/or visual hallucinations. A minority of such attempts on a couch or in a pool brought mystical ineffable trips to Beyond and feelings of universal love and joy.

The production of N,N-DMT by the placenta or the lungs somehow *reminds* the mystical birth theory from Stanislav Grof. A possible impaired blood-flow in the brain during S.Grof's hyperventilation technique, would be possibly due to brain's vasoconstriction induced by a depletion of CO₂ in the blood through hyperventilation (it would be interesting to check such practitioners for endogenous DMT and for brain-blood-flow in a fMRI machine).

Trip into mystical Beyond as a taboo

Mystical experience is often more significant for a person than the birth of a first child, or a death of a parent (MacLean et al., 2012). Unfortunately such an important event is often considered taboo, due to it's perceived sacredness and ineffability.

"We do not talk about such very personal things; and people won't understand it; unless we'd have solid science" [N.Molchanova, personal communication]. "The only way we get somebodies' attention (among top ranking officers or in medical departments in US Army) is if they are experiencers themselves [D.Corcoran, personal communication] (of Near Death Experience, which has similarities with Mystical Experience)" (Timmermann et al., 2018). "There remains a huge degree of skepticism on whether this is an appropriate way to treat patients (through Mystical Experience)" (Griffiths, 2017).

Neurophysiology of CO₂ (hypercapnia and psychedelics)

When a freediver is holding breath, CO₂ is naturally accumulating in the tissues and in the lungs.

Researchers still don't know how exactly CO₂ interacts with the neural system, though some research is conducted now and then (Iceman et al., 2013) (Buchanan et al., 2015). Sometimes CO₂ at less than 10% in the air

is used in experiments as a stressor (Bailey et al., 2005) though a small percentage of subjects love it [Dr D.Nutt, personal communication]. Buffering a dog's blood pH helped an anesthetized dog to survive during an hour long hypercapnia CO₂ buildup (the dog was not ventilated, i.e. was intubated and fed vital O₂ by diffusion). Another dog's unbuffered blood pH dropped linearly and this poor dog ended up dead after an hour (US Department of Defense, 1963).

In hypoxic humans a specific enzyme is quickly activated in the lungs and the psychedelic DMT is synthesized from tryptophan and it floods the brain, and passing through a series of dedicated transport gates into neurons, it protects hypoxic neurons accumulating byproducts of hypoxia-impaired metabolism, it protects them by switching off their death by apoptosis (Barker, 2018) (Szabo & Frecska, 2016). There is no indications that this mechanism is induced by hypoxia (lack of O₂) rather than hypercapnia (excess of CO₂). N,N-DMT is quickly metabolized into an inactive DMT-NO, which should be detectable in the urine of (blacked-out or just very hypoxic?) freedivers (and maybe also in cardiac-arrest experiencers of Near Death). The methodology of DMT-NO metabolite detection already exists (McIlhenny et al., 2011) (Barker et al., 2013).

CO₂ is known to be a strong narcotic (Joiner, 2010) and was used as anesthetic before the invention of better anesthesia in surgery. Later CO₂ was used and still is occasionally used today to increase blood flow in the brain. And CO₂ is safe to inject into the bloodstream for X-Ray contrast in angiography.

In psychotherapy, as a treatment of anxiety and stress, Ladislav Meduna and his followers pioneered the use of a psychedelic effect of CO₂ in the 1930s - 1950s, performing tens of thousands of sessions at 30% CO₂ mixed with 70% O₂ (Meduna, 1958). One spectacular case was the therapy of distressed inmates in a high security prison (as medicating or couch-talking them out of distress was obviously not an option). The notion of mindset-and-setting was unknown in those times, so prisoners were breathing the psychedelic O₂/CO₂ mixture in a common room, in view of other unfriendly inmates queuing and laughing at each-other. Nevertheless after tens of sessions per person, chances of getting one mystical experience were realistic, and some prisoners were reportedly cured from distress (or was it post-traumatic stress disorder?), and allegedly they would later become law abiding churchgoing citizens (Harry, 1958). Further research on the criminal population however was not successful, then psychedelics-assisted psychotherapy switched to LSD and went to a stop with the worldwide ban on psychedelics. After the ban, Meduna Mixture have not become mainstream and faded into oblivion. Maybe the view of a patient "switched-off from reality", and breathing heavily violently, was too much to bear for young prospective therapists.

Philosophy of feeling Mystical Experience

Freedivers sometimes argue whether the Mystical Beyond is real or is it just an illusion, a perception fabricated by the mind. "Qualia" is a term for personal subjective perceptions of one's experience.

Newborns were cut alive without anesthesia by surgeons, as babies were considered to be a sort of philosophical zombies, not having any *qualia*. This inhumane approach continued unchallenged until a 1987 paper about how newborns do suffer pain as a "*quale*" experience (Anand & Hickey, 1987). We still lack full understanding of pain neuroanatomy, but babies are now given anesthesia, despite the illusionary nature of quale i.e. the feeling of pain in this case. The same discussion goes in sports: for example pain in burning muscles would be an illusion

fabricated by the brain to preserve the heart, as in the lactate Everest paradox (Noakes, 2009), and idem pain is an illusionary feeling when a rubber substituted hand is pricked by a fork (Botvinick & Cohen, 1998). Illusionary qualia and conscience *would* have evolved for a useful purpose. For example, it helps finding saliently red flowers (F. Jackson, 1986) amidst green grass, or it helps reading a scrawly yet familiar handwriting. People enjoy useful pleasant qualia, even if people might struggle with a practical idea of counteracting unproductive pain or anger quale with a more useful loving quale in sport competitions or in martial arts.

For a practical purpose though, industries do manufacture and sell red-quale color paint for attractively red roadsters, without knowing how the quale of red color is wired in humans or in shrimps. Engineers can't wire subjectively compassionate love-quale-feeling robots, neither researchers know if love had already evolved (Marsh, 2016) 480 millions years ago in a shrimp bothering to care for its eggs (Caron & Vannier, 2016). This lack of knowledge is of no importance for practical applications of the red color quale as well as applications of universal love feeling. Thus artists do practice imagination for method acting (Stanislavsky, 1936) to recreate love-in-mindset through a fictional story-and-setting script, acting on stage or on screen, and filmmakers touch filmgoers' hearts. Also filmmakers use a gimbal mount for a camera to imitate a steady eyesight's quale within a movie, without knowing exactly why conscious eyesight is not jerky when people walk, as a shaky camera is. People make touching movies for pleasant cinematic experience or for propaganda or for ads, without knowing how a touching quale experience is made inside the viewer's head.

Before solving an "easier" riddle about how "simple" animals experience color, or before recreating qualia in robots (and thus solving the hard problem of consciousness), it is premature to argue over the reality or the illusion or over a dual nature of some controversial universal love or mystical experience or a feeling of metaphysical realms.

Mystical experiences inducing a feeling of compassionate love can serve just a practical purpose. For now.

Water, drowning, and more Paths into mystical Beyond in cultures

As said above, Mystical Experience and similar to it Near-Death Experience, probably affect tens of millions of people after such events as massive blood loss, stroke, respiratory or cardiac insufficiency, drowning, CO₂-narcosis, grief, dangerous or dramatic situations including war and death of loved ones, floating sensory deprivation, temporal lobe epilepsy, religious or spiritual practices. By the way, it would be interesting to submit MEQ30 in such extreme sports as Skydiving or Big Wave Surfing, or in a perfectly easy Sensory Deprivation (Floating) activity.

We can speculate that in different cultures Drowning and/or Freediving may be a possible origin of beliefs in mythological passage to Beyond through the water. Consider the epic hero Gilgamesh in the story from 4 thousands years ago, as he "went into the Realm of Death" while he was freediving to the bottom of the sea (Stephens, 2019). The Indo-European root "ViR" is found in words "Iram" or "Viram" meaning "Heavenly Beyond" in the Zoroastrian religion and in Slavic countries predating Christianization. For lack of seas in continental areas, ("freediving" or near-drowning) "gates into Beyond" were dangerous whirlpools in rivers (Levkievskaya, 2004). In Russian language a whirlpool is called "vodo-VoRot" (literally 'water-rotation') or "ViR" in Ukrainian. The same rotation or circling idea of the Indo-European root "ViR" is found in Ancient Greek (vir -> gyr "gyroscope") and in

Latin (vir -> French "virage"), dating back to an idea of a ring in Ancient Greek or of a bracelet in Latin, as these items made of bronze wire were circling a finger or a hand. Circles of rotating water in dangerous deep spots of a river seem to be also evocative in this Slavic curse "you go to ViR" in the sense "go to Hell"

Compassion or/and Mindfulness?

(clues about compassion helping to manage pain-or-effort in sport and in business)

Does compassion play a practical role in pain-management, in motivation, in recuperation between workouts? It is suggested in martial arts to use compassion as a tool to push out of one's mind any anger or fear during a fight, for in turn better relaxing antagonist muscles ("reciprocal inhibition") in order to hit the opponent harder. Also compassionate relaxing of the body and mind is better than anger for learning techniques and for pushing one's efforts beyond failure, as if lives would depend on it (Robert, 1971) (*Aikido, Power, and Generational Trauma*, Paul Linden PhD (Interview), 2020). Selecting candidates into special forces, according to popular documentaries, relies among other, on compassionate mutual support between soldiers within a small group. Yet much emphasis is also put on the mindful meditative state or "flow".

Which one is more efficient to alleviate fear and suffering: mindfulness or compassion, or a combination of both?

Arguments for compassion (sourced from ME)

Bullet ants extreme pain in a rite of passage *seems to be* relieved through compassionate hugs and body-to-body dance with supportive fellow tribesmen. Many primitive cultures as well as modern military have evolved painful rites of passage *supposedly* as a way to teach compassionate courageous team spirit vs. egotistic cowardly whining. Or is it intended to screen-out non-compassionate people out of teams operating in a deadly environment? Sometimes cultures associate the selfless loving kindness (gained from a religious trip to Beyond), with the ability to withstand a painful self-mortification or even a painful self-immolation as for the monk Thich Quang Duc (Associated Press, 1963).

Grenade leaping self-sacrifice only happens when compassionately saving a teammate, not as a result of any "grenade leaping training", nor to improve an outcome of a battle (Blake, 1978). Ancient samurai utilized zen-buddhism *allegedly* for a better performance in combat, i.e. they practiced a combination of mindfulness and compassionate loving kindness and followed ethical rules of virtuous living. Compassion alleviates distress by reducing counterproductive self-criticism (Neff, 2003). In turn, a lower self-criticism *anecdotally* improves the efficiency in learning freediving [champions T.Zemskikh, A.Matveenko, personal communication].

Missed research opportunities. Before the ban on substances, the Army missed the opportunity to investigate any "heroic compassion" hypothetical boosts by mystical experiences induced by the psychedelic LSD (Ketchum & M.D., 2006). The Navy never studied mystical experiences from hypercapnia (US Department of Defense, 2011) (Joiner, 2010). Neither Mystical Experience nor Near Death Experience *seemingly* have not been investigated in the Army.

In the 1990s the US sniper Chris Kyle's *reportedly* had a compassionate selfless desire to go to war to protect his fellow soldiers. His motivation to go to war *appears* similar to the one of 1944 female Soviet sniper Rosa Shanina (Kyle et al., 2012) (Shanina, 2014). Hundreds of cases of brutally painful suicide by fire are always an altruistic public statement, motivated by a will to correct some injustice for the public good (Laloë, 2004). Heroic altruists are *deemed* to be ordinary people, having unwillingly, effortlessly and spontaneously switched into a selfless mode when their fellow companions or strangers appeared to be in danger (Marsh, 2016) (Marlantes, 2011).

MMA martial artist and champion Fedor Emelianenko had stepped up his career after *allegedly* having a religious revelation while visiting Diveyevo Convent as a tourist and talking to priests there. The same intuitive feeling of the grace of God resulting out of a discussion with a believer is *subjectively* linked by tennis champion Mary Pierce to her second single win of Grand Slams' title in 2000 and to her gain in overall happiness. Twice decorated for saving drowning and burning people, the fin-swimmer Shavarsh Karapetyan *appears* in the media accounts as a compassionate selfless hero, and coincidentally he is a big champion.

In many of such examples, we can reasonably *suspect* compassion to help reducing fear-and-pain and to help increasing efficiency with the task at hand, at least for *some* people.

Return On Assets (ROI) in US companies managed with compassion (thus with integrity, responsibility, forgiveness) is about 5 times superior compared to companies lead by egotistic callous leaders. This was found after recruiting and extensively testing and assessing the traits of less than a hundred CEOs directly and through the eyes of over 4000 of their employees anonymously, and correlating the CEOs traits with the financial results of their companies (all corrected for the impact of different macroeconomic factors and business strategies) (Kiel, 2015).

Almost a Trillion dollars opportunity was missed in the refusal of purchasing Google by the CEO of Excite in 1999. It is considered to be the most costly error in the history of business. Egotistic hubris (i.e. lack of compassion) is a *plausible* cause of this error, according to accounts of the story by different protagonists.

The billion dollars success and gain from building and selling the Zappos company is *allegedly* linked to hiring compassionate hotline employees, against the odds and against all advice (Hsieh, 2010).

Successes of JAL airlines in the US market were *allegedly* based on Buddhism and on the strategic culture of Go, both more close to win-win thus less aggressive than the western Chess win-loose culture (Miura, 1995). *The same goes* for the success of non-competitive *thus supposedly non-aggressive* win-win Blue Ocean Strategy of efficient money making (Kim & Mauborgne, 2017).

The coldhearted selfish Homo Economicus is not even considered anymore as a suitable model of successful business behavior (Constable et al., 2016) (Fleming, 2017) (Bowles, 2017). On the contrary, compassion and altruism appear as traits favoring managerial and sales success or efficiency (Futrell, 2012) (Hansen, 2018).

For family happiness, a "compassionate" look into a spouse's view on conflicts was performed during 7 minutes once every 4 months (not daily; just one time every 4 months, i.e. 21 minutes per year). In 60 couples over 3 years

it preserved a constant level of affection, while in a control group affection was steadily deteriorating (Finkel, 2017). Such link between compassion and happy relationship reminds the longest adult life study (Waldinger, 2016), in which happy relationship is positively correlated to health even more than a healthy lifestyle or a success in business (Vaillant, 2012). For medical doctors with their daily exposure to suffering, compassionate loving-kindness meditation was suggested as a way to improve psychological wellbeing and reduce suicides (Singer & Bolz, 2013).

One way of quickly maximizing the expression of one's Compassion, is a one-time full Mystical Experience (MacLean et al., 2011) (Griffiths et al., 2006) (Griffiths et al., 2011). (Another way is a gradual and slow rise of compassion in people through imagination. This slower method seems to be more common than ME. Indeed the gradual approach to compassion is done through dramatic art, poetry, movies, ethical life, religions). Religions have guided routines to rise compassion and eventually to attain a mystical experience (Clark, 1958).

Arguments for mindfulness (without any ME)

Some advanced freedivers report of *occasionally* reducing the suffering of breath-holds to a point of "effortlessly" getting hypoxic blue lips or even a loss of consciousness (i.e. blackout) [champions N.Molchanova, A.Matveenko, A.Molchanov personal communications] (Schiffer, 2014) (Julian, 2010). Most freedivers suppose that mindfulness alone helps to reduce suffering (though mindfulness *seems* to be rather in contradiction with an egocentric "fame-seeking" motivation, and mindfulness *seems* to be in line with an altruistic "inspiring-others" compassionate motivation).

A relatively well-accepted way of pain-management and performance enhancement in freediving and in military and in sports is "flow" or mindfulness or self-hypnosis (S. Jackson & Csikszentmihalyi, 1999) (Stavrou et al., 2007) (Dextegen, 2014) (though mindfulness *might as well be* just a first step into a pain-reducing compassion).

The military do research mindfulness (measured by the Five Facet Mindfulness Questionnaire), as well as some sports do.

For relaxation Freedivers naturally learn mindfulness through the whole body awareness in order to relax unsolicited muscles. Usually freediving instructors don't tell freedivers about a possibility of mystical experience beforehand, because instructors themselves are not always aware of such thing, or because expectations as well as goal-setting to get the ME impede ME [champions N.Avseenko, S.Campbell, personal communications].

Argument for a more exotic pain-reliever hypothesis

Would stress/pain-management in compassionate freedivers have any similarities with a presumably pleasant erotic asphyxiation in "gaspsers" as a form of erotic BDSM described by (Coluccia et al., 2016)?

Caution and counseling: compassionate love vs. pain-and-adversity in making money

A freediving instructor is not a coach, nor a life-teaching guru [N.Molchanova, personal communication].

Even if from the epistemic viewpoint ME's metaphysical realm is probably an illusion, the therapeutic or life improving consequences of "visiting the Beyond" do outweigh its untruthfulness (Letheby, 2021). It changes a "core belief" in the spiritual area (Timmermann et al., 2021), thus possibly changing life for the better as it is intended in Cognitive Therapies (J. Beck, 2011), (A. T. Beck & Dozois, 2011).

Is there a risk from accidentally "visiting the Beyond" to wreck people's lives? Is there a risk of mystical experience (ME) or NDE turning people into reckless fanatics, endangering themselves and others after they would increase their selfless compassionate behavior and baseless "beliefs in being protected by underwater gods"? Despite compassion being viewed as important for performance and/or for happiness, compassion is not a well studied subject yet (Gu et al., 2017) (Gilbert et al., 2017).

For example, cases of fathers killing a "sinful" child to "compassionately save his or her eternal soul and the honor of the family" are sometimes believed to be induced by "obsolete" mystical/religious feelings, and are cited as a critique of the religious path to compassion. Such atrocities are not religious though, but they are imperatives of honor culture and thrive in poverty and outside the rule of law (Wold, 2019) (Brown, 2016).

For example, an "overly" increased compassion, as a "natural" healthy affect related to ethics, will it override reasonable restraints and thus cause harm in the "unnaturally" industrial world? Or, on the contrary, such a compassion, will it taper-down a cognitive conflict induced by (for example) a feeling of "unjust and callous inequality" of the unavoidable industrial managerial hierarchy? An overview of how naturally evolved feelings conflict with industrial world's *ethical dilemmas* is found in (Greene, 2013). If popular natural feelings can cause a rejection of reasonable industrial imperatives or of the safety guidelines in freediving, it is legitimate to ask ourselves whether a manager or a leader has the paternalistic obligation to compassionately manipulate people, or the risk of being caught and an ensuing managerial chaos would ethically rule out such paternalism.

Religions usually provide some ethical "counseling" along with the "go into Beyond" training. On the contrary, after getting a mystical experience accidentally and outside of any religious setting, experiencers may become confused: they divorce, quit jobs, downshift, and an integration of the experience into one's life *may* take years (Lommel, 2010) [N.Molchanova, personal communication]. Religious teaching is for now the biggest offer in the mystical landscape (Harris, 2020), yet religion is not the best help for searching a more compassionate job in the modern consumerist society nor would religion help to be a better freediving safety instructor. Developing and providing *secular* counseling at this stage *would* be useful.

Such counseling *would be* even more useful for the benefit of all, since in society there is a cultural skew into praising callousness and evil in managers, there's a skew against natural humane compassion, as it was *demonstrated* by the 1971 Stanford prison experiment (Zimbardo, 2007) or by an absurdly common road-rage statistics (AAA Foundation for Traffic Safety, 2016). Philosophers discuss the middle path between freedom and equality (Rawls, 1999) (Nozick, 1974), while both extremes represent an egotistic basis supporting our consumerist prosperous economy. An altruistic way to happiness is not contradictory but complementary to prosperity (Hobbes, 1651). Modern societies thrive on division of labour, thus on managerial authority, thus according to the Stanford prison experiment there *might* be a skew into a reduced compassion in authority figures i.e. in managers. We can't

fall though into binary thinking and we can't only blame genetics co-evolving with culture (Pigliucci et al., 2019) for decreasing compassion in population. People need both the consumerist economy to survive at the current population densities, and they need compassion for happiness and at least for family and kids. A choice of the ratio between greed and compassion seem to be an *ethical dilemma*, solved differently in different social groups. Whatever the ratio is, the path to compassion is always freely open even within a greediest of consumerist economies.

What exactly compassion has to do with population density, subsistence farming, and the division of labour? For example 5000 years ago in Germany in Cologne region there was about 0.5 people per sq km feeding on available natural resources without much of division of labour (Zimmermann et al., 2009). Reverting to such a "compassionate egalitarianism", thus abandoning the modern productive division of labour for it to be based on "evil" enforcement of non-egalitarian contracts, this would mean a reduced productivity and a risk of hunger for over 200 people on sq km living in Germany today, for example.

The "social group" of managers/leaders would possibly benefit from mystical experience (ME) and a subsequent Counseling, to integrate the new gained compassion with their old ways of doing business. ME *has chances* to immediately counterbalance a callousness skew by re-establishing a harmonious expression of compassion in managers, and in conjunction with their business experience, ME would hypothetically improve their money-making efficiency and their ethical dilemmas' solving. The same hypothesis stands for freediving instructors willing to develop their sport.

Is compassion accessible to all (but psychopaths)? At least compassion towards one's baby is natural and widespread (US Children's Bureau, 2018) since it *would* have evolved from a survival-critical natural drive to care for offspring, and from a need for cooperation with non-kin strangers (Goetz et al., 2010). Yet, despite a mentioned earlier efficiency gain from a humane expression of compassion in top-managers in business, despite compassion being naturally present in most people, career counseling and company politics usually denigrate the value of compassion in managers (Bradberry & Greaves, 2005). Thus counseling in career strategy of newly compassionate managers might be critical for their personal benefit as well.

Are there a danger of fostering mystical cultists lacking education, highly compassionate yet low IQ/openness fanatics, (un)restricted by law and by virtuous political power? Indeed most utilitarian and egalitarian evil ideologies thrived on a compassionate yet insufficient desire to lift people from poverty. Fanatics were quick to make the error of promoting an egalitarian "classless" society, forgetting the division of labour, enforcing "reeducation" and class politics, or even turning themselves genocidal, as in the murderous terrifying ideology given to the World by this nazis writer (Eckart, 1924). To counterbalance such aggressively stupid and murderous error, civilizations categorize it as criminal and use political enforcement, including enforcement of keeping promises and obeying rules within industrial activity (Cooter & Schäfer, 2012) (Lee Kuan Yew, 2000). *We believe* caution might be needed in fostering compassion and we believe ethical counseling might be important (especially in cases of accidental Mystical Experiencers). This is uncharted territory. History provide us with plenty of examples of terrible "highly compassionate" fanatics waging wars over religions or ideology (or were they not compassionate, but posing as such?).

On the other extreme are “low compassionate” libertarians. Is it enough to only continue to enforce business rules politically, without improving compassion? Would market forces somehow favor and promote compassion and happiness? Or alternatively, would regulations imposed on managers left such managers distressed and unhappy from *ethical dilemmas*, while still abusing unhappy employees and minorities and ecology for the sake of utilitarian productivity of goods and services?

Or would a combination of compassion and intelligence in managers make them even more efficient in inventing and promoting civilized laws and rules, in both sustainably happy and efficient productive ways?

Reducing the efficiency of industrial productivity for equality sake seems not being an option: all 4 historically known estates or classes or castes or strata are probably still around (Gerlach et al., 2018) (Andreoni et al., 2017). Thus a happy equality of outcome for the less affluent people seems unattainable. Modern humans don't even have anymore the Big Two traits of personality for people to thrive without division of labour on subsistence farming (Gurven et al., 2013). Eugenics (i.e. voluntary planned breeding of people) is obviously out of question, it is incorrect politically and illegal and immoral, yet involuntary for example in India 95% of marriages are within castes, keeping the “class” boundaries tight. Within the industrial division of labour, do 3 out of 4 of these “classes” rely on unpleasantly enforced directives from the management to produce livelihood for all? Yet, it feels o.k. to consider a “compassionate breeding of managerial ideas” for reducing the suffering of all.

Can we start by maximizing first in managers their individual potential for compassion or agreeableness as a Big Five trait, for them in turn to lead more people into compassionate ethical living afterwards? Great caution is needed with hypotheses related to Big Five traits (John et al., 2008) in people “clustered into castes” defined by innate personality traits. This research area is “politically explosive” (Plomin, 2019) (Herrnstein & Murray, 1994). Yet we can suspect a hypothetical skew (cultural or occupational) towards callousness in managers. This would allow the managerial compassion to become a practical subject. First, is it practically possible to boost the potential of managerial compassion through mystical experience? Luckily publications about Mystical Experience (ME) *seem to not mention* any other specific “innate” personality traits to be a prerequisite or an impediment for the onset of compassion-potentiality flourishing through ME. Mostly it is mindset-and-setting that is important (and presumably it is linked to culture, not so much to genetics, as most people can love at least their kids). Proof of nurture vs nature in terms of prerequisites for mystical experience is *yet to be done*.

Mystical Experience (ME) is mostly studied today not as a happiness increasing tool, but only in view of an upcoming pharmacological cure of PTSD and Addictions. We looked at freediving as a *potential* natural source of ME-“tool” for happiness, as a path of revealing/expressing one's innate natural compassion, and as a source of expressing one's openness or IQ through reducing stress by ethical harmonious living. Both of these Big Five traits are correlated with sustainable money-making livelihood-producing efficiency of business managers. *Possibly* after having a ME, a well-counseled manager *might* become both happy and rich, improving the economic development for all. And hypothetically becoming a potential leader towards a better happiness in others, thus maximizing happiness for all.

Also we were thinking of freedivers' compassionate mindfulness as a *possible* model to improve sport training efficiency. Indeed some freedivers anecdotally appear excessively efficient in their training progress. Overall

freediving World Records increased almost 2-fold, i.e. 100% in 25 years, while in similarly early years of many sports, records progressed usually much slower, i.e. 10 – 20 % (Lippi et al., 2008) (AIDA International, n.d.).

Freediving vs. psychedelics for Mystical & Compassion: an (un)practical application

Future mystical experience (ME) therapy is supposed to be based on high dose psychedelics and a soothing mindset-and-setting, as such therapy is being developed and tested in the USA and the UK.

Against this backdrop, Freediving ME appears rather as a curiosity, than as a practical application. Yet at least Freediving may bring some useful insights on mindset-and-setting, and ME's freedivers themselves will not appear to be crazy to their relatives, after reading this paper.

As a potentially practical way to improve happiness and compassion and to reduce stress through mystical experience, freediving at sea is a glamorous recreational activity, easily accessible for (stressed) business managers. On the contrary, a pharmacologically induced mystical experience might be less attractive for healthy business people for now, at least for legal reasons (though this may be changed soon). Floating sensory deprivation was also suggested as a practical source of ME and creativity, but a float tank lacks the glamour of white yachts and tanned girls in deep blue sea freediving. Improving happiness and boosting money-making skills through maximizing managers' potential intelligence and compassion along with a glamorous image of freediving, all this may attract CEOs into freediving.

Our freediving contribution to mystical experience (ME) research is modest. ME is becoming a mainstream research in neuropharmacology of PTSD or addictions or coping with stress (Doblin, 1986) (Rothman, 2019). One peculiarity of freediving though, is that freediving seems to be a "natural" way of getting ME, a straightforward training routine sometimes (rarely?) yielding a mystical experience underwater. If a safety/buddy/instructor has a gentle personality, in combination with warm clear water, a comfortable stretchy warm wetsuit, and a reassuring safety setting in general; from all this, a reassuring mindset-and-setting *might* occur in a natural way, *probably* helping the onset of ME. Freedivers are experimenting further for an even better mindset-and-setting (music, breath-work, locations, subjective preferences). What is the best mindset-and-setting, and what O₂ or CO₂ levels, and which breath-hold techniques would guarantee ME, we don't know. Yet besides going through lengthy FDA and ethical approvals to research a ME induced by psychedelics, science also can capitalize on accidental spontaneous ME in freediving competitions, without much formalities.

During a freedive, the strong narcotic gas CO₂ is building up in the lungs gradually, while the amount of a weaker N₂ narcotic gas is constant throughout a dive. Even though during a breath-hold on the surface, the CO₂ concentration is almost never narcotic [Annex 5: pool diving CO₂ build-up graph], at depth CO₂ *should* reach narcotic partial pressure, due to the high pressure of the water (Joiner, 2010).

Clearly it is unpractical to learn to dive 40 - 50 meters 150 - 160 ft deep just for a small chance of getting ME. A controversial idea of performing static apnea at depths around 40 m with scuba is not great either (this, along with "skip-breathing", is contrary to modern scuba safety guidelines, though before the advent of buoyancy compensators, short breath-holds or "skip-breathing" was common for buoyancy control in scuba diving). But

Technical Freediving (i.e. assisted with O₂-inhalation) is appearing. Medical-grade O₂ is sold freely in drugstores in some jurisdictions. Also O₂ is often available in dive clubs, and oxygen is routinely used for decompression after deep freedives. Combining O₂-assisted Technical Freediving with the right mindset-and-setting in shallow pool static apnea, supervised by compassionate instructors/safeties, *may* be a promising path into mystical experience. Obviously for a non-greedy non-for-profit section of freediving. This might be fun.

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