

Confirmatory factor analysis of Mystical Experience in Freediving as a recreative way to higher efficiency in sport performance and planet saving and money making

Olga Mitina⁽¹⁾, Mir Mirsaidov⁽¹⁾, [Natalia Molchanova]⁽²⁾, Andy Tutrin^{(2)(*)}

(1) Faculty of Psychology, Lomonosov Moscow State University, Moscow, 125009, Russia

(2) Freediving Federation, Moscow, 119330, Russia

(*) corresponding author, email: tutrin(at)gmail.com

DRAFT preprint

Abstract: searching what and how, and results

Aim

Investigate accounts from breath-holding freedivers about high efficiency in coping with adversity and pain. Investigate rumors of immediately quitting addictions, attaining harmonious meaningful life, becoming perspicacious and compassionate, getting a spontaneous religious experience. The aim of this research was to investigate such allegations, and if confirmed, to verify would freediving be useful to improve happiness and efficiency in sustainable business money-making.

Roadmap

- = Self-experimenting with feelings during CO₂- and O₂-assisted freediving to test the technique from Ladislav Meduna (i.e. CO₂-and-O₂-enriched breathing). Indeed high partial pressure of endogenous CO₂ in deep-water hypercapnia is translated into a similar to a high concentration of CO₂ in Meduna mix at atmospheric pressure, and anecdotal freediving reports have similarities with mystical experience in the scientific meaning of the word.
- = Persuade major world champions of deepwater freediving to endorse an anonymous online Mystical Experience Questionnaire MEQ30 survey of freedivers, to check for mystical experiences.
- = Collect enough anonymous data from freedivers for a Confirmatory Factor Analysis of mystical experience.
- = If mystical experience is confirmed, conduct a second round of online data collection from freedivers about their personality, experience, happiness, performance in sport and business, etc.
- = Verify if freedivers need some specific personality traits to get the mystical experience. Verify if going mystical makes them happier. Verify if mystical experience in freediving yields a better efficiency in training or in overcoming adversity, including at work or in business money-making.

Findings

Full Mystical Experience is confirmed to happen in freediving, i.e. it is the same Mystical experience found in psilocybin users or in religious believers. Mystical Experience Questionnaire "MEQ30" is validated for use in freediving. The total score of mysticism in self-selected 413 freedivers is normally distributed from full mystical experience to a low one. [Annex 1 for a short one-picture overview].

The objective of verifying a better efficiency of mystical freedivers in business or in training was not finalized (though we did a first version of a survey of efficiency and data is available online and were analyzed by friendly researchers Florian Lecaer and Dr. Olivier Roques at Aix-Marseilles University Business school, and preliminary findings appear interesting).

Further research

Mystical experience is already known to increase the expression of compassion and openness, to reduce

suffering, cope with PTSD and cure addictions. In turn increased compassion is known to correlate with better money-making in business people. Thus business executives are possible candidates to test mystical O2-assisted static apnea in a calm mindset-and-setting, as a naturally pleasant path to mystical experience, hence to more compassion, hence to an improved money-making performance. In case of advent of mystical experience they might also need counseling with ethical business-dilemmas and to integrate compassion into business practices (may be Insead's wn-win Blue Ocean Strategy team will agree to help with such counseling).

Literature on endogenous N,N-DMT (Ayahuasca) synthesis in the lungs and Dr. Attila Szabo are suggesting a search for the DMT-NO metabolite in the urine of blacked-out freedivers.

Culture and/or a specific set of Big Five traits might impede the calm mindset and setting prerequisite for mystical experience in freediving, this possible hindrance need to be investigated.

Raw data collected from anonymous freedivers is downloadable from Harvard Dataverse. Please feel free to contact us for introduction to the freediving community if you'd like to take over and investigate the impact of freediving mystical experience further.

Keywords: Mystical Experience; MEQ30; Freediving, hypercapnia, hypoxia, DMT, efficiency in sport performance; efficiency in business; compassion; Ladislav Meduna, Natalia Molchanova

Literature review

Trip into mystical Beyond is 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). Paradoxically such an important event is often considered taboo.

"We do not talk about such things, people won't understand it; even less when we do not have solid science" [N.Molchanova, personal communication]. "The only way we will get somebodies' attention (among top ranking officers or in medical departments) is if they are experiencers [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).

There is some popularization in this paper as an attempt to suggest to scientists to take over this controversial mystical research theme, although we try to avoid falling into propaganda (Pratkanis, 1995). Indeed an important source of new discoveries is the communication between scientific disciplines across terminological barriers and against compartmentalization of science (A. Jackson, 2014).

Anecdotal clues or proof of compassion increasing efficiency in pain/effort management in sport or business

Some freedivers sometimes can effortlessly reduce the uncomfortable suffering of breath-holds to a point of having hypoxic blue lips or even until loss of consciousness (i.e. blackout) [N.Molchanova, A.Matveenko, A.Molchanov personal communications] (Schiffer, 2014) (Julian, 2010).

Return On Assets in US companies managed with compassion (and integrity, responsibility, forgiveness) is about 5 times superior compared to those with egotistic 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 44 of the CEOs with the financial results of their companies, all corrected for the impact of macroeconomic factors and business strategies (Kiel, 2015).

One way of effortlessly boosting the expression of one's compassion is a One-time Mystical experience (MacLean et al., 2011) (Griffiths et al., 2006) (Griffiths et al., 2011), (be such mystical experience coming from freediving or else). Another way is a gradual and slow rise of compassion in people through imagination, this slower method *seems* to be more common, as it is for example done through dramatic art, poetry, movies, ethics, religions, politics.

Almost a Trillion dollars missed business opportunity because of egotistic lack of compassion, is *presumably* the most costly error in the history of business. This missed opportunity would be the failure to purchase Google by the CEO of Excite in 1999. Egotistic hubris is a *plausible* cause of it.

The billion dollars gain in Zappos company success is *allegedly* linked to hiring compassionate employees (Hsieh, 2010).

Successes of JAL airlines were *allegedly* based on Buddhism and on the strategic culture of Go, less aggressive than the western Chess culture (Miura, 1995). *Idem* for success of non-competitive *thus supposedly non-aggressive* 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 come out as a trait favoring managerial and sales success or efficiency (Futrell, 2012) (Hansen, 2018).

In family happiness a "compassionate" look into a spouse's view on conflicts, was done during 7 minutes once every 4 months. In 60 couples over 3 years it preserved a constant level of affection in family, while in a control group affection was steadily deteriorating (Finkel, 2017). Such link of compassion to happy relationship reminds the longest adult life study, in which happy relationship is correlated to health even more than to lifestyle or to success in business (Vaillant, 2012). For medical doctors with their daily exposure to suffering, compassionate loving-kindness meditation was proposed as a way to improve psychological wellbeing (Singer & Bolz, 2013).

Would compassionate freedivers pain-management have any similarities with presumably pleasant erotic asphyxiation of gaspers as a form of BDSM (Coluccia et al., 2016)? Bullet ants extreme pain in a rite of passage *seems to be* relieved thru compassionate hugs and body-to-body dance with 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. Religions are guided routines to mystical experience of Beyond (Clark, 1958). Sometimes we associate the success in selfless loving kindness outcome 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).

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

Modern military do study mindfulness (measured by the Five Facet Mindfulness Questionnaire), as well as some sports do, while de facto sports teams and military *would* also increase compassion by fostering squad brotherhood? Grenade leaping self-sacrifice only happens when saving a teammate, not to improve the outcome of a battle at large (Blake, 1978). Ancient samurai utilized zen-buddhism i.e. a combination of mindfulness and compassionate loving kindness, along with ethical rules of virtuous living. Self-compassion alleviates distress by reducing counterproductive self-criticism (Neff, 2003). Lowering self-criticism anecdotally improves the efficiency in learning freediving [T.Zemskikh, A.Matveenko, personal communication]. Unfortunately the Army missed the opportunity to investigate any heroic compassion boost from mystical experiences induced by psychedelic LSD before the substances ban (Ketchum & M.D, 2006). The Navy never studied mystical experiences from hypercapnia (US Department of Defense, 2011) (Joiner, 2010). Neither a mystical experience from Near Death Experience was yet studied in the Army.

Beginner freedivers start to learn mindfulness at every training session, and later they may add compassion from at least one unique mystical dive leading to trust and openness and reducing self-overvaluing egotism. One-time mystical experience might be life-changing, though people may need time to adjust their old lifestyle to new worldviews. Usually freediving instructors never tell freedivers about a possibility of mystical experience beforehand, because expectations as well as goal-setting impede it [N.Avseenko, personal communications] [S.Campbell, personal communications].

US 1990s sniper Chris Kyle's compassionate selfless desire to protect fellow soldiers and his desire to go to war *appear* strikingly 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 aimed to correct some injustice for the public good (Laloë, 2004). Heroic altruists are deemed to be ordinary people, having effortlessly and spontaneously switched into selfless mode when their fellow compagnons appear to be in danger (Marsh, 2016) (Marlantes, 2011).

MMA martial artist and world 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. The same intuitive feeling of the grace of God resulting out of a discussion with a believer is *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 citizens, the swimmer Shavarsh Karapetyan *appears* as a compassionate selfless hero, and coincidentally he was a big champion in fin-swimming.

In many of these examples, we can reasonably *suspect* fear-and-pain-reduction and increased efficiency with a task at hand.

Compassionate love vs. pain or vs. adversity in making money: caution and counseling

A freediving instructor is not a coach, neither a life-teaching guru [Molchanova, personal communication].

Are there a risk from accidentally "visiting" the Beyond to wreck people's lives? Are there a risk of turning people into reckless fanatics, endangering themselves and others, after they would increase their selfless compassionate behavior? Despite compassion appearing important for performance and/or for happiness, compassion is not a well studied subject yet (Gu et al., 2017) (Gilbert et al., 2017).

Cases of father killing a "sinful" child to "save his or her soul and the honor of the family" are sometimes believed to be induced by obsolete religious teaching, and are cited as a critique of religious path to compassion. Such atrocities are rather imperatives of honor culture (in turn thriving in poverty and lack of rule of law) (Wold, 2019) (Brown, 2016). After a mystical experience boosting compassion expressed by such a father, he may have to painstakingly integrate his newly unrestricted compassion with the old cultural background. Freediving as well as Near Death mystical experiences are accidental and unexpected. People find themselves alone to deal with it, may become confused, they divorce, change jobs, downshift, and integration *may* take years (Lommel, 2010) [Molchanova, personal communication]. Religious teaching is for now the biggest offer in the mystical landscape (Harris, 2020), it is not the best help for searching a more compassionate job in the modern consumerist society. Developing and providing 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 callousness and evil in managers, 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 (AAA Foundation for Traffic Safety, 2016). Modern societies have division of labour, thus have managerial authority, thus according to the Stanford prison experiment there *might* be a skew into reduced compassion in managers. Even if we blame only a cultural skew for depleting compassion, and even if we don't take into account any genetics co-evolving with culture (Pigliucci et al., 2019). Indeed *in some experiments* was found a boost in the expression of compassion, without not any increase in the agreeableness Big Five trait per se (Griffiths et al., 2006) (Griffiths et al., 2011).

Mystical experience *has chances* to immediately counterbalance this evil skewness by re-establishing a sane expression of compassion by managers and hypothetically improving their money-making efficiency. *Possibly* managers would also need counseling to integrate new compassion with ethical ways to do business.

Compassion towards one's baby is natural and widespread (US Children's Bureau, 2018) since it *would* evolved from a survival-critical natural drive to care for offspring, and from a need for cooperation with non-kin (Goetz et al., 2010). 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 politics usually disregard 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, i.e. low IQ/openness highly compassionate fanatics, bridled only by virtuous political power? Indeed most utilitarian egalitarian evil ideologies thrived on a

compassionate 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 genocidal as in the murderous terrifying ideology given to the World by this nazis (Eckart, 1924). To counterbalance such aggressively stupid and murderous errors, civilizations categorize it as criminal and use political enforcement, including enforcement of keeping promises and obeying rules in industrial activity (Cooter & Schäfer, 2012) (Lee Kuan Yew, 2000). *We believe* caution is needed in fostering compassion and we believe ethical counseling is important. This is uncharted territory. History provide us plenty of examples of terrible "highly compassionate" fanatics waging wars over religions or ideology.

On the other extreme are "low compassionate" libertarians. Is it enough to only continue to enforce business rules politically without improving compassion (relying only on market forces to somehow favoring compassion)? Or alternatively would regulations imposed on managers let such managers distressed from ethical dilemmas while still abusing employees and minorities and ecology for the sake of utilitarian productivity of goods and services? Or would compassionate intelligent managers become even more efficient in inventing and promoting civilized laws and rules, in both sustainable and efficient ways and for productivity sake?

Reducing the efficiency of industrial productivity seems not being an option: the historically known 4 estates or classes or castes or strata are *probably* still around (Gerlach et al., 2018) (Andreoni et al., 2017). Within the division of labour most of these "classes" rely on industrial management to set up production of livelihood. *Reasonably* we do not have the option to revert to classless subsistence farming. For example in Germany in Cologne region there was about 0.5 people per sq km feeding on available natural resources 5000 years ago without any division of labour (Zimmermann et al., 2009); Reverting to no division of labour would mean a risk of hunger for over 200 people on sq km living in Germany today. Neither have we anymore the Big Two traits personality to thrive without division of labour on subsistence farming (Gurven et al., 2013).

All hypotheses of the Big Five traits (John et al., 2008) clustered into "castes" with innate personalities traits are "politically explosive" (Plomin, 2019) (Herrnstein & Murray, 1994). But considering only a cultural or occupational skew towards callousness in managers, would make the restoring of managerial compassion a hypothetically interesting practical subject. Is it even possible to boost managerial compassion through mystical experience? At least no research in Mystical experience by the Johns Hopkins team neither any publications on Near Death Experience *did not find yet* any specific "innate" personality traits to be a prerequisite or impediment for the onset of compassion-boosting mystical experience. Mostly it is set-and-setting that is important (presumably linked to culture, not so much to genetics). Proof of nurture vs nature in terms of prerequisites for mystical experience is *yet to be done*.

Mystical Experience is mostly studied today in view of a pharmacological upcoming cure of PTSD and Addictions. We are looking into freediving as a *potential* natural source of mystical boost in expressing compassion and a source of improving the openness trait, both of which in turn would be potential tools of increasing the sustainable money-making livelihood-producing efficiency of business managers. And as tools to improve sport training efficiency. Indeed some freedivers anecdotally appear excessively efficient in their training progress. Overall freediving World Records increased almost 2-fold in 25 years, while in similarly early years in many sports the records' progress was usually much slower, i.e. 10 – 20 % (Lippi et al., 2008) (AIDA International, n.d.).

The science of mystical experience

Importantly, as mentioned earlier, mystical experience is for now the only known way to immediately improve such Big Five personality traits as openness (correlated with IQ) and to boost the expression of compassion (agreeableness). These positive changes are long-lasting.

For clarity and simplification the 4 facets of Mystical experience can be described here in lay terms as follow: feeling peaceful love and intuitive belief in the sacred unity within the universe; joy; literally perceived exit out of material space and time; inability to describe it by words. Mystical experience despite stirring public controversy is a relatively well studied psychological construct, manifested by these 4 factors. Please see MEQ30 below for a detailed description of the Mystical experience.

Research on mysticism started with religions, continued with psychedelics (Doblin, 1991), (Paloutzian & Park, 2013), (Hood et al., 2018) attracted controversy and politicization in the 1960s with Tim Leary promoting LSD for public use (Leary, 1999) and with the hippy anti-war and anti-consumerism street actions, resulting in a complete ban of the research worldwide.

Professor Roland Griffiths from Johns Hopkins managed to overcome this ban on psychedelics research in 1991 and his team is pioneering this mystical work (Griffiths, 2013), along with the team of Dr Nutt at Imperial College (Carhart-Harris et al., 2017) and more researchers getting involved. There is a problem though: it takes time and effort to get the red tape done, psychedelics are still being controlled substances.

An improved Questionnaire for Mystical Experience "MEQ30" was finetuned (MacLean et al., 2012) (Frederick S Barrett et al., 2015) and mystical experience under psychedelics is at final stages of clinical trials as a one-time radical treatment for Post-Traumatic Stress Disorder (PTSD) and Addictions, and as a way to reduce stress and fear of death in terminally ill people. Researchers are carefully staying within scientific methodology and are advancing with caution into these politically sensible areas.

Psychedelics may induce negative experiences. To avoid it, i.e. for the mystical experience to happen, there is a prerequisite, the so called "set-and-setting". In short it means the person'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).

Freediving

Late Dr Natalia Molchanova the co-author of this research was the most decorated freediver in the world and had 41 world records and 23 world champion titles in freediving (Ap for CNN, 2015). She started training and competing in freediving in her 40s. Thus we can suspect her training was very efficient. She never made any secrets of publishing and sharing her routines. Her mystical experiences though, along with her creative and caring personality traits, were only expressed in poetry or videoclips or by small bits in interviews [Annex 2: BBC documentary and N.Molchanova interviews on mystical experience].

Freediving is an extreme sport and a leisure activity consisting of holding breath in the water. Receptors on the face feel the water and induce a diving reflex, helping to save oxygen. In particular the reflex redirects oxygenated blood-flow from the lungs to the brain, away from the extremities, so freedivers freeze and have to wear a wetsuit for comfort even in relatively hot water. To save oxygen freedivers learn to relax the face, the whole body, and voluntarily calm down emotions and thoughts. Also to save oxygen they practice slower expirations compared to inspirations, doing so for a couple of minutes before a dive. This activates their soothing rest-and-digest parasympathetic nervous system, relaxing the body and saving oxygen.

Among freediving disciplines there is "static apnea" when motionlessly lying face down on the surface of water as long as possible without losing consciousness (i.e. avoiding "blackout"). And there are "constant weight" much more athletic free-dives, going as deep as possible and swimming all the way back to the surface. In this latter discipline, freedivers give interesting descriptions of narcosis (Néry & Vaillant, 2016), whatever is it CO₂ or N₂ narcosis or a combination of these. Stronger CO₂ narcotic gas is building up in the lungs gradually, while weaker N₂ narcotic gas amount is constant in a dive. In breath-holds on the surface, the CO₂ concentration is almost never narcotic [Annex 5: pool diving CO₂ build-up graph], while at depth it should reach narcotic concentrations due to the high pressure of the water.

Freedivers must have a safety buddy, because there is a deadly risk of drowning in case of losing consciousness. Usually freedivers are gentle people, so the presence of such safety partners, combined with warm clear water, comfortable stretchy warm wetsuit, and reassuring safety equipment, naturally creates elements of the reassuring mindset-and-setting.

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

A relatively new and sometimes controversial "technical freediving" is using oxygen-enriched inhaled gas 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]

Set-and-setting is not perfectly soothing in freediving. Some highly consciousness and/or very egocentric competitive freedivers anecdotally report feeling insecure or aggressive or goal-oriented, which hinders the set-and-setting. One high consciousness champion freediver subjected 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 (to which any 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 random 427 signed forms of beginner freedivers taking courses at Molchanovs, we found nobody listing 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 set-and-setting prerequisite for mystical experience.

For more information on freediving please visit "AIDA International" website and/or look into manuals (Lemaître, 2019) and books or accounts from champions: (Nitsch, 2017), (Mathieu, 2018), Jessea Lu interview about her mystical near-drowning experience in a 2018 documentary (French, 2018), Sara Campbell interview (Wilkinson, 2009), etc. The problem with mystical experiences in freediving is that not all big champions had it in its fullest form, freedivers rarely talk about it, and mostly we 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, we take it as cinema.

Known neurophysiology of CO₂

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

We still don't know how exactly CO₂ interacts with the neural systems, 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). An unbuffered dog's blood pH dropped linearly and the 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?) freedivers (and may be 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). The production of N,N-DMT by the placenta for hypoxic-blue newborns reminds the mystical birth theory from Dr Stan Groff. A possible hypoxia of the brain during Dr Groff's hyperventilation technique might be due to vasoconstriction induced by a depletion of CO₂ in the blood through hyperventilation (would be interesting to check such practitioners for endogenous DMT).

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

Larislav Meduna pioneered the psychedelic use of CO₂ in psychotherapy in the 1930s - 1950s, performing tens of

thousands of sessions at 30% CO₂ mixed with 70% O₂ (Meduna, 1958). One of spectacular cases was the therapy of distressed inmates in a high security prison, where medicating or couch-talking them out of distress was not an option. The notion of set-and-setting was unknown in those times, so prisoners were breathing the psychedelic 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 acceptable, 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 were not successful, then psychotherapy switched to LSD and went to a stop with the worldwide ban on psychedelics.

(Un)necessary philosophy

Newborns were cut alive without anesthesia by surgeons like a sort of philosophical zombies until the 1987 paper about how newborns suffer pain (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. feeling of pain, as in the lactate Everest paradox (Noakes, 2009), despite the illusionary feeling a rubber hand (Botvinick & Cohen, 1998). Illusionary qualia have evolved possibly for a useful purpose. For example it helps finding saliently red flowers (F. Jackson, 1986) amidst green grass or it helps reading a scrawly familiar handwriting. We enjoy useful qualia, even if we might struggle counterbalancing pain quale with loving quale in sport competitions.

It is premature to argue over materialistic or illusionary or dualistic nature of freedivers' mystical experience, before solving a less controversial and "easier" riddle of experiencing color in "simple" animals or recreating qualia in robots.

For practical purpose our industries are able to manufacture and sell red color paint for attractively red roadsters, without knowing how quale or feeling of red color is wired in humans or in shrimps. Engineers can not wire subjectively compassionate loving robots, neither we know if love has already evolved (Marsh, 2016) in a shrimp bothering to care for its eggs 480 millions years ago (Caron & Vannier, 2016). This lack of knowledge is of no importance for practical applications of the universal love feeling. Thus we practice method acting (Stanislavsky, 1936) recreating love within a set-and-setting script on stage or on screen, and we touch or educate filmgoer's hearts. And we use a gimbal mount of a camera to imitate a steady eyesight within a movie, without knowing exactly why conscious eyesight is not as jerky as a shaky camera is. We make touching movies for pleasant cinematic experience or for propaganda or for ads, without knowing how it all works inside the viewer's head.

Mystical experiences inducing a feeling of compassionate love are interesting to study for practical purpose.

Paths into mystical Beyond

Besides use of 5HT_{2a} agonists, Mystical experience is anecdotally reported or proven in different cases: sensory deprivation (Kjellgren et al., 2009), compassion or grief in scenic wilderness (Davidson, 1980) or in war, meditation or prayer (Frederick Streeter Barrett et al., 2017), 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), in near death experience, including blood loss and lung failure and cardiac arrest (Charland-Verville et al., 2015) (Lommel, 2010) (Doty, 2016).

Anecdotal reports of Mystical Experience and Near Death Experience (NDE) have similarities (as demonstrated by looking at Mystical Experience induced by the DMT substance and assessing it with the Greyson scale, usually applied to Near Death Experience) (Greyson, 1983) (Timmermann et al., 2018). It would be interesting to apply the Mystical MEQ30 to Cardiac Arrest NDE or Skydiving- or War-induced NDE.

Near-Drowning and/or freediving mystical experience is a possible origin of mythological passage to Beyond through freediving. The epic hero named Gilgamesh went into the Realm of Death while he was freediving to the bottom of sea in the story from 4 thousands years ago (Stephens, 2019). The Indo-European root "ViR" is found in "Iram" or "Viram" word meaning "Heavenly Beyond" in Zoroastrian religion and in Russian terms predating Christianization. For lack of seas in continental Russia, "freediving" gates into Beyond were dangerous whirlpools in rivers (Levkievskaya, 2004), called "vodo-VoRot" (literally 'water-rotation'). The same Indo-European root "ViR" is found in Ancient Greek (vir -> gyr "gyroscope") and in Latin (vir -> French "virage") both dating back to a ring in Ancient Greek or to a bracelet in Latin, items made of bronze wire circling a finger or a hand. Circles of rotating water in dangerous deep spots of a river are present in an obsolete Russian curse "you go to Vir!" in the sense "go to hell!"

Experiment and results

Feasibility self-experimentation

Bad design in our self-experiments with CO₂- and O₂-assisted breath-holds lead to some success and mostly to failures in reaching mystical experience. At the time we had no idea about the importance of mindset-and-setting, so a majority of breath-holds with added CO₂ or O₂, or breathing up to 50% of CO₂ yield nothing but urge to breathe and/or visual hallucinations. A minority of such attempts on couch or in pool brought mystical ineffable trips to Beyond and universal love, and joy. After such an approximate "freediving-and-CO₂/O₂-feasibility study" we discovered the existence of MEQ30 and the methodology of the psilocybin anonymous online survey.

Main experiment: Freedivers' online survey setup

Mystical experience questionnaire MEQ30 items were randomly intermixed with 60 or 70 questions (in English and in Russian consequently) about freediving general experience (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 name had ambiguity since freedivers do dive in the ocean by definition. Thus we hope the call for participation would not tip-off the theme either. The "cover-up" questions went by pairs, formulated negatively and positively (e.g. water was cold; water temperature was comfortable). Unfortunately we did not ask for any demographic information at this stage. Google Forms was used for the two language versions of the survey. Freediving champion Natalia Molchanova formulated and endorsed the two language versions of 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 end 2014 to beginning of 2016. The survey was anonymous, without any possibility to sign-in one's name or any personal data.

Main experiment: Freedivers' online survey statistics and results

The survey Google Form URLs resulted in being clicked by order of 10k people and was completed online in Russian language by 153 freedivers and in English language by 310 freedivers, which seemed to be enough for confirmatory factor analysis (MacCallum et al., 2001) (Mundfrom et al., 2005). It took one year and several repeated calls for participation to attain these numbers. After a first draft analysis of the data and an encouraging help from Johns Hopkins Medicine Dr Fred Barrett and Dr Roland Griffiths, the confirmatory factor analysis was taken over and finalized by Lomonossov University Dr Olga Mitina and her 3-rd cycle student Mir Mirsaidov.

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'd 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 from where the MEQ30 originated.

As a potential source of compassion-improving mystical experience, freediving at sea is a straightforward recreational glamorous activity, easily accessible for well-off business people. Pharmacologically induced mystical

experience might be less practical for healthy business people for now, at least for legal reasons (though this may be changed in some countries soon). Float tanks were suggested to business people as a source of mysticism and creativity, but a float tank lacks the glamour of white yachts and tanned girls in open sea freediving. Money-making skills' boost along with a glamorous image of freediving may attract business people into this sport. We hope freediving scientists will take over this research and test this compassionate money-making hypothesis.

There were mostly two types of objections to our findings.

One type of objections came from people unfamiliar with surveys and/or with the factor analysis concept. Such objections could be dealt with by explaining the basics of the methodology.

Second type of objections was due to an apparent absurdity of mystical experience from a common sense perspective. It was exacerbated by the ineffability of mystical experience. The objectors were even more suspicious, because despite decades of Navy research in CO₂ poisoning nobody really looked into mystical experience underwater. Scientific curiosity might help researchers to take mystical freediving accounts in the first degree, not as metaphors.

Our freediving contribution to mystical research is modest. Mystical experience is becoming mainstream research in neuropharmacology of PTSD or addictions (at least two teams are going for advanced phases of clinical trials now, plus many researchers already have FDA licenses for work with 5HT_{2a} agonists), so we could capitalize on the publications and on great support from experienced researchers from Johns Hopkins and from Imperial College. The only peculiarity of freediving mysticism seems to be the "naturalism" of its neurophysiology and the existence of a straightforward training routine sometimes leading to mystical experience underwater. Freediving does not require any lengthy FDA or ethical approval as it is the case in pharmacologically-induced mysticism. Some researchers appeared to be mildly interested in taking over this first glimpse into mystical freediving theme.

Mindset and freediving setting are anecdotally reported to be an important prerequisite for mystical experience. We did not address this mindset-and-setting issue to prove or disprove it. Several champions and instructors pointed out two major obstacles to mindset-and-setting in a training routine while discussing our findings.

One obstacle is that freedivers become goal-oriented for sport performance. Western culture of achieving goals through grit is inline with this attitude. This goal-fixation *allegedly* hinders the onset of mystical experience even in deepest dives with higher partial CO₂ pressure. Some instructors teach mindfulness meditation (or a similar wide-attention-span training) which reduce goal-fixation. Anecdotally freedivers report two breeds of champions: zen vs. goal-fixated ones.

Second obstacle to set-and-setting seem to be cognitively or culturally induced, such as a mere reluctance to openness and to letting go, due to a strong desire to control everything or due to fears of narcosis or whatever is lurking from the abyss to endanger a freediver. Especially it is the case if the freediver is skipping steps of progress out of greed or pride. Nevertheless most freedivers do accept the need to let go, because any psychological tension is supposedly bad for saving oxygen. Compassionate meditation might be a way to improve the mindset of freedivers. For now freedivers are mostly advised to keep a slow secure pace in increasing depth.

A double-blind study with oxygen-or-air and with the right mindset-and-setting in shallow pool static apnea freediving and supervised by compassionate instructors/safeties, would be an interesting further research of the

advent of mystical experience.

After we found publications on DMT endogenous synthesis in hypoxic lungs, and discussed of searching for DMT metabolites in the blood during freediving competitions, Dr. Attila Szabo suggested a much easier search in the urine. Chromatography-based methodology is already described in literature. We hope someone will take over this idea.

How biased were our self-selected respondents? Would mystical experience be accessible to every freediver? Unfortunately we did not collect any demographics in the mystical survey. We attempted to correlate life experiences and personality traits to mystical experience in a follow-up online anonymous survey, including demographics items and seven psychological scales. It yielded ~1800 views, 85 respondents for 190 items [Annex 9: follow-up survey]; and ~1400 views, 97 respondents in a short test survey of only 4 items to assess self-selection bias. There was a similar proportion of self-selected respondents generously contributing personal time to the 190 items and sparsely giving time to the 4 items survey. Thus the proportion of biased participants is independent of the amount of time/effort asked for. This may indicate a strong bias into naturally agreeable selfless respondents (DellaVigna et al., 2012). The 190 follow-up survey raw data were taken over for further investigation by a team at Aix-Marseille University.

At this point of the discussion about freedivers' innate personality vs. cultural bias, our IT colleagues mentioned an idea of modeling a hypothetical 4-castes' genetic and cultural co-evolution (Rendell et al., 2011) and eventually to test such a "castes" approach in online marketing. It is indeed interesting to distinguish between Big Five personality traits influence vs. cultural background as obstacles to mindset-and-setting and as preconditions of mysticism in freediving.

From a practical standpoint objections were raised against freediving as a way to mystical experience. Indeed learning to freedive to a 40 - 50 meters 150 - 160 ft depth is a pleasant but lengthy path to mystical experience without any guarantee to getting mystical. Less costly options were suggested by freediving instructors: O₂-assisted static apnea in a shallow comfortable pool (it would yield high endogenous CO₂ while extra O₂ would prevent hypoxia and give time to hypercapnia to rise into narcosis). Medical-grade O₂ is sold freely in some countries in drugstores and it is also usually available in some dive clubs as oxygen is sometimes used for decompression by freedivers. A more controversial idea is to perform static apnea at depth around 45 m with scuba (along with skip breathing, this is contrary to modern scuba safety guidelines, though before the advent of buoyancy compensators, short breath-holds within skip-breathing was common for buoyancy control).

Conclusions:

Known for its benefits in terms of coping with stress or addictions and revelations of life meanings, Mystical experience is confirmed to sometimes occur in deep water freediving. It is the same experience known to happen under psychedelics or in western religious practice or in buddhist meditation.

Further proof is needed to verify anecdotal reports about a calm open mindset and calm surrounding setting in freediving, i.e. verify that freediving set-and-setting is helping to achieve mystical freediving experience, while

competitive goal-fixation in freediving would be hindering mysticism.

A possible link of mystical experience to endogenous DMT in freediving is yet to be investigated using chromatography.

A potential practical application of O₂-assisted shallow pool static freediving is interesting to test as a future way of getting mystical experience for non-freedivers (distressed persecuted minorities or money-making business executives dealing with stressful conflicts or ethical dilemmas, addicts, healthy individuals in search of meaning of life, artists in search of inspiration, etc.).

Since mystical experience improves compassion, and compassion is predicting efficiency in money-making, such hypothesis of mystical freediving to improve managerial money-efficiency is interesting to verify while at the same time giving researchers a justification for asking money to do so.

Who did what and acknowledgments

The project was not funded, all contributors are volunteers.

For the issue of a diseased author (Teixeira da Silva & Dobranszki, 2015), at our best knowledge late Dr 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 on 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.

Dr. Olga Mitina and her PhD student Mir Mirsaidov did the confirmatory factor analysis. Dr. 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 hypothesis and the idea of MEQ30 in freediving, self-tested O₂ and versions of Meduna mix on couch and in pool, set up the online survey at Google Forms, and coordinated the project. Several freedivers also self-tested Meduna or O₂. The Johns Hopkins team (R.Griffiths, F.Barrett) and the SINP MSU team (S.Dolenko, A.Efitorov) generously helped and inspired this work, though declined further involvement.

The Medical Commission of the South branch of the non-for-profit French Federation FFESSM and MD Andre Grousset encouraged us to finalize this paper and paid for the trip of Andy Tutrin to present 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.

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 the 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.Matveenko, T.Zemskikh, E.Sychev, E.Fattah, 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.Tutrin, Dr.Y.Tutrin, G.Zveryaeva, 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, V.Korsun, MD.S.Knyazeva, S.Zimin, K.Kriworuczko, Ilia-X, Eugene-X, Ivan-X, Y.Shmatko, A.Guseva, N.tasha.Vassilieva.

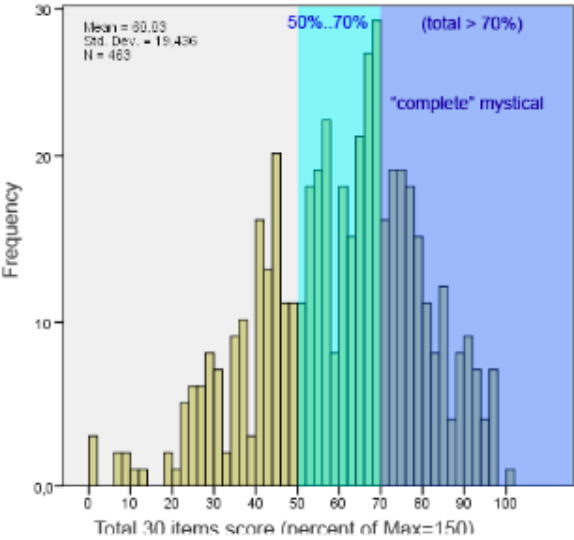
Annex 1: one-page recap

freediving 413 people loadings compared to the original MEQ30
year 2015 online survey of 1602 people

MEQ30 in freediving, total scores distribution

Table 5. Factor loadings, mystical surveys in Freediving (O.Mitina, M.Mirsaidov, N.Molchanova, A.Tutrin, 2020)

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



1602 users of Hallucinogen Psilocybin: Table 2: Factor loadings obtained from a principal components analysis of the mystical experience questionnaire (30 items) (MacLean et al., 2012)	items MEQ30 numbers	Factor loadings (psilocybin survey, MacLean et al, 2012)			
	83	.86	-.05	-.05	.05
	69	.82	-.12	-.05	.05
	22	.79	-.15	-.05	.14
	77	.74	-.05	.15	-.05
	47	.74	.15	.05	-.05
	35	.68	.15	.05	.05
	41	.68	.14	.05	.05
	73	.68	.14	-.05	.05
	36	.67	.15	-.05	.05
	54	.65	.15	.15	-.05
	9	.60	-.05	-.05	.17
	12	.59	-.05	.15	-.05
	74	.52	.15	-.05	.05
	14	.45	.17	.05	-.05
	55	.45	.15	-.05	-.05
	87		.92	-.05	.05
	43		.76	.15	-.05
	30		.71	-.05	-.05
	18		.57	.15	-.05
	80		.56	.15	.15
	5		.48	.15	.15
	15			.74	.05
	65			.73	.05
	2			.64	.15
	29			.64	.05
	34			.57	.05
	48			.52	-.05
	6				.85
	23				.83
	86				.66

Annex 2: Personal accounts from deep free-dives and from commercial diving, quotes picked-up and translated from various public interviews with Natalia Molchanova on TV, etc., made available on her Russian-language website. Quotes are classified by mystical experience factors.

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

	<p>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><i>2. Loss of your usual sense of time.</i></p> <p><i>15. Loss of your usual sense of space.</i></p> <p><i>29. Loss of usual awareness of where you were.</i></p> <p><i>34. Sense of being "outside of" time, beyond past and future.</i></p> <p><i>48. Being in a realm with no space boundaries.</i></p> <p><i>65. Experience of timelessness.</i></p>	<p>You are kind of out-of-time, the time disappears, it is swallowed away;</p> <p>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><i>6. Sense that the experience cannot be described adequately in words.</i></p> <p><i>23. Feeling that you could not do justice to your experience by describing it in words.</i></p> <p><i>86. Feeling that it would be difficult to communicate your own experience to others who have not had similar experiences.</i></p>	<p>(I only try to express it in poems and videos)</p>	<p>It's .. eh.. hard to explain</p>

Annex 3: Igor Azhikin 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 existence in general, me being part of the universe, the purpose of me coming to planet Earth, and plenty of such stuff and all in parallel. 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:

<https://www.facebook.com/azhikin/posts/832654370138000>

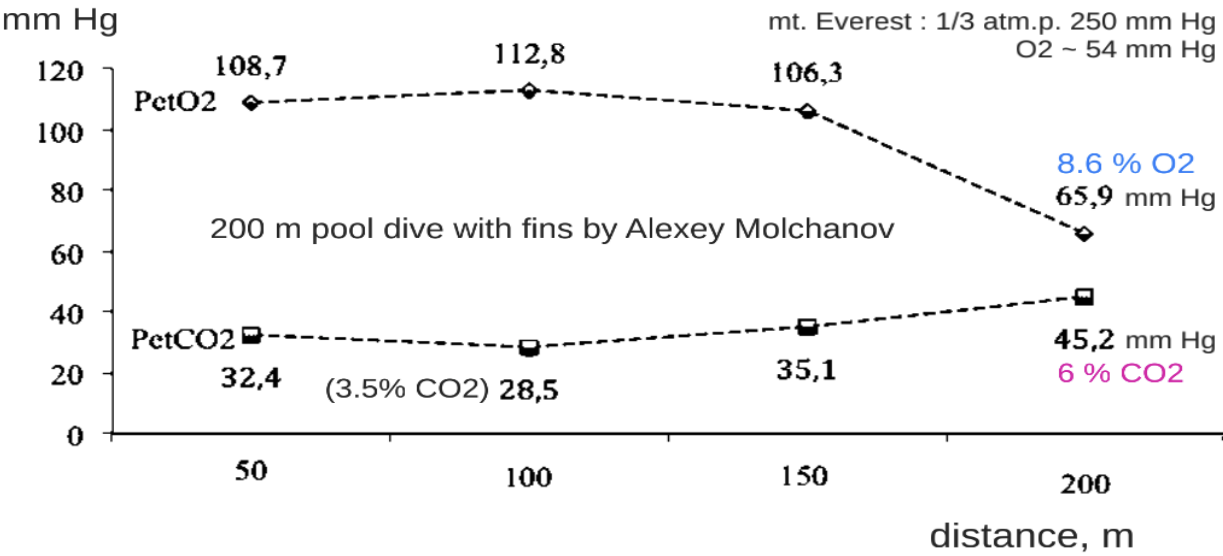
Annex 4, online call for participation, message from freediving world champion Natalia Molchanova
(relayed by several others big names in the freediving community):

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:

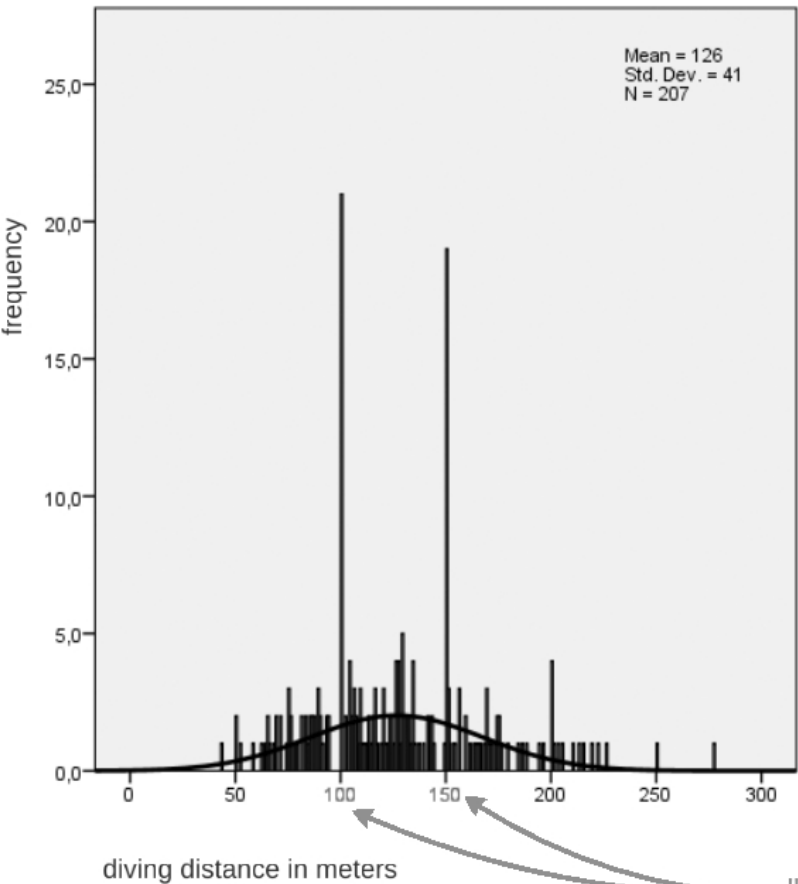
(link url)

Annex 5, hypercapnia stays below narcosis levels at sea surface freedive (in a pool)
[data courtesy of N.Molchanova]



= Annex 6, goal-oriented vs process-oriented competitors 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

"let go" vs. ego
"vanity" goals ?

Annex 7: 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: Beginner Freedivers' motivation to learn freediving at Molchanovs' courses. This sample contains 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: follow-up and further research 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 tobacco GATS survey, and similarly formulated legal alkaloids survey based on (World Health Organization, 2007), social desirability 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).

Reference:

- AAA Foundation for Traffic Safety. (2016). *Prevalence of Self-Reported Aggressive Driving Behavior: United States, 2014*.
<https://aaafoundation.org/wp-content/uploads/2017/12/Prevalence-of-Aggressive-Drivig-2014.pdf>
- AIDA International. (n.d.). *AIDA official Worlds Records History in Freediving (1995—2020)*.
<https://worldrecords.aidainternational.org/>
- Anand, K. J. S., & Hickey, P. R. (1987). Pain and Its Effects in the Human Neonate and Fetus. *New England Journal of Medicine*, 317(21), 1321–1329. <https://doi.org/10.1056/NEJM198711193172105>
- Andreoni, J., Nikiforakis, N., & Stoop, J. (2017). Are the rich more selfish than the poor, or do they just have more money? A natural field experiment. *NBER Working Paper Series, No. 23229*. <https://doi.org/10.13140/RG.2.2.22043.26403>
- Ap for CNN, T. (2015, August 6). *World's greatest freediver Natalia Molchanova feared dead*. CNN. Cable News Network.
<https://edition.cnn.com/2015/08/04/world/world-freediver-missing/index.html>
- Associated Press. (1963, June 11). Monk Suicide by Fire in Anti-Diem Protest. *New York Times*.
<https://www.nytimes.com/1963/06/11/archives/monk-suicide-by-fire-in-antidiem-protest.html>
- Bailey, J. E., Argypoulos, S. V., Kendrick, A. H., & Nutt, D. J. (2005). Behavioral and cardiovascular effects of 7.5% CO₂ in human volunteers. *Depression and Anxiety*, 21(1), 18–25. <https://doi.org/10.1002/da.20048>
- Barker, S. A. (2018). N, N-Dimethyltryptamine (DMT), an Endogenous Hallucinogen: Past, Present, and Future Research to Determine Its Role and Function. *Frontiers in Neuroscience*, 12, 536. <https://doi.org/10.3389/fnins.2018.00536>
- Barker, S. A., Borjigin, J., Lomnicka, I., & Strassman, R. (2013). LC/MS/MS analysis of the endogenous dimethyltryptamine hallucinogens, their precursors, and major metabolites in rat pineal gland microdialysate: LC/MS/MS of endogenous DMTs in rat pineal gland microdialysate. *Biomedical Chromatography*, 27(12), 1690–1700.
<https://doi.org/10.1002/bmc.2981>
- Barrett, Frederick S, Johnson, M. W., & Griffiths, R. R. (2015). Validation of the revised Mystical Experience Questionnaire in experimental sessions with psilocybin. *Journal of Psychopharmacology*, 29(11), 1182–1190.
<https://doi.org/10.1177/0269881115609019>
- Barrett, Frederick Streeter, Johnson, M. W., & Griffiths, R. R. (2017). Psilocybin in long-term meditators: Effects on default mode network functional connectivity and retrospective ratings of qualitative experience. *Drug and Alcohol Dependence*, 171, e15–e16. <https://doi.org/10.1016/j.drugalcdep.2016.08.058>
- Blake, J. A. (1978). Death by hand grenade: Altruistic suicide in combat. *Suicide & Life-Threatening Behavior*, 8(1), 46–59.
- Botvinick, M., & Cohen, J. (1998). Rubber hands 'feel' touch that eyes see. *Nature*, 391(6669), 756–756.
<https://doi.org/10.1038/35784>
- Bowles, S. (2017). *The Moral Economy: Why Good Incentives Are No Substitute for Good Citizens* (Reprint edition). Yale University Press.
- Bradberry, T., & Greaves, J. (2005, December). Heartless Bosses? *Harvard Business Review*. hbr.org/2005/12/heartless-bosses
- Brown, R. P. (2016). *Honor Bound: How a Cultural Ideal Has Shaped the American Psyche* (1 edition). Oxford University Press.
- Buchanan, G. F., Smith, H. R., MacAskill, A., & Richerson, G. B. (2015). 5HT_{2A} receptor activation is necessary for CO₂-

- induced arousal. *Journal of Neurophysiology*, 114(1), 233–243. <https://doi.org/10.1152/jn.00213.2015>
- Carhart-Harris, R. L., Roseman, L., Bolstridge, M., Demetriou, L., Pannekoek, J. N., Wall, M. B., Tanner, M., Kaelen, M., McGonigle, J., Murphy, K., Leech, R., Curran, H. V., & Nutt, D. J. (2017). Psilocybin for treatment-resistant depression: FMRI-measured brain mechanisms. *Scientific Reports*, 7(1), 13187. <https://doi.org/10.1038/s41598-017-13282-7>
- Caron, J.-B., & Vannier, J. (2016). Waptia and the Diversification of Brood Care in Early Arthropods. *Current Biology*, 26(1), 69–74. <https://doi.org/10.1016/j.cub.2015.11.006>
- Charland-Verville, V., Lugo, Z., Jourdan, J.-P., Donneau, A.-F., & Laureys, S. (2015). Near-Death Experiences in patients with locked-in syndrome: Not always a blissful journey. *Consciousness and Cognition*, 34, 28–32. <https://doi.org/10.1016/j.concog.2015.03.011>
- Clark, W. H. (1958). How do Social Scientists Define Religion? *The Journal of Social Psychology*, 47(1), 143–147. <https://doi.org/10.1080/00224545.1958.9714350>
- Coluccia, A., Gabbriellini, M., Gualtieri, G., Ferretti, F., Pozza, A., & Fagiolini, A. (2016). Sexual Masochism Disorder with Asphyxiophilia: A Deadly yet Underrecognized Disease. *Case Reports in Psychiatry*, 2016, 1–4. <https://doi.org/10.1155/2016/5474862>
- Constable, G. W. A., Rogers, T., McKane, A. J., & Tarnita, C. E. (2016). Demographic noise can reverse the direction of deterministic selection. *Proceedings of the National Academy of Sciences*, 113(32), E4745–E4754. <https://doi.org/10.1073/pnas.1603693113>
- Cooter, R. D., & Schäfer, H.-B. (2012). *Solomon's Knot: How Law Can End the Poverty of Nations* (First Edition edition). Princeton University Press.
- Cosimano, M., & Richards, B. (2013). *Clinical Perspectives in Managing High Dose Psilocybin Sessions* [MAPS youtube channel]. Psychedelic Science 2013.
- Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology*, 24(4), 349–354. <https://doi.org/10.1037/h0047358>
- Davidson, R. (1980). *Tracks* (1st American ed edition). Pantheon Books.
- DellaVigna, S., List, J. A., & Malmendier, U. (2012). Testing for Altruism and Social Pressure in Charitable Giving. *The Quarterly Journal of Economics*, 127(1), 1–56. <https://doi.org/10.1093/qje/qjr050>
- Dextegen, U. (2014). Ulf Dextegen helped Björn Ferry to rise to the top with hypnosis (in Swedish). *Kajak & Aventyr*. www.kajakaventyr.com/huvudet-och-sjalen-pa-hypnotisoren-dextegen/
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment*, 49(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13
- Doblin, R. (1991). Pahnke's Good Friday experiment: A long-term followup and methodological critique. *Journal of Transpersonal Psychology*, 23(1).
- Doty, J. R. (2016). *Into the Magic Shop: A Neurosurgeon's Quest to Discover the Mysteries of the Brain and the Secrets of the Heart - Ch. 8* (Later prt. edition). Avery.
- Eckart, D. (1924). *Bolshevism from Moses to Lenin* (2016 reprint of the 1924 nazi book). OSTARA PUBLICATIONS.
- Finkel, E. J. (2017). *The All-or-Nothing Marriage: How the Best Marriages Work*. Dutton.
- Fleming, P. (2017). *The Death of Homo Economicus: Work, Debt and the Myth of Endless Accumulation*. Pluto Press.
- French, S. (2018). Religion of Sport: Freediving (see from min 26th forward, the Jessea Lu near-droning mystical experience account) (season 3; episode 5). In *Religion of Sports*. AT&T's AUDIENCE Network.
- Futrell, C. (2012). *ABC's of Relationship Selling through Service* (12 edition). McGraw-Hill Education.
- Gerlach, M., Farb, B., Revelle, W., & Nunes Amaral, L. A. (2018). A robust data-driven approach identifies four personality types across four large data sets. *Nature Human Behaviour*, 2(10), 735–742. <https://doi.org/10.1038/s41562-018-0419-z>
- Gilbert, P., Catarino, F., Duarte, C., Matos, M., Kolts, R., Stubbs, J., Ceresatto, L., Duarte, J., Pinto-Gouveia, J., & Basran, J. (2017). The development of compassionate engagement and action scales for self and others. *Journal of Compassionate Health Care*, 4(1), 4. <https://doi.org/10.1186/s40639-017-0033-3>
- Goetz, J. L., Keltner, D., & Simon-Thomas, E. (2010). Compassion: An evolutionary analysis and empirical review. *Psychological Bulletin*, 136(3), 351–374. <https://doi.org/10.1037/a0018807>
- Greyson, B. (1983). The Near-Death Experience Scale: Construction, Reliability, and Validity. *The Journal of Nervous and Mental Disease*, 171(6), 369–375. <https://doi.org/10.1097/00005053-198306000-00007>
- Griffiths, R. R. (2013). *Johns Hopkins Psilocybin Research Project* [MAPS youtube channel]. Psychedelic Science 2013. <https://www.youtube.com/watch?v=lbRbMavHm-8>
- Griffiths, R. R. (2017). *Johns Hopkins Psilocybin Project—Implications for Spirituality & Therapeutics. - Q&A session; Psychedelics-2017*.
- Griffiths, R. R., Johnson, M. W., Carducci, M. A., Umbricht, A., Richards, W. A., Richards, B. D., Cosimano, M. P., & Klinedinst, M. A. (2016). Psilocybin produces substantial and sustained decreases in depression and anxiety in patients with life-threatening cancer: A randomized double-blind trial. *Journal of Psychopharmacology*, 30(12), 1181–1197. <https://doi.org/10.1177/0269881116675513>
- Griffiths, R. R., Johnson, M. W., Richards, W. A., Richards, B. D., McCann, U., & Jesse, R. (2011). Psilocybin occasioned mystical-type experiences: Immediate and persisting dose-related effects. *Psychopharmacology*, 218(4), 649–665. <https://doi.org/10.1007/s00213-011-2358-5>

- Griffiths, R. R., Richards, W. A., McCann, U., & Jesse, R. (2006). Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance. *Psychopharmacology*, 187(3), 268–283. <https://doi.org/10.1007/s00213-006-0457-5>
- Gu, J., Cavanagh, K., Baer, R., & Strauss, C. (2017). An empirical examination of the factor structure of compassion. *PLOS ONE*, 12(2), e0172471. <https://doi.org/10.1371/journal.pone.0172471>
- Gurven, M., von Rueden, C., Massenkoff, M., Kaplan, H., & Lero Vie, M. (2013). How universal is the Big Five? Testing the five-factor model of personality variation among forager–farmers in the Bolivian Amazon. *Journal of Personality and Social Psychology*, 104(2), 354–370. <https://doi.org/10.1037/a0030841>
- Hansen, M. T. (2018). *Great at Work: How Top Performers Do Less, Work Better, and Achieve More*. - (chapter: the 5000-person study) (1 edition). Simon & Schuster.
- Harris, S. (2020). *Making Sense: Conversations on Consciousness, Morality, and the Future of Humanity*. Ecco.
- Harry, B. (1958). *Carbon Dioxide Therapy: A Neurophysical Treatment of Nervous Disorders*. - ch. “Carbon Dioxide Therapy in prison with some comparisons in private practice” (L. J. Meduna, Ed.; Second edition). Charles C. Thomas.
- Herrnstein, R., & Murray, C. (1994). *The Bell Curve: Intelligence and Class Structure in American Life*. Free Press.
- Hood, R. W., Jr., Hill, P. C., & Spilka, B. (2018). *The Psychology of Religion, Fifth Edition: An Empirical Approach* (Fifth edition). The Guilford Press.
- Hsieh, T. (2010). *Delivering Happiness: A Path to Profits, Passion, and Purpose* (1 edition). Grand Central Publishing.
- Iceman, K. E., Richerson, G. B., & Harris, M. B. (2013). Medullary serotonin neurons are CO₂ sensitive in situ. *Journal of Neurophysiology*, 110(11), 2536–2544. <https://doi.org/10.1152/jn.00288.2013>
- Jackson, A. (2014, February 3). Marcus du Sautoy: Communicating Science within the Sciences. *Soapbox Science, a Community Guest Blog from Nature Publishing Group*. <http://blogs.nature.com/soapboxscience/2014/02/03/marcus-du-sautoy-communicating-science-within-the-sciences-and-to-the-public>
- Jackson, F. (1986). What Mary Didn't Know. *The Journal of Philosophy*, 83(5), 291. <https://doi.org/10.2307/2026143>
- Jackson, S., & Csikszentmihalyi, M. (1999). *Flow in Sports: The keys to optimal experiences and performances* (First edition). Human Kinetics, Inc.
- John, O. P., Naumann, L. P., & Soto, C. J. (2008). *Handbook of personality: Theory and research* - pp. 114-158, ch.II: *Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues*. (Oliver P. John, R. W. Robins, & L. A. Pervin, Eds.; 3rd ed). Guilford Press.
- Joiner, J. T. (2010). *NOAA Diving Manual: Diving for Science and Technology* - page 3-9, section 3.2.6.2. (NOAA Diving Division, Ed.; 4th Edition Revised edition). Best Publishing Company.
- Julian, J.-F. (2010). *La vie sans air (Fr: “Life without breathing”, in particular the account of Stéphane Mifsud making his 11 min 35 s static apnea world record)*. “France 4” TV channel.
- Ketchum, J. S., & M.D. (2006). *Chemical Warfare Secrets Almost Forgotten: A Personal Story of Medical Testing of Army Volunteers* (second 2007 edition). ChemBook, Inc.
- Kiel, F. (2015). *Return on character: The real reason leaders and their companies win*. Harvard Business Review Press.
- Kim, W. C., & Mauborgne, R. (2017). *Blue Ocean Shift: Beyond Competing - Proven Steps to Inspire Confidence and Seize New Growth*. Hachette Books.
- Kjellgren, A., Lindahl, A., & Norlander, T. (2009). Altered States of Consciousness and Mystical Experiences during Sensory Isolation in Flotation Tank: Is the Highly Sensitive Personality Variable of Importance? *Imagination, Cognition and Personality*, 29(2), 135–146. <https://doi.org/10.2190/IC.29.2.d>
- Kyle, C., McEwen, S., & DeFelice, J. (2012). *American Sniper: The Autobiography of the Most Lethal Sniper in U.S. Military History* - ch. 14 (Hardcover Edition). William Morrow.
- Laloë, V. (2004). Patterns of deliberate self-burning in various parts of the world. A review. *Burns: Journal of the International Society for Burn Injuries*, 30(3), 207–215. <https://doi.org/10.1016/j.burns.2003.10.018>
- Leary, T. (1999). *Turn On, Tune In, Drop Out* (6th ed. edition). Ronin Publishing.
- Lee Kuan Yew. (2000). *From Third World to First: The Singapore Story - 1965-2000* (1st edition). Harper.
- Lemaître, F. (2019). *Freediving: From theory to practice*. Publications de l'Université de Rouen et du Havre.
- Levkievskaya, E. E. (2004). Представления о “том свете” у восточных славян (rus: East Slavs' views about the outer realm). *Slavic Almanac*, 2003(printed by “Indrik” editor, Moscow, 2004), 342–367.
- Lippi, G., Banfi, G., Favaloro, E. J., Rittweger, J., & Maffulli, N. (2008). Updates on improvement of human athletic performance: Focus on world records in athletics. *British Medical Bulletin*, 87(1), 7–15. <https://doi.org/10.1093/bmb/ldn029>
- Littlemore, K. (2007, August 12). Real Men Under Pressure. In *Real Men (docu series)*. BBC One.
- Lommel, P. van. (2010). *Consciousness Beyond Life: The Science of the Near-Death Experience* (1st edition). HarperOne.
- MacCallum, R. C., Widaman, K. F., Preacher, K. J., & Hong, S. (2001). Sample Size in Factor Analysis: The Role of Model Error. *Multivariate Behavioral Research*, 36(4), 611–637. https://doi.org/10.1207/S15327906MBR3604_06
- MacLean, K. A., Johnson, M. W., & Griffiths, R. R. (2011). Mystical experiences occasioned by the hallucinogen psilocybin lead to increases in the personality domain of openness. *Journal of Psychopharmacology*, 25(11), 1453–1461. <https://doi.org/10.1177/0269881111420188>
- MacLean, K. A., Leoutsakos, J.-M. S., Johnson, M. W., & Griffiths, R. R. (2012). Factor Analysis of the Mystical Experience Questionnaire: A Study of Experiences Occasioned by the Hallucinogen Psilocybin. *Journal for the Scientific Study of*

- Religion*, 51(4), 721–737. <https://doi.org/10.1111/j.1468-5906.2012.01685.x>
- Marlantes, K. (2011). *What It Is Like to Go to War* (1st Edition edition). Atlantic Monthly Press.
- Marsh, A. A. (2016). Neural, cognitive, and evolutionary foundations of human altruism: Neural, cognitive, and evolutionary foundations of human altruism. *Wiley Interdisciplinary Reviews: Cognitive Science*, 7(1), 59–71. <https://doi.org/10.1002/wcs.1377>
- Mathieu, V. (2018). *Apnée spirit: Une plongée au cœur de soi*. FLAMMARION.
- McIlhenny, E. H., Riba, J., Barbanoj, M. J., Strassman, R., & Barker, S. A. (2011). Methodology for and the determination of the major constituents and metabolites of the Amazonian botanical medicine ayahuasca in human urine. *Biomedical Chromatography*, 25(9), 970–984. <https://doi.org/10.1002/bmc.1551>
- Meduna, L. J. (1958). *Carbon Dioxide Therapy: A Neuropsychical Treatment of Nervous Disorders* (L. J. Meduna, Ed.; Second edition). Charles C. Thomas.
- Miura, Y. (1995). *Go: An Asian Paradigm for Business Strategy* (First Printing edition). The Ishi Press.
- Molchanova, N. (2020). *Motivations and Personal Bests of Beginner Freedivers* [Data set]. Harvard Dataverse. <https://doi.org/10.7910/DVN/OYLD0E>
- Molchanova, N., & Tutrin, A. (2020). *MEQ30 Russian survey raw data* (DRAFT VERSION). Harvard Dataverse. <https://doi.org/10.7910/DVN/WJ2I6W>
- Mundfrom, D. J., Shaw, D. G., & Ke, T. L. (2005). Minimum Sample Size Recommendations for Conducting Factor Analyses. *International Journal of Testing*, 5(2), 159–168. https://doi.org/10.1207/s15327574ijt0502_4
- Neff, K. D. (2003). The Development and Validation of a Scale to Measure Self-Compassion. *Self and Identity*, 2(3), 223–250. <https://doi.org/10.1080/15298860309027>
- Néry, G., & Vaillant, L. L. (2016). *Profondeurs—(French edition, see chapter 9, narcosis accounts by several top freedivers)*. Arthaud.
- Nitsch, H. (2017). *Herbert Nitsch: Breathing is overrated* (R. Jelinek, Ed.). Der Konterfei.
- Noakes, T. D. (2009). Evidence that reduced skeletal muscle recruitment explains the lactate paradox during exercise at high altitude. *Journal of Applied Physiology*, 106(2), 737–738. <https://doi.org/10.1152/jappphysiol.90410.2008>
- Paloutzian, R. F., & Park, C. L. (Eds.). (2013). *Handbook of the Psychology of Religion and Spirituality, Second Edition* (Second edition). The Guilford Press.
- Pigliucci, M., Stoltzfus, A., Moczek, A. P., Dayan, D. I., Graham, M. A., Baker, J. A., Foster, S. A., Sultan, S., Odling-Smee, J., Feldman, M. W., Duckworth, R. A., Helanterä, H., Watson, R. A., Thies, C., Walsh, D., Otsuka, J., Pocheville, A., Chiu, L., & Stoltz, K. (2019). *Evolutionary Causation: Biological and Philosophical Reflections* (T. Uller & K. N. Laland, Eds.). The MIT Press.
- Plomin, R. (2019, December 5). *How DNA makes us who we are (Q&A section)* [RSA Events (video on Facebook)].
- Pratkanis, A. (1995, August). How to Sell a Pseudoscience. *Skeptical Inquirer*, 19(4). <https://skepticalinquirer.org/1995/07/how-to-sell-a-pseudoscience/>
- Ramachandran, V. S., & Blakeslee, S. (1998). *Phantoms in the brain: Probing the mysteries of the human mind - page 127* (1st ed). William Morrow.
- Rendell, L., Fogarty, L., & Laland, K. N. (2011). Runaway cultural niche construction. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366(1566), 823–835. <https://doi.org/10.1098/rstb.2010.0256>
- Schiffer, T. (2014). *Metabolic efficiency (focus on dietary nitrate, hypoxia and exercise)* [Karolinska Institutet]. https://openarchive.ki.se/xmlui/bitstream/handle/10616/42224/Thesis_Tomas_Schiffer.pdf
- Shanina, R. (2014). *Songs and dew are her legacy: 1944—1945 war diary of sniper Rosa Shanina* (P. A. Molchanov, Ed.). Ustyansky District Museum.
- Singer, T., & Bolz, M. (Eds.). (2013). *Compassion. Bridging Practice and Science (free e-book)*. www.compassion-training.org
- Stanislavsky, K. S. (1936). *An actor prepares* (2013 reprint of the 1936 book) (E. R. Hapgood, Trans.). Bloomsbury.
- Stavrou, N. A., Jackson, S. A., Zervas, Y., & Karateroliotis, K. (2007). Flow Experience and Athletes' Performance with Reference to the Orthogonal Model of Flow. *The Sport Psychologist*, 21(4), 438–457. <https://doi.org/10.1123/tsp.21.4.438>
- Stephens, J. C. (2019). *Journeys to the Underworld and Heavenly Realm in Ancient and Medieval Literature*. McFarland.
- Szabo, A., & Frecska, E. (2016). Dimethyltryptamine (DMT): A biochemical Swiss Army knife in neuroinflammation and neuroprotection? *Neural Regeneration Research*, 11(3), 396. <https://doi.org/10.4103/1673-5374.179041>
- Teixeira da Silva, J., & Dobranszki, J. (2015). The authorship of deceased scientists and their posthumous responsibilities. *Science Editor (CSE)*, 38, 98–100.
- Timmermann, C., Roseman, L., Williams, L., Erritzoe, D., Martial, C., Cassol, H., Laureys, S., Nutt, D., & Carhart-Harris, R. (2018). DMT Models the Near-Death Experience. *Frontiers in Psychology*, 9. <https://doi.org/10.3389/fpsyg.2018.01424>
- Tutrin, A. (2020). *MEQ30 and Personality traits and demographics Freediving follow-up survey raw data* [Data set]. Harvard Dataverse. <https://doi.org/10.7910/DVN/DEJQM4>
- US Children's Bureau. (2018). *Child maltreatment 2016* (by U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau). U.S. Department of Health & Human Services. <https://www.acf.hhs.gov/cb/research-data-technology/statistics-research/child-maltreatment>
- US Department of Defense. (1963). *Buffering of carbon dioxide during hypercapnia—US Department of Defense 1963—PIN 25917—PMF 5356—Tests performed on an untreated and treated dog—Preparation of animal, denitrogenation of*

- lungs, apneic oxygenation, effects on animals.* <https://www.youtube.com/watch?v=Bd0LQ-tVfkg>
- US Department of Defense. (2011). *Special Operations Forces Medical Handbook (ch.20, Robert Price; CO2 poisoning)*. Skyhorse. <https://www.simonandschuster.com/books/Special-Operations-Forces-Medical-Handbook/U-S-Department-of-Defense/9781616082789>
- Vaillant, G. E. (2012). *Triumphs of Experience: The Men of the Harvard Grant Study* (1 edition). Belknap Press. www.adultdevelopmentstudy.org
- Wilkinson, A. (2009). The deepest dive: How far down can a freediver go? *The New Yorker*, August 24, 2009. <https://www.newyorker.com/magazine/2009/08/24/the-deepest-dive>
- Wold, L. (2019). *Inside an Honor Killing: A Father and a Daughter Tell Their Story* (Translation edition). Greystone Books.
- World Health Organization. (2007). *The Global Adult Tobacco Survey (GATS)*.
- World Health Organization. (2014). *Survey on the prevalence of adverse childhood experiences among young people in the Russian Federation*.
- Zimbardo, P. (2007). *The Lucifer Effect: Understanding How Good People Turn Evil* (1st edition). Random House.
- Zimmermann, A., Hilpert, J., & Wendt, K. P. (2009). Estimations of Population Density for Selected Periods Between the Neolithic and AD 1800. *Human Biology*, 81(2–3), 357–380. <https://doi.org/10.3378/027.081.0313>