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Abstract: Abusing psychoactive substances has been a popular sport in the business world since the mid-19th century. First, they were appreciated for their stimulating or tonic effects, but later with psychedelics on the scene, their importance in subculture matured. In the last decade, it has become very popular to use LSD and cocaine in subtle doses, which provides users with a high that is enough to feel their psychoactive potential, but not as high that significant behavioral changes can be seen. Unlike regular use, microdosing is usually sufficient to affect a few without undue finish and withdrawal symptoms. It allows for abuse in the regular mode of the working week with a rest phase on the weekend. The diametric difference between the abuse of standard dosing and micro-dosing is also in the decreasing tolerance of the organism. Over time, an organism permanently exposed to microdosing of stimulants is sufficient to achieve a gradually decreasing dose effect that psychedelics develop resistance to. Case studies of such prolonged use were described and analyzed to show the role of microdosing in the creative world and for business managers. Initial field research, funded by the Newton University internal grant, focused on contamination mapping in office spaces for employees in target positions. Further research continues on the investigation of microdosing in conditions of corporate reality.

Keywords: microdosing; methamphetamine; psychoactive substances; business; contamination

1. Introduction

The business world places great pressure on its participants, asking for maximal productivity with minimal non-productive time and no mistakes. This scheme goes against the general rules of psycho-hygiene, which requires a balanced proportion of mental strain and relaxation. Thus, there is no exception to meet stressed clerks and business people, supporting their weakened mental condition with psychoactive chemical substances-both legal and illegal. The most popular are stimulants, closely followed by psychedelics, which both stimulates their work effort and, on the other hand, opioids and cannabinoids help to calm down overstressed minds and relax. Using certain psychoactive substances is based on the economic situation of the person. Generally, employees tend to use cheaper ones such as methamphetamine, and managers demonstrate their social status by abusing more expensive substances such as cocaine. The presented text is based on the preliminary results from a pilot study focused on developing and influencing trends of human behavior and systems in changing environments, researched on the Newton University in the Czech Republic. The main topic is targeted at changes in the perception of psychoactive substances in current business with a basic description of the most common psychoactive substances used for microdosing and their biological effects. Briefly described are new approaches to microdosing in business, both for use and qualified legal sale, and safety countermeasures from the employer's point of view. Microdosing of psychoactive substances is an emerging trend of business practice, which is described below and supported with randomly selected case studies published in open sources. The meaning of the study is to cover the background of the microdosing phenomenon and later continue with the descriptive study of methamphetamine micro contamination.



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2. Psychoactive Substances

Psychoactive substances are substances that, when taken in or administered into one's system, affect mental processes (e.g., cognition or affect). 'Psychoactive' does not necessarily imply dependence-producing, and in common parlance, the term is often left unstated, as in 'drug use' or 'substance abuse', based on the WHO definition [1]. Groups of psychoactive drugs include stimulants, depressants, narcotics (opioids), hallucinogens, and cannabinoids. There are several ways in which psychoactive drugs are classified:

- By their common effects (effects they all have) in the brain and body—for example, stimulants and depressants;
- By their likelihood to cause addiction (high to low);
- By their chemical structure; and
- By U.S. Drug Enforcement Administration Schedules I–V, which classify these drugs by the potential for abuse [2].

So far, one of the most popular illegal psychoactive substances and most widespread worldwide is methamphetamine, with many slang names in different countries. Methamphetamine is a global problem, with growing quantities being cooked every year. First synthesized from ephedrine (alkaloid of *Ephedra sinica*) during the traditional Chinese Ma Huang drug research by Japanese chemists Nagai Nagayoshi in 1893, pharmacologist Akira Ogata first used hydroiodic acid and red phosphorus for ephedrine reduction to produce methamphetamine hydrochloride, which created the opportunity for standard pharmaceutical production in tablets widely available on the open market. Mass-produced in the 30s and 40s in Germany and Japan as a stimulant and slimming medicine, first for the civilian market, and then for military use, but due to the addictive potential, it was withdrawn from the approved medicine list in 1959 [3].

An important illegal stimulant in the business world is cocaine, the most frequently used stimulant globally [4]. Cocaine is a hydrochloride of coca base, sourced from coca leaves (*Erythroxylum coca*). Cocaine is addictive due to its effect on the reward pathway in the brain. After a short period of use, there is a high risk that dependence will occur. Its use also increases the risk of stroke, myocardial infarction, lung problems in those who smoke it, blood infections, and sudden cardiac death [5]. Cocaine acts by inhibiting the reuptake of serotonin, norepinephrine, and dopamine, which results in greater concentrations of these three neurotransmitters in the brain [6]. It can easily cross the blood–brain barrier and may lead to the breakdown of the barrier [7,8]. Following repeated doses, a person may have decreased ability to feel pleasure and be very physically tired. In the developed world, 1–3% of people have used cocaine at some point in their life [6].

Cannabinoids are the most frequently abused illegal substance in the world [4]. Generally, they can be divided into natural-borne and synthetic ones. At least 144 different natural cannabinoids are isolated from cannabis, exhibiting varied effects [9]. Synthetic cannabinoids consist of various distinct chemical classes—the classical cannabinoids structurally related to THC, the nonclassical cannabinoids (cannabimimetic), and the aminoalkylindoles, 1,5-diarylpyrazoles, quinolines, and aryl sulfonamides as well as eicosanoids related to endocannabinoids [10]. Psychoactive cannabinoids produce euphoria, enhancement of sensory perception, tachycardia, antinociception, difficulties in concentration, and impairment of memory. The cognitive deficiencies seem to persist after withdrawal. The psychoactive effect increases the activity of dopaminergic neurons in the ventral tegmental area-mesolimbic pathway. Since these dopaminergic circuits play a pivotal role in mediating the reinforcing (rewarding) effects of most drugs of abuse, the enhanced dopaminergic drive elicited by the cannabinoids is thought to underlie the reinforcing and abuse properties of marijuana. Thus, cannabinoids share a final standard neuronal action with other significant drugs of abuse such as morphine, ethanol, and nicotine in facilitating the mesolimbic dopamine system [11].

Psychedelics are a subset of hallucinogenic drugs whose primary effect is to trigger non-ordinary states of consciousness (known as psychedelic experiences or "trips") via serotonin 2A receptor agonism. It causes specific psychological, visual, and auditory changes and often a substantially altered state of consciousness. The typical psychedelics with the most extensive scientific and cultural influence are mescaline, LSD (lysergic acid diethylamide), psilocybin, and DMT (dimethyltryptamine). Most psychedelic substances fall into one of the three families of chemical compounds: tryptamines, phenethylamines, or lysergamides. These chemicals all bind to serotonin 5-HT2A receptors [12], which modulate the activity of critical circuits in the brain involved with sensory perception and cognition. However, the exact nature of how psychedelics induce changes in perception and cognition via the 5-HT2A receptor is still unknown, although reduced default mode network activity is likely a primary mechanism of action [13,14]. The psychedelic experience is often compared to non-ordinary forms of consciousness such as those experienced in meditation [15,16], mystical experiences [17,18], and near-death experiences [18]. The phenomenon of ego dissolution is often described as a critical feature of the psychedelic experience [15,16,18].

3. The Use and Effects of Microdosing in Business

Microdosing is the practice of using sub-threshold doses (microdoses) of psychedelics to improve creativity, boost physical energy level, emotional balance, increase performance on problem-solving tasks, and treat anxiety, depression, and addiction [19,20]. The practice of microdosing has become more widespread in the 21st century, with more people claiming long-term benefits from the practice [21,22].

3.1. Psychedelics

The two most common psychedelic drugs used in microdosing are lysergic acid diethylamide (LSD) and psilocybin from psychoactive mushrooms [23,24]. Other psychedelics used for microdosing include 1P-LSD, mescaline, 4-HO-MET, 2,5-dimethoxy-4-bromoam phetamine, 2C-H, 2C-D, 2C-E, and lysergic acid amide [23]. A microdose is usually 1/20 to 1/10 of an active dose of a psychedelic drug [24]. In contrast to the recreational use of psychedelics, individuals who microdose stick to drug schedules, often dosing about every three days [22]. There have been no published empirical studies on microdosing, and the current legal and bureaucratic climate make direct empirical investigation of the effects of psychoactive substances difficult. The microdosing phenomenon has seen a rapid explosion of popularity in recent years. Individuals who microdose psychedelics report minimal acute effects from these substances yet claim a range of long-term general health and well-being benefits [23].

There has been little peer-reviewed research on psychedelic microdosing, but numerous blogs and online communities discuss the practice, with detailed guides to methods and anecdotal outcomes reports (e.g., www.microdosing.com; www.reddit.com/microdosing/ wiki; accessed on 10 April 2021). Typical doses can be as small as one-twentieth of a typical recreational dose, sometimes even less. For example, a micro-dose of lysergic acid diethylamide (LSD) might be 6–25 micrograms, or a micro-dose of psilocybin might be 0.1 to 0.5 grams of dried mushrooms. People microdose using a wide range of substances, although LSD and psilocybin are the most commonly discussed in online forums [23], as described in the following case study.

Case Study No. 1

A male twenty-five with a master's degree from Stanford works for a tech startup in San Francisco, making a little bit of everything: hardware and software design, sales and business development. He has recently discovered a new way to enhance his productivity and creativity, and it is not Five Hour Energy or meditation. He is one of a growing number of professionals who enjoy taking "microdoses" of psychedelics—in his free time and, occasionally, at the office. "I had an epic time," he says at the end of one such day. "I was making many sales, talking to many people, finding solutions to their technical problems." [25].

3.2. The Effects of Psychedelics Microdosing

Despite the reported lack of acute effects of microdosing, proponents claim a wide variety of psychological and social benefits from regular microdosing including increases in vitality, creativity, productivity, social ability, focus, analytic thinking, positive mood, memory, mindfulness, and general well-being [26]. These levels of 10 micrograms are intended to be "sub-perceptual," or "too small to inspire Technicolor hallucinations, but large enough to enhance a sense of mental flow". Hundreds of microdosing users have reported decreased anxiety, depression, and even migraines. Others have said that they had experienced improvements in creativity, diet, sleep, and sex. LSD is sometimes adulterated or improperly synthesized and may vary widely in potency, with someone intending to take a tiny, sub-perceptual dose at risk of having "a full-blown psychedelic effect when trying to do a PowerPoint presentation". The effects of psychedelic microdosing are similar to stimulants due to the activation of dopamine pathways, minus perhaps some of the anxiety or agitation. However, it is not known from a rigorous medical standpoint what sustained microdosing does to the brain over time [27]. The following case study introduces the research results of the long-term microdosing experiment.

Case Study No. 2

In the Polito and Stevenson study [23], 98 participants (recruited from Reddit and Bluelight microdosing discussion communities) were asked to provide daily overviews of their microdosing experiences via email and complete a questionnaire at the start and end of the experiment. The experiment took place over six weeks and found that participants felt an increase across all psychological functions (well-being, mindfulness, creativity, attention, etc.) measured on the days they took the microdose. This increase did not continue over the following days, but focus and productivity rose two days after taking the dose (most users tend to have one day on and a few days off. Participants mentioned a reduction in mind wandering, lower levels of depression and stress, and a rise in absorption (being absorbed in mental imagery) which are all fantastic tools for working. Though, creativity and general quality of life were not reported to change at all.

People in Silicon Valley and elsewhere say they are using microdoses of psychedelics to increase their productivity. Others say they have been self-medicating with microdoses for conditions such as depression [20]. According to some senior management, the usual reason for microdosing is the obsession with youth—those with grey hair seem outdated and do not fit in with the corporate culture. Psychedelic microdosing helps them to succeed in their careers, as described in the following case study. The general practice is to obtain an individual psychedelic-trip coach or guru to guide them through the mind-altering journey for up to \$2000 per month [28].

Case Study No. 3

Steve Jobs was said to have partaken in psychedelics and playfully derided his rival, Bill Gates, as being "unimaginative" and suggested dropping some LSD. Scott Adams, the creator of the Dilbert cartoon strip, pundit on YouTube and Periscope and resident of Northern California, claims that he took mushrooms once and it was the best day of his life, and he no longer felt any limits to his life and career success. Joe Rogan, the host of one of the most listened-to podcasts and another California resident, is a big proponent of psychedelic microdosing and has had numerous guests on his shows, ranging from scientists to MMA fighters, who have shared their positive experiences from microdosing [28].

Clinical research with psychedelics is currently undergoing a significant revival after being brought to a halt in the 1960s. One of the benefits of research into psychedelics is their potential to help deepen our understanding of consciousness. In 2016, researchers from Imperial College London were the first to use brain scanning techniques to visualize how LSD alters the way the brain works. One key finding was that LSD had a disorganizing influence on cortical activity, which permitted the brain to operate in a freer, less constrained manner than usual. There have even been some reports of psychosis-like symptoms in specific vulnerable individuals who use LSD recreationally. However, two recent U.S. population surveys found no link between psychedelics and mental health conditions [29]. The U.S. Food and Drug Administration (FDA) has granted psychedelic psilocybin and synthetic stimulant MDMA (ecstasy) "breakthrough" designations, allowing them to be clinically researched after showing promising potential in treating patients with mental health conditions. Other early research has looked at the positive impacts of psychedelics in treating addiction and even easing headaches [30], which was, from a short time perspective, found as a distinct advantage as in the following case study.

Case Study No. 4

A female 40, describes her reasons to microdose as "I will take some this Wednesday because my business is expanding and I am designing that day. Microdosing will help with the creative side. I will take some on Thursday because I am trying to upskill one of the managers, and it helps with my human interaction and empathy. However, if I knew I was going to be sitting at home doing the bookkeeping and looking at spreadsheets for hours, I would not microdose—I would get distracted" [31].

3.3. The Microdosing Business

Microdosing has become a very trendy business in itself. Medical companies such as MindMed have already established the first microdosing divisions to develop the pharmaceutical application of psychedelic microdoses and run scientific studies evaluating benefits on neuroplasticity, sleep, cognitive enhancement variables, and immune system response on humans. Another well-organized business is, except for psychedelic coaching, selling psychedelic microdose packages online. A good example is an Amsterdam-based startup called Earth Resonance, selling psilocybin truffles. This item, legally sold as a "luxury good" (with 19% VAT), gives everyone a chance to see what it is like to microdose using psilocybin truffles—in a legal manner—by selling truffles online without having to worry about the repercussions. Earth Resonance's founder, Robert Nass, declared that people have opened up to microdosing since coronavirus lockdowns started. Orders have gone up as people start to seek new experimental ways to deal with these peculiar conditions. Of course, experimenting with hallucinogenic drugs is daunting and not for everyone, which is why Earth Resonance offers online consultancy (8900€ per hour) to help people prepare for their microdosing month. For now, the Netherlands is the only country that allows for over-the-counter sales of psilocybin truffles. Canada is expected to legalize it within the next three years [32].Psychedelic experience coaching is a promising business everywhere legalization of any psychoactive substance has been declared as described below.

Case Study No. 5

Male 29, working in the Silicon Valley, describes his everyday experience under the guidance of a professional psychedelic coach: "In that altered state, it became much more real than I did not know anything about the world," says he. "We realized how ignorant we were and how much growth we had left in our lives. It was, in a strange way, very humbling but also very liberating. That helped me understand my potential." [30].

Cannabis microdosing is different from the increasingly popular topic of microdosing psychedelics. However, in the same way, microdoses of psychedelic substances are suggested to be beneficial. Users may benefit from microdoses of cannabis as opposed to consuming higher amounts. While using cannabis medicinally is an excellent option for many, not everyone wants to get high. Unsurprisingly, we have seen an explosion of CBD products on the market in recent years because CBD provides therapeutic, non-intoxicating effects. However, it is not just CBD in cannabis that provides therapeutic effects. THC also has plenty of promising medical benefits. It is suggested that CBD and THC work better together because of the synergy between the various cannabinoids. Plenty of people are satisfied with the benefits of CBD, but there are other options for users who may want an extra boost without a solid high [33].

A good start is at around 2.5 mg of THC products for the first microdose. It is pretty easy to have a well-dosed edible or tincture, but can pose a challenge if one is microdosing by smoking weed. The goal of microdosing is to eliminate the side effects such as paranoia to allow users to benefit from the plant's therapeutic effects. While we do not have enough research to back up definitive claims about microdosing using weed, we do know that many users see benefits from microdoses. The most common reasons that users microdose are to manage depression, pain, and anxiety. Additionally, many users microdose weed to improve their focus or help with their sleep cycles [33].

Research about Post Traumatic Stress Disorder and cannabinoids supports the use of low-dose cannabinoids for therapeutic benefits [34]. In the study, incarcerated participants received low doses of Nabilone (synthetic cannabinoid typically used to reduce nausea in patients receiving cancer treatment) to manage their PTSD and related symptoms. The study results indicated improvements in nightmares, chronic pain, insomnia, and other PTSD-related symptoms. It is promising evidence that low doses of cannabinoids may provide beneficial therapeutic effects [33].

Another good practice of white-collars and university students is to pretend to have attention deficit disorder to obtain prescribed approved medicines Desoxyn (metham-phetamine hydrochloride) or Adderall (amphetamine and d-amphetamine salts), both of which stimulate their minds to work better and faster [28].

4. Microdosing at the Workplace

Taking even a microdose of psychoactive substances over some time could mean that the body becomes accustomed to them, leading to the risk of normalizing a potent substance, in order to achieve the desired effects, and people eventually find themselves taking higher doses in order to obtain the same effects, as has been found with other substances.

Case Study No. 6

A female 34, has been facing court after being accused of illegal handling of psychoactive substances. The matter of legal action is financing medicinal drugs being used to produce methamphetamine and transport for the cook to purchase medicines, sell methamphetamine, and the illicit laboratory for production. When caught by the criminal police, she had several grams of methamphetamine with her. "I am an occasional user. I take it as a booster helping me to go through a huge load of work" [35].

One example is coffee, where caffeine is recognized as a potent stimulant with a highly abusive effect. If you drink coffee every day in order to stay awake and energized, over time, there is a need to increase the amount in order to obtain the same effect—one cup of coffee quickly turns into four or five, which then becomes a vicious circle as the increased caffeine dose keeps you awake when you want to sleep. Employers should calculate with this emerging trend of microdosing. In a company with a policy fighting drugs and alcohol, it is good practice to review it and also incorporate microdosing in the health and safety risk assessment. New personal training standards to raise awareness against the workforce are necessary, with some very early applications being demonstrated below.

Case Study No. 7

Czech critical infrastructure company has raised a flag against psychoactive substances microdosing. Full-size contamination mapping went through the company's premises, especially the national control room. Every control was thoroughly searched and analyzed with Mistral wet chemistry tests and a nearby changing room. There was a strong trace of marijuana smoked in the changing room ventilated through the window with joined subtle traces of cannabinoids on

the office desks, probably delivered by the sleeves of smokers. The trace pathway was interrupted in the middle section by regular cleaning, so the trace pathway seems to be of an older pattern. Significant evidence of continuous contamination was found between the palm scanner at the door entrance and office desks. According to instructions, there was no origin of the contamination—either pain killers or targeted abuse of the psychoactive substance.

Later, samples from common spaces at the office wings—kitchenettes, showers, printers—were also analyzed. At the southern office wing, there was found a strong, located trace of cannabinoids, later recognized according to the noticeable part of grease as a probable medicinal cannabinoid salve. A good hit was made in the showers of top management, where significant traces of amphetamine were found. Without further analysis, there was no chance to identify whether there were traces of abuse of psychoactive substances or medical treatment. At the northern office wing, there were many traces of pseudoephedrine in every kitchenette, likely due to cold medicines. A substantial hit was made on rough particles of marijuana dry matter, which was evidence of abuse of cannabis in the workplace.

5. Discussion

The description of different psychoactive substances used for microdosing shows the above various effects of such abusive drugs. Business personnel use microdosing to increase their productivity, while others have been self-medicating with microdoses for mental illnesses that they do not want to treat regularly. The usual reason to microdose is their obsession with youth, as microdosing helps them to succeed in their careers and stay in line with an effective workforce.

On the other hand, employers have become alert to having a workforce that is high. Taking even a microdose of psychoactive substances over some time could mean that one's body becomes accustomed to them, leading to the risk of normalizing a potent substance, in order to achieve the desired effects, and people eventually find themselves taking higher doses in order to obtain the same effects as found with other substances. Employers should calculate, with a rational argument, that the personnel regularly microdosing would soon be working while affected, and therefore could be dangerous and unpredictable. In a company with a policy of fighting drugs and alcohol, a good practice is to review it and also incorporate microdosing in the health and safety risk assessment. Trends in the stimulation of the workforce with microdoses are widely accepted around the globe, although the first signs of combating such practices have been reported from the United Kingdom and the Czech Republic.

6. Conclusions

The above-mentioned comprehensive description of the microdosing of psychoactive substances in business showed two different levels—both in the level of personal use, supporting one's ability to work more efficiently, and professionally, creating new opportunities for business development. Future research focuses on the spread of microdosing and micro-contamination through the business environment. Newton College, as a university of management studies, is researching that emerging trend and also brings the topic to educative processes. The main topic of future research is the practical study of microdosing in a business environment based on contamination screening and following an investigation of the sources where the contamination originates—not only technically, but also about the primary motives.

Generally, the microdosing of psychoactive substances has become a crucial part of corporate culture in different branches. Although it produces the desired short-time effect, there is no scientific evidence of its safe use for a more extended period. The supply of psychoactive substances in microdoses develops subtle changes in brain chemistry as total doses do, but the final bill will be the same. Compared to the regular abuse of total doses,

it borrows time for the user toward a further future, but brings no overall advantage. Additionally, from the employer's position, it is very dubious to rely on the workforce's work while being affected by psychoactive substances. Zero tolerance of such practices is necessary such as drinking alcohol. For HR and security managers, this is a fundamental challenge in the future to develop training that supports good practice of a clean mind to comply with health and safety regulations. However, the authors are not as naive to believe that humans can live without addiction, as this habit is as strong as hunger or sex.

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