Titulo:

Tratamiento de un caso de fobia a los insectos, mediante la exposición con Realidad Virtual y en vivo: estudio de un caso.

Case study of entomophobia (insect phobia) with Virtual Reality and in vivo: a new treatment approach.

Palabras clave: realidad virtual, entomofobia, fobia, in vivo, caso, estudio, exposición

Keywords: VR, Entomophobia, case study, in vivo, exposure, interbehaviorism.

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RESUMEN

Estudio realizado acerca del tratamiento con exposición con Realidad Virtual e in vivo de un paciente de 9 años de edad y con miedo a los insectos. A causa de este miedo, no puede salir al campo, bañarse en la piscina, ni estar en el parque con sus amigos.

En este manual se plantea que el paciente se expone al estímulo temido poco a poco, y puede parar la exposición y retomarla después o bien en otro momento, siempre que vaya aproximándose al estímulo temido, además siguiendo el modelo interconductual, se le enseña a actuar, de otra manera, frente al estímulo, con una conducta general más eficaz y parecida a la que tienen las personas que no evitan esta situación habitualmente, como explicaremos detalladamente más adelante.

Antecedentes: los trastornos de ansiedad son los grupos de trastornos observados con mayor frecuencia en los niños y una carga importante para su calidad de vida. Las intervenciones basadas en la realidad virtual (RV) han mostrado una amplia gama de ventajas sobre las psicoterapias convencionales en el campo de los trastornos relacionados con la ansiedad.

Objetivo: Los propósitos de este artículo son presentar hipótesis para diagnosticar la fobia a los insectos en niños basadas en teorías interconductuales y presentar una nueva vía de práctica para tratar la fobia a los insectos en niños utilizando una combinación de RV y terapia de exposición in vivo. Se presenta un caso de fobia a los insectos en un paciente de 9 años, que estaba causando importantes reducciones en la calidad de vida del paciente, para integrar los constructos clave de la vía de práctica mediante la identificación de los estímulos exactos que presentan la fobia y para introducir una terapia combinada de RV y exposición in vivo en un niño con fobia a los insectos.

Métodos: El estudio de caso se realizó utilizando RV y terapia de exposición in vivo, con un modelo similar al de Mathews, Gelder y Johnston (1986). En su manual se propone que el paciente se exponga al estímulo poco a poco, pudiendo detener la exposición en cualquier momento y volver a ella más tarde o en otra sesión, siempre que se acerque al estímulo temido en un punto. También seguimos el modelo interconductual, donde al paciente se le enseña a actuar de otra manera como de costumbre ante el estímulo, enseñándole un comportamiento general más efectivo, similar al de las personas que no evitan habitualmente un estímulo dado. El paciente fue tratado durante un período de 5 meses, con 7 sesiones (total), dos sesiones por mes. Resultados: En el caso del paciente de 9 años, el miedo a los insectos le impidió visitar el campo, nadar en la piscina o estar en el parque con sus amigos. Fue posible modificar el miedo y alcanzar un mejor funcionamiento en su vida, utilizando una combinación de realidad virtual y terapia de exposición in vivo siguiendo un enfoque interconductual.

Conclusiones: debido a que la realidad virtual brinda oportunidades ilimitadas para adaptarse a las necesidades exactas de un paciente y a los problemas complejos muy específicos de uno, los terapeutas deben considerar incorporarla en sus prácticas. Las intervenciones de RV pueden ayudar a establecer enfoques terapéuticos individualizados y rentables, tanto para pacientes como para terapeutas. Los estudios futuros basados en la realidad virtual deben centrarse en desarrollar herramientas de realidad virtual innovadoras, fáciles de usar y ajustables para ayudar a los terapeutas en sus prácticas a tratar síntomas complejos y resistentes al tratamiento que, de otro modo, serían difíciles de abordar con los tratamientos tradicionales.

ABSTRACT

Background: Anxiety disorders are the most frequently observed clusters of disorders in children and a major burden for their quality of life. Virtual reality (VR)–based interventions have shown a wide range of advantages over conventional psychotherapies in the field of anxiety-related disorders.
Objective: The purposes of this paper are to present hypotheses for diagnosing insect-phobia in children based on interbehavioral theories, and to present a new practice pathway for treating insect-phobia in children using a combination of VR and in-vivo exposure therapy. An exemplar case of a 9-year-old patient's insect-phobia, which was causing major reductions in the patient's quality of life, is presented to integrate key constructs of the practice pathway via identifying the exact stimuli that present the phobia and to introduce a combined VR and in vivo exposure therapy in a child with insect phobia.
Methods: The case study was conducted using VR and in vivo exposure therapy, with a similar model like Mathews, Gelder and Johnston (1986). In their manual it is proposed that the patient should be exposed to the stimulus little by little, and can stop the exposure at any given time and return to it later or at another session, as long as he approaches the feared stimulus at one point. We also followed the interbehavioral model, where the patient is taught to act in another way as usual when confronted with the stimulus, teaching a more effective general behavior, similar to that of people who do not avoid given stimulus habitually. The patient was treated over a period of 5 months, with 7 sessions (total), two sessions per month. Results: In the case of the 9 years old patient, the fear of insects kept him from visiting the countryside, swimming in the pool, or being in the park with his friends. It was possible to turn the fear into successful adaptive behavior using a combination of VR and in vivo exposure therapy following a dimensional interbehavioral approach.
Conclusions: Because VR provides unlimited opportunities of tailoring to the exact needs of a patient and one's very specific complex problems, therapists should consider embedding it into their practices. VR-interventions can help establish individualized and cost-efficient therapy approaches, for patients and therapists likewise. Future VR-based studies should focus on developing innovative, easily usable, and adjustable VR tools to help therapists in their practices treating complex and treatment-resistant symptoms that are otherwise difficult to address with traditional treatments.

Introduction

Fear & the Specific Insect Phobia

In children and adolescents anxiety disorders are the most frequently observed clusters of disorders and a major cause of suffering (Kessler et al., 2005). The WHO (World Health Organization) survey investigating mental health, states that half of the mental health conditions are manifesting by the age of 14 years and three-quarters by the mid-20s. Childhood and adolescence are important periods for the emergence of mental disorders (Baranne et al., 2018; Kessler et al., 2007). The functional emotional phenomena of fear is an inevitable and necessary part of human evolution, which can be traced back to our distant mammalian heritage (Öhman, 2008). Fear can be understood from a learning perspective of escape and avoidance and as a defensive mechanism. Fear causes an aversive, activated state which is centered on threat while involving intense negative feelings and strong bodily manifestations. The difference between fear and anxiety mainly lies in the identifiable stimulus, whereby anxiety is considered to be more anticipatory to a threatening stimulus and fear elicited by such. Clinical fear is described as recurrent and persistent, with for the norm population unreasonable intensity towards the objective danger or threat. Individuals affected by clinical fear report helplessness, inability to cope or feelings of immobilization, leading to an impeded psychosocial and/or physiological functioning. Fear can be focused on external sources, this is exemplified by insect phobia, a very common fear (Öhman, 2008). However, specific phobias form a very heterogeneous class of disorders characterized by etiologic diversity (Himle et al., 1991). The prevalence of specific fears is especially high among young children (Merckelbach et al., 1996). Widely feared are animals, including common domestic animals, other small, often harmless animals, and creeping and crawling animals such as insects and reptiles (Öhman, 2008). Insect phobia or so-called entomophobia is a specific phobia characterized by an excessive or unrealistic fear of one or more classes of insect. In the DSM-5 it falls under the disorder class of anxiety disorders and is classified under the specific type of animal phobia. To be diagnosed as an insect phobia: 1) the fear has to be persistent, meaning it lasts for 6 months or more, 2) causes clinically significant distress or impairment in social, occupational, or other important areas of functioning, 3) the phobic object or situation is actively avoided or endured with intense fear or anxiety, 4) the fearis out of proportion to the actual danger posed by the specific object or situation and to the sociocultural context, and 5) the phobic object or situation almost always provokes immediate fear or anxiety (Center for Behavioral Health Statistics and Quality, 2016). A specific phobia, like the insect fear, represents in most children a solemnly transitory phenomena (Merckelbach et al., 1996). However, in the minority of affected children, such specific fears can become chronic. As explanations of how such fears develop, classical conditioning, modelling, negative information transmission as well as other learning paradigms have been used. Once acquired the specific phobia can be upheld by cognitive biases (e.g. attentional bias, covariation bias, reasoning bias) (Field, 2006; Merckelbach et al., 1996). Many therapeutic interventions are based on such conditioning models of fear acquisition and cognitive biases of fear maintenance. These frameworks help to gain better insight into how to prevent and treat specific phobias (Field, 2006).

Conventional- & Virtual Reality-Therapy

Often, exposure therapy is proposed as an effective approach for treating anxiety disorders. However, a substantial number of individuals fail to benefit or return to fear after treatment, whereby research suggests that this might be because of deficits in inhibitory learning in anxious patients (Craske et al., 2014).
A systematic overview on the efficacy and quality of typical pharmaco- and psychotherapies showed that many are effective, but that there is also a lot of room for improvement (Huhn et al., 2014). Furthermore, there is an ongoing discussion as to whether an individual option or a combination of options of therapy should be rather considered to treat mental disorders (Dellazizzo et al., 2020).
Out of this wish for implementing novel treatments for a wide range of mental, behavioral, or emotional disorders, virtual reality (VR)-based approaches were developed and intend to offer support plus an increase in the effectiveness and further benefits to evidence-based psychotherapy (Dellazizzo et al., 2020; Diemer et al., 2015). VR has been introduced three decades ago, serves as a complement to conventional psychotherapeutic treatments, and also has made its way into psychological research (Diemer et al., 2015). Many of the scientific investigations using VR focused on pathological processes in mental disorders, especially anxiety disorders, whereby threat perception, fear, and exposure therapy play a significant role, where VR-based interventions have been mainly developed for (Diemer et al., 2015). Especially in the field of anxiety-related disorders, VR-interventions have shown a wide range of advantages over conventional therapy approaches. However, VR has also been used successfully for treating developmental disorders, severe mental disorders, and neurocognitive disorders (Dellazizzo et al., 2020). The relatively new field of VR techniques offers a wide range of advantages: 1) unique ability to simulate complex, real situations and contexts. Some people are resistant to conventional evidence-based treatments, where VR therapy can fulfill the need for novel mental health treatments in those groups in need of very individualized settings (Dellazizzo et al., 2020). However, it is important to keep in mind the initial costs for a therapy-adequate VR set and that some patients might tend to so-called cybersickness induced by the VR stimulation. Several meta-analyses have been conducted to summarize the evidence and efficacy of VR-based interventions. Dellazizzo et al. (2020) carried out a meta-review including meta-analyses published until February 2020 to VR–based therapies for psychiatric disorders. According to their research, the current state of evidence speaks for overall medium-to-large effects for anxiety-related disorders when compared with inactive controls but no significant difference when compared with standard evidence-based approaches. A recent meta-analysis by Carl et al. (2019), which included 30 randomized controlled trials (RCTs) supports the efficacy of virtual reality exposure therapy (VRET) in anxiety disorders. However, we see a lack of research on the efficacy of VR exposure therapy for anxiety disorders in children and adolescents, which may even more so effectively be treated by several forms of such exposure therapy. Diemer et al. (2015) state that fear reactions in specific phobias (animal type) are primarily caused by simple perceptual fear-related cues e.g. a spider.
Just like evidence-based psychosocial interventions (e.g., psychoeducation, interpersonal psychotherapy, cognitive behavioral therapy) have shown promising results (Barbui et al., 2020), VR-techniques allow patients to learn and establish better coping-skills to overcome and prevent symptomatic

relapses. However, VR-based interventions have not shown superiority compared with usual evidence-based treatments (Dellazizzo et al., 2020). New VR-based intervention focuses are needed, especially in the field of anxiety disorders in children (Kothgassner & Felnhofer, 2020). This is why the given case study includes an innovative VR-approach for treating complex symptoms of insect phobia in a child. The high potential of virtual reality as a tool for treating children and adolescents with anxiety disorders encouraged us to do this case study focusing on a very specific phobia to facilitate future research with younger cohorts and to be able to support this promising field of application.

Interbehaviorism & the Introduction of a New Treatment Approach

VR therapy relies on the adequate selection of specific perceptual cues to activate emotions and trigger emotional experiences, which are strongly related to the user's sense of being present in a VR environment (Diemer et al., 2015). Having the opportunity to simulate real-life situations and contexts to confront the client with a fear-loaded stimulus, like an insect, to transform this fearful approach into a playfully and positive one is the main goal of our presented interbehavioral approach. It is stated that fear can be activated by at least two pathways: The perceptual (e.g., visual fear-related cues) and the conceptual (fear-related information) paths, whereby the perceptual fear-related cues are assumed to rapidly evoke physiological and behavioral fear reactions, (Diemer et al., 2015; Hofmann et al., 2008). VR, as a perceptual medium, meaning that emotional cues rely on perceptional simulations - mostly visual cues, sounds, and sometimes touch - allows therapists therefore also to activate very specific fears. In this case study VR has been used as a particularly suitable tool to activate a fearful emotional response to an insect and reorganize via learning the behavior system. Through that, the goal is to establish a new adaptive emotional and behavioral response to insect stimuli guided by interbehavioral theories.

Interbehavioral psychology explicitly points out that behavior encompasses the mutual and reciprocal defining functional relationships between stimuli and responses with a primary focus on these stimuli and responses interrelationship (Morris, 1984). Kantor - the father of Interbehavioral Psychology - highlights mutual and reciprocal interactions among the following variables (a) the organism, (b) the stimulus, (c) the media of stimulation, (d) setting factors, and (e) interbehavioral history. According to Kantor all behavioral events are composed of these factors and can not be reduced to an analysis of any single one or subset of them. In these and other matters, Interbehavioral Psychology marks an integrated-field theory. An interbehavioral approach to clinical intervention offers an interdisciplinary system where assessment and treatment of physical and psychological effects are treated as continuous interactions, whereby his interbehavioral methods include one's individual history. Kantor describes behavior disorders and their elimination following a general learning theory model. His theory allows responses and stimuli of having their own functions which directly affect progress in therapy (Ruben, 1986).

In the interbehavioral approach, behavior is best understood as part of a complex causal system instead of a simple linear model (Silva et al., 2019). Because Kantor was primarily a philosopher of science rather than an investigator, Kantor's views generated few empirical studies (Silva et al., 2019). Nevertheless, inspired by those interbehavioral theoretical constructs, we intended to develop a wholesome, integrated therapy approach, where one's

individual history stands in the main diagnostic focus and will be mirrored in the therapy.

- **The new approach** Interbehaviorism: a resume

That approach was created by Kantor (1888–1984), a professor at Indiana University from 1920 to 1959. Kantor wrote extensively about philosophy of science and epistemology (Mountjoy, 2001). He believed that behavior could not be adequately studied as part of a simple (linear) causal model (Kantor, 1959; see also Clayton et al., 2005). As a result, interbehavioral psychology is characterized by systems thinking. Kantor (1970) represented the main components of the system – what he termed the "interbehavioral field" or "psychological event" but modern science terms the "system" (Delprato and Smith, 2009) – by the formula PE = C(k, sf, rf, hi, st, md). PE represents the psychological event, which is anything an organism senses, perceives, and does in relation to a constellation of past and present stimulus conditions. C conveys that the psychological event is an integrated outcome of stimulus (sf) and response (rf) functional relations, interbehavioral history or hi (e.g., history of leverpressing; evolutionary history), setting factors or st (e.g., time of day; presence of occasion setters), and the media of contact between environmental stimuli and the organism or md (e.g., light stimulates receptors in the eye allowing a rat to see a lever; the surface of a lever stimulates tactile receptors allowing the rat to feel the lever). The letter k symbolizes the uniqueness of every psychological event, that the same precise circumstances of a psychological event can never be repeated. In sum, "Kantor conceived of an interbehavioral field that consists of the organism and the stimulus objects in its environment reciprocally relating to each other according to psychophysical laws" (Pear, 2007, p. 138).

For example, like a resume:

"Behavior analysts have also provided an account of the verbal coding that is said to participate in observational learning. For example, behavior analysts propose that individuals derive self-rules when they observe their environment (e.g., Hayes, Barnes-Holmes, & Roche, 2001; Hayes, Zettle, & Rosenfarb, 1989; Poppen, 1989). It is assumed that society teaches the organism to tact (Skinner, 1957) relationships in their environment, and that these descriptions exert tremendous control over behavior. Indeed, it is suggested that a large amount of rule-following behavior is reinforced throughout the organisms lifetime, and when combined with a history of tact repertoires being reinforced, individuals both derive self-rules (i.e., tact if-then relations in their environment) and subsequently engage in a great deal of rule-following with respect to those rules.

- *For example, a child might observe a teacher praising another child for accurately matching a Spanish flashcard to the corresponding English flashcard (¡"Good job matching perro with dog!"). Two days later, the child who observed the incident may be asked to "match same" when given that same Spanish flashcard, and correctly place it on the corresponding English flashcard. From the behavior analytic perspective it may be assumed that the child already has a generalized imitative repertoire, so they are imitating the child they observed at a later point in time (see conditioned reinforcement hypotheses above). Furthermore, the child may or may not have tacted the observed relationship*

> *when it occurred (rule-stating), and engaged in rule-following behavior when she interacted with the card at a later time. Both of these possibilities are consistent with the behavior analytic position. Importantly, the behavior analytic position does not require the individual to engage in rule-stating and following for observational learning to occur.*" Fryling M.J. (2011).

One of the fundamental differences to other approaches is in the concept of "behavioral training to operate", it would be to form a new behavioral rule, breaking the effect of the initial modeling. "

> *The patient could not stay in the same room as any insect, he could not walk in the countryside or go near a swimming pool in case there was an " insect " like a dragonfly, for example. If there was a fly or a mosquito near him, he would call for help and run screaming from there. He couldn't go out in the park with his friends either .Wasps were especially threatening because they could sting him.*

It is of utmost importance to take into consideration that people are affected differently by the above-named dimensions e.g. a client might be afraid of the rapid movements of one insect but doesn't mind if another insect, which doesn't tend to move rapidly, approaches in a slow pace.

Why using virtual reality?

To deal with the dimensions that allow us to use it, there are no dangerous, it is accessible and amazing for the patient

Virtual reality was used based on diverse advantages, especially concerning the treatment of the above-described dimensions. Most of the dimensions allow the use of VR plus there are no direct dangers involved when confronted with the insect stimuli. Furthermore, it is accessible, replicable, and also cost-efficient.

Why too in vivo?

For the dimension that cannot be done via virtual reality we decided to use in vivo confrontation with the client.

Even though the stimuli may be tangible (physical/material) the dynamics are equal to those stimuli that are social.

They are functionally identical in terms of psychology.

We fall into making the error of looking for physical objectives instead of the functional relationship made by the person.

For example "fear of going out" this depends on the bases of the fear (the functionality of the fear) because it is not always the same for all people:

If the fear is that people see me and ask, it is worse to go out in the day time.

If the fear is that I am attacked, it is worse to go out at night.

Intervention is more than only exposition, it is based on training to operate. *The goal is adaptative conduct.*

If your fear is to go out alone. Why is that?. Because … if I became lost… Training: ask any one, look at the map, research one reference …

After psychological abuse from a boyfriend, the fear for a woman may be words which make her feel scared.

His behaviour is to hide the response these words effect.

All fears about people are not the same for everyone.

From an environmental model:

Generalised objectives: only applicable as such.

Following a hypothesis: behaviourism which establish themselves within our concrete interventions.

Functional concepts. Not morphological concepts.

In the case of insects phobia is similarly, there is necessary to wnow what is the or fear or your dimensions.

In our case there are some dimensions:

1. Insect size
2. Whether the insect can sting or bite
3. If the insect can carry some type of contamination or infection
4. How far or close it is
5. If it moves in an unpredictable or unexpected way or momento

What we try to do is to train alternative behaviours for the patient that correspond to his or her goals and those of his or her family, since he or she is a minor, the parents are fundamental in the decisions about the whole treatment.

It is crucial to choose the most appropriate alternative response, taking into account the size of the stimulus, its functionality and the behaviour of high functioning individuals in such situations.

To lose the fear of swimming, for example, it is not only effective to teach the person to stay in the water, but teaching skills such as diving or swimming is qualitatively more effective.

Another very clear example is the behaviour of the agoraphobic person when he/she is afraid of getting lost and really moves away from home, the way he/she relates to the street, the pavement, the signs, the help systems (like the mobile phone) or the people he/she can ask if he/she gets disoriented are totally different from the way people with this problem function when they are lost, or do not find their destination.

Teaching an agoraphobic person to stay in the situation they fear until the anxiety passes is fine (this would be an exposure) but training them to look for visual references, to use google maps or to ask someone is infinitely more positive and appropriate (teaching them to operate).

We follow the same approach in the case of insect phobia: we implement behaviours other than escape or avoidance. Direct contact with insects, the game of "killing" insects and having fun with it and the opposite of what he traditionally did.

In the in vivo sessions we essentially teach him to endure anxiety without being able to escape, but in the virtual reality sessions we teach him to handle the feared situations, killing the insects virtually, in many different ways.

His emotions in the insect games, according to what the child reported, what we observed and what his mother saw, were of entertainment, enjoyment and pleasure in attending the sessions and he experienced it as a real triumph in the face of his fear.

Also, thanks to VR we didn't have to actually do any harm to any insects, as being all virtual, we maintain our values with the child of not doing any harm, but at the same time, the killing response is very effective in combating anxiety. We teach him in reality to move away from the insects or also to help them leave, without harming them.


Trigger
Bar
DONUTS
VIVE

After the 7 treatment sessions, the child managed to have fun playing the Virtual Reality and insect games described above.
He was able to stay in his room with a mosquito on the wall, without asking anyone for help or running away.
He could approach, touch, stand next to, leave his hand attached to the insect.

Other research gave positive results as an example.

- Effect of multiple context exposure on renewal in spider phobia

Youssef Shiban, Paul Pauli, Andreas Mühlberger (2013)

- Meta- analysis of the Efficacy of Virtual Reality Exposure Therapy for Social Anxiety.
  Chesham, Malouff, Shütte (2018)
- Virtual reality exposure therapy for adolescents with fear of public speaking: a non-randomized feasibility and pilot study Kahlon et al. (2019)

<u>Conclusion</u>

Given the prevalence of mental health problems (Kessler et al., 2007), VR therapy should be considered an easily viable and cost efficient approach for children with anxiety disorders.

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