The Impact of Chemicals and Disorders and Diseases on Our Ability to Focus: A Global and Local Perspective

Mohsen Dolatabadi, Tarbiat Modares University ,Tehran, Iran
Department of linguistics
Mohsen. Dolatabadi@modares.ac.ir

Aliyeh Kord Zafaranlu Kambuziya, Tarbiat Modares University ,Tehran, Iran
Department of linguistics
akord@modares.ac.ir

Arsalan Golfam
golfamar@modares.ac.ir

Maryam Niksolat, Assistant Professor,Department of Geriatric Medicine, School of Medicine, Firoozabadi Clinical and Research Development Unit, Iran University of Medical Science, Tehran, Iran

Niksolat.m@iums.ac.ir

https://orcid.org/0000-0002-3725-7462

Hosna Mirfakhraee, internist, Assistant Professor,Department of Internal Medicine, School of Medicine, Firoozabadi Clinical and Research Development Unit, Iran University of Medical Science, Tehran, Iran

0000-0003-1889-6389

Mirfakhraee.h@iums.ac.ir

Abstract
This review is a comprehensive overview of the effects of various drugs, diseases, and disorders on attentional breadth in individuals. Here we discuss how chemicals such as Testosterone, progesterone, cocaine, Caffeine, alcohol, and ecstasy can affect attentional scope. As well as we explore the impact of several diseases and disorders, including Schizophrenia, ADHD, autism, rumination, and Huntington's disease, on attention shifting between global and local targets. Meanwhile, we provide an in-depth discussion of local and global processing, attentional processes, and their interconnections. Identifying the factors that affect attentional breadth can help researchers and clinicians develop effective interventions to improve cognitive abilities and enhance human performance.

Keywords:
Attentional Breadth, Drugs, Disease, Disorders, Modifications, changes

Introduction

Local and global processing are two modes of perception that underlie many aspects of our cognitive abilities. While local processing involves focusing on the details or individual parts of a stimulus, global processing involves perceiving the overall structure or "bigger picture" of the stimulus.

One example of local processing can be seen in visual tasks such as identifying letters or shapes within a larger image. In these tasks, individuals skilled at local processing can quickly identify small details, even when hidden among other information. This skill is essential in medical or forensic investigations, where attention to detail can be critical in accurate diagnoses.

In contrast, global processing involves recognizing patterns and relationships among different pieces of information. For example, when reading a sentence, understanding its meaning depends on recognizing the relationships between words and phrases. People skilled at global processing tend to be better at tasks that involve perceiving a stimulus's gestalt or overall structure.

Research has shown that people differ in their preference for local versus global processing, with some individuals tending to rely more heavily on one mode than the other. For example, individuals with autism tend to show a stronger preference for local processing, which may contribute to their exceptional abilities in tasks that require attention to detail. On the other hand, people skilled at global processing may be better suited for tasks such as language comprehension or problem-solving, where recognizing patterns and relationships among different pieces of information is critical.

It is worth noting that local and global processing are not mutually exclusive, and both processing modes can be beneficial in different contexts. Research suggests that switching between these two processing modes is essential to cognitive flexibility. For example, when solving a complex problem, it may be helpful to focus on the details of each piece of information before stepping back to consider the overall pattern or structure of the problem. Switching between these processing modes can help individuals adapt to new situations and learn more efficiently.

Moreover, local and global processing plays a role in many aspects of our cognitive abilities beyond visual perception. For example, researchers show that individuals who prefer local processing memorize lists of unrelated items better. In contrast, those who prefer global processing tend to excel at tasks that require reasoning about complex systems. Similarly, studies have shown that people may rely on different processing modes when learning a new language. Some individuals focus more on grammar and syntax (global processing), and others focus more on vocabulary and pronunciation (local processing).

In addition, while local and global processing is functional constructs for understanding individual differences in cognition, they do not fully capture the complexity of human perception and thought. Like any other psychological construct, local and global processing exist on a spectrum, and most people likely fall somewhere between the extremes of each processing mode. Furthermore, factors such as motivation, attention, and context can all influence which mode of processing an individual relies on in a given situation. In addition, various chemicals and diseases can change the especially attentional scope from baseline. For example, Caffeine is a stimulant that can improve global attention, while alcohol is a sedative that can impair global and local attention. Additionally, mental disorders such as Schizophrenia affect attentional scope. Here we review the effect of drugs, diseases, and disorders on attentional scope.

Method

We searched the following databases: PubMed, Embase, PsycINFO, Web of Science, and Scopus. These keywords and phrases were used in the search: Attentional Breadth, Attentional Scope, Drugs, Disease, Disorders, Modifications, and Changes.
We also employed the following inclusion and exclusion criteria to select studies: Inclusion: Studies published in peer-reviewed journals from 1900 to 2023. Exclusion: Non-English language studies.
We identified 80 studies that met our inclusion criteria. These studies were selected based on their relevance to our research question and the rigour of their methodology.

Attentional processes

Attentional processes are cognitive functions that involve selecting and focusing on specific information from the environment or from one's thoughts and feelings. Attention is crucial in perception, learning, memory, and problem-solving.

There are several types of attentional processes, including selective attention, divided attention, sustained attention, and executive attention.
Selective attention allows us to focus on specific stimuli while ignoring distracting input. In visual perception, selective attention helps us recognize objects and read the text in a cluttered scene. In contrast, in auditory perception, selective attention allows us to follow a conversation in a noisy environment. Global-Local attention is predominately selective (Hübner,2014; Mozolic et al.,2008).

Divided attention plays a vital role in visual and auditory tasks requiring multitasking. For example, when driving a car, you must simultaneously pay attention to various visual and auditory stimuli cues, such as the road, other cars, traffic signals and sounds outside the car(Bankoti et al.,2019; Bonnel et al.,1998).

Sustained attention is crucial for maintaining focus on a task over time, allowing us to learn and remember information. For example, sustained attention is necessary for studying for a test or listening to a lecture(Langner et al.,2013).

Alternating attention is necessary for switching between different tasks or stimuli. In visual perception, alternating attention allows us to move our eyes across a page of text or scan a crowded scene. In auditory perception, alternating attention allows us to switch focus between different sound sources, such as following a conversation in a crowded room(Lee et al. et al.,2016; Larson et al.,2014).

Executive attention involves controlling and regulating attentional processes to achieve specific goals. It is crucial for problem-solving and decision-making in both visual and auditory domains. For example, in visual perception, executive attention helps us plan and

execute complex actions, such as playing a musical instrument or assembling the furniture(Krumbholz et al., 2009)

Overall, attentional processes are essential for visual and auditory perception, and By processing and organizing relevant information, they help us interpret the world around us. These different attentional processes are closely interconnected and help us navigate the world.

Chemicals and Diseases and Disorders

1. Chemicals

Testosterone

As a sex hormone and anabolic steroid, Testosterone plays a vital role in men's health. In humans, Testosterone is essential for the growth of the testes and prostate, as well as for the development of secondary sexual traits such as increased bone and muscle mass and the formation of body hair. In addition, both sexes' Testosterone affects emotions, behaviour, osteoporosis prevention, and other aspects of health and well-being (Tuck, S. et al., 2009; Bassil, N.,2009). Men who do not have enough Testosterone may develop problems, including bone loss and weakness.

Testosterone enhances global attentional scope in contradiction to progesterone. In a study prior to the experiment, the researchers asked participants whether or not they were able to perceive items on a global or a local level (focused attention). All variables were included in a multiple regression model of naturally-cycled women and men; a global advantage during the focused concentration condition was positively connected to Testosterone levels and significantly negatively to progesterone levels but not Estradiol levels. These effects result from a Testosterone-mediated enhancement of right-hemispheric functioning and a Progesterone-mediated inter-hemispheric decoupling because global processing is lateralized to the right and local processing is lateralized to the left hemisphere(kimura,2002).

1.1.Cocaine

Cocaine is Europe's second-most popular recreational drug after cannabis, yet little is known concerning cognitive problems among new users (monthly consumption).
The Global-Local task compared the attentional scope of cocaine-free polydrug controls and cocaine polydrug users who were matched on sex, age, alcohol intake, and IQ (using Raven's progressive matrices).
Cocaine polydrug users paid more attention to local features of stimuli, which aligns with the hypothesis that a decreased breadth of attention may be connected with drug use (Colzato et al., 2009).

1.2.Caffeine

Caffeine is methylxanthine CNS(central nervous system) stimulant. It boosts attentiveness and attentional performance. Caffeine inhibits adenosine's affinity to the A1 receptor, boosting

acetylcholine release. Caffeine raises cyclic AMP(Adenosine Monophosphate) by inhibiting phosphodiesterase none selectively (Camfield, D. A.,2014 et al.; Wood S. et al.,2014)

Global cues typically override local cues in information processing. Arousal conditions may amplify either a local or global processing bias. That caffeine-induced arousal increases global spatial processing biases, which are mediated by regular Caffeine use, is shown in a 2013 study(Giles et al., 2013). also, Caffeine improves reading productivity.(Franceschini et al., 2020).

1.3.Alcohol

Beer, wine, and distilled spirits contain alcohol, also known as ethanol, a psychoactive drug. Recreational drugs like marijuana have been used for hundreds of years, producing the same effects as alcohol (Room R. et al., 2005).

The Alcohol Myopia Model states that drunkenness causes a focus on central environmental cues at the expense of peripheral information. A standardized experiment has established quick differential recollection of central and peripheral signals in alcohol myopia(Jaffe et al., 2019).

Alcohol appears to limit unknown face encoding by focusing attention on the outside area of unfamiliar faces. Also, gender, hair length, and facial feature uniqueness may influence drunken eyewitness accuracy(Harvey & Tomlinson, 2020).In conclusion, in such studies, local attention is more dominant than.(Frederiksen et al., 2007; Hernandez-Diaz et al., 2009) global attention

1.4.MDMA (Ecstasy)

Methylenedioxyphenol methamphetamine (MDMA), which is usually found in tablet form (Ecstasy) and crystal form (molly or mandy)(Brust, J. C.,2010), is a kind of methamphetamine. It is a strong central nervous system (CNS) stimulant that is mostly used for fun (de Menezes, R. F., et al.,2013). Changes in sensation, greater vitality, empathy, and enjoyment are all desired outcomes.

A study looked at long-term ecstasy addicts' capacity to combine local orientation information into a global form percept. Ecstasy appears to interfere with the serotonin pathway, causing vision problems. Serotonin-mediated lateral inhibition has been linked to altered orientation processing in users' primary visual region (V1).
Previous research has indicated that consuming ecstasy results in impairments in the ability to process global form and reduces sensitivity to orientation jitter. The current findings further support these earlier conclusions. (White et al., 2014)

2. Diseases and disorders

2.1.Schizophrenia

Mental illnesses such as Schizophrenia affect cognition, emotions, and behaviour. Those who suffer from Schizophrenia may exhibit signs of detachment from reality, which can be distressing for both themselves and their loved ones. Engaging in routine activities may pose a challenge for individuals with this condition, but there are effective therapies accessible. People with Schizophrenia can attend school, work, become self-sufficient, and enjoy their relationships with the right treatment (Van Os et al., 2010).
There is evidence that schizophrenics have attention and visual perception issues. For the global-local task, large letters (global level) made up of smaller letters (local level) measure attention and perceptual organization (local level). Subjects identify target letters in the stimulus at the global or local scale. In this study, 30 schizophrenia patients and 24 healthy controls completed a lateralized hemispheric processing and attention-shifting test. Presented in couplets, global-local stimulus (consecutive pairs). Both conditions (global-global, local-local) and levels (global-global, local-local) were used to compare the second target reaction time (global-local, local-global). Both groups showed similar level-specific priming (global to global and local to local). However, schizophrenia patients were slower to change focus from global to local. These findings suggest a problem shifting attention from global targets to local targets. Local interfering effects in global processing promote defective magnocellular processing in schizophrenics(Coleman et al., 2009)

2.2.ADHD

Inattention and/or hyperactivity/impulsiveness that are developmentally inappropriate are symptoms of attention-deficit hyperactivity disorder (ADHD), a neurodevelopmental disease that affects 5% of children and 3% of adults. ADHD is connected to unfavourable results in life, such as poor performance in school and at work accomplishments, elevated risk of drug use, and psychiatric (Faraone SV et al., 2015; Polanczyk GV, 2014; Fayyad J et al.,2007).

There is a difference between normal people and ADHD subjects. When processing complex patterns, the Navon effect (Navon, 1977)(Song & Hakoda, 2015) causes the global image to be processed before the local details. However, new research shows that this impact is absent in ADHD. Since the Navon effect is greatly impacted by viewing angles, researchers look at the lack of the Navon effect in ADHD from multiple viewpoints to make sure it's not a saliency issue. The global and local processing of Navon-type hierarchical letters was studied in ADHD and a control group using three different visual angles for local stimuli. In ADHD, there is a loss of global precedent and global-to-local interference without a local processing deficiency(Kalanthroff et al., 2013). In accordance with the Diagnostic and Statistical Manual of Mental Disorders (5th edition; American Psychiatric Association, 2013), ADHD is not a mental disorder., which emphasizes failure to pay close attention to details. Moreover, this finding and similar

finding(Kalanthroff et al., 2013) have crucial implications for ADHD research and may be clinically useful(Song & Hakoda, 2015).

In a study, participants with attentional issues (autism plus ADHD and ADHD alone) demonstrated a high shifting cost (difference between sustaining and changing attention) while switching between tasks. In conclusion, attentional problems associated with ADHD may be related to a higher attentional shifting cost than in the general population(Gargaro, B. A. et al.,2018).
While Hyperopia, astigmatism, and strabismus seem to be independently associated with ADHD, the association between myopia and ADHD in children was not significant.

2.3.Autism (ASD)

As a range of neurodevelopmental conditions, autism is characterized by difficulties in social interaction and communication, repetitive behaviour, intense interests, and unusual sensory responses. It is commonly referred to as autism or, in the context of a professional diagnosis, as autism spectrum disorder (ASD), but the latter term remains controversial among neurodiversity advocates, neurodiversity researchers, and many autistic people because it uses the word disorder and is questioned outside of diagnostic contexts (Dwyer, P. et al., 2022). Even though it has been generally stated that ASD is characterized by aberrant local/global processing, the published findings are in conflict with this notion. In a study, the researcher evaluated a large group of youngsters on both a free-choice task and an instructed task that utilized hierarchical local–global stimuli. Although children with autism demonstrated a diminished preference to report global features of a stimulus when given the option to do so, their capacity to process global properties when instructed is unaffected by the condition of their autism. These findings lend support to previous claims that people with autism spectrum disorder (ASD) demonstrate a disinclination rather than a disability in global processing, and they raise the broader question of whether other characteristics of autism spectrum disorder (ASD) reflect disinclinations rather than disabilities as well(Koldewyn et al., 2013). This disinclination must be an important fact, While recent findings show Specific Global–Local Visual Processing Abilities Mediate the Influence of Non-social Autistic-like Traits on Mental Rotation(Zappullo et al., 2022)**.**
In the vision, typically developing (TD) individuals perceive "global" (whole) before "local" (detailed) features, whereas individuals with autism spectrum disorder (ASD) exhibit a local bias. However, auditory global–local differences are less clear in autism spectrum disorders, particularly when examining age and attention effects. In this study, ASD and TD children judged nine-tone melodies for local and global pitch structures. In both groups, global precedence was observed to be similar, but ASD children at younger ages were less sensitive to global interference. There was no effect on attention tasks. As a result, these findings demonstrate developmentally observed differences in auditory perception and may provide new insight into sensory phenotypes associated with autism spectrum disorders. (Foster, N. E. et al., 2016).

2.4.Rumination

Rumination, or repetitive negative thought, has been linked to substantial maladaptive outcomes, such as prolonged and severe major depression.

We here present and analyze study findings based on the hypothesis that individual variations in cognitive processes that govern information processing will increase the likelihood of recurrent and unpleasant thoughts. Several studies have linked ruminative tendencies to difficulty updating working memory (WM) and disengaging from and forgetting irrelevant information. Other studies have linked trait rumination to an improved capacity to disregard distracting information and better task-relevant knowledge retention. Unlike trait rumination, state rumination is linked to general cognitive control deficiencies.
The attentional scope model of rumination proposes that a constrained and local set of ideas, perceptions, and behaviours active in WM or accessible for selection from LTM(long-term memory) impacts the control functioning of trait ruminators(Whitmer & Gotlib, 2013).

According to the attentional scope model of rumination, rumination is accompanied by a restricted attentional focus that increases emotional response and decreases problem-solving.

Antidepressants that block serotonin or norepinephrine reuptake are beneficial in treating depression and anxiety. It is unknown if antidepressant medicines may directly influence the brain processing of emotional information, as suggested by cognitive psychology theories.

Alongside, Citalopram and reboxetine lowered the detection of unpleasant facial emotions, including rage and fear. Citalopram also reduced the startle response associated with unpleasant emotional imagery. Both medicines boosted pleasant emotional recollection. These shifts in emotional processing occurred despite no substantial changes in mood or anxiety ratings. However, reboxetine reduced aggressiveness and increased energy(Harmer et al., 2004).

2.5.Huntington and the other degenerative disorders
Huntington's disease (HD), also known as Huntington's chorea, is primarily hereditary (Illarioshkin, S. N. et al., 2018). The first signs are frequently modest issues with mood or cognitive function(Dayalu P. et al., 2015). Gait instability and a general lack of coordination frequently follow (Caron, N. S. et al., 2020)

In a study, the attention shifts of Huntington's disease patients were studied utilizing a divided attention paradigm with global-local stimuli. Their results were compared to those of groups of people with Alzheimer's disease or Parkinson's disease (PD; Filoteo et al., 1994). During split attention trials, a visual target may appear at the same global-local level or at a different level. Within-trial attention disengagement was impaired in both AD and PD patients when the target changed levels. Unlike these patterns of performance, the HD patients' attention shifting between hierarchical levels was not significantly impaired(Filoteo et al., 1995).

Participants were given global-local numbers and told to focus on either the global or local level(Roman et al., 1998). The stimuli were either "consistent" (same form global and local) or "inconsistent" (different form global and local). The RTs of PD patients were equivalent to those of age-matched controls regardless of stimulus consistency. RTs to inconsistent stimuli were longer in HD patients than in the age-matched control group. There was no correlation

between RT scores for inconsistent and consistent stimuli in either the HD or PD groups. These findings support the existence of heterogeneity in attentional impairment in subcortical degenerative diseases.

For auditory attention in Parkinson's disease, mismatch negatives in event-related potentials were greatest with double-deviant stimuli, intermediate in amplitude with local deviant stimuli, and minimal with global deviant stimuli. As far as mismatch negativity was concerned, it was the same in both patients and controls (larger in controls). As a result of dopaminergic medication enabling cognitive flexibility with higher distractibility, PD patients are more distracted than healthy controls. (Heldmann, M,2019).

2.6.Attentional Scope, Myopia, and Chinese Eye Exercises in the Context of the COVID-19 Pandemic

The attentional scope may vary depending on environmental factors such as online versus offline contexts or the level of abstractness in language. Additionally, the differentiation between local and global attention highlights how our brains process information by focusing on specific details or larger-scale patterns(Krahmer,2009; Peng et al.,2020). Meanwhile, myopia and Hyperopia are visual conditions that affect our ability to focus on objects at different distances(Sutisna et al.,2023). Overall, a better understanding of both cognitive and visual processing is useful for analyzing visual perception.

Myopia may be exacerbated during and after the advent of the COVID-19 pandemic if people spend more time in front of computers, work in close proximity, and engage in less outdoor activity. In the short term, school closures may not have a detrimental effect on children's development, but in the long run, greater use, adoption, and dependency on digital gadgets may. Parents, children, and government organizations need to be educated about the dangers of myogenic actions during this time period(Wong et al., 2021).

In addition, to treat myopia, we can use Chinese eye exercises, a type of massage focused on the periocular acupoints, which were developed and infused with ancient Chinese medical concepts. As a means of protecting children's vision and possibly preventing myopia, the Chinese government has supported these exercises since 1963. For the past 50 years, they have developed into a communal tradition and a daily habit among primary and secondary school children in China(Östberg, O. et al., 1992).

Using a meta-analysis, Sangvatanakul (2019) and his colleagues investigated the effect of Chinese eye exercises on myopia control in an East Asian population. According to this meta-analysis, CEE (Chinese eye exercise) either boosted or decreased myopia control in eight studies.
Using CEE, researchers were able to reduce myopia by 28%. This finding was uniform and consistent because of the outlier treatment. When CEE was performed up to five times a week,

subgroup effects increased myopia control to 62 per cent. Fifty-seven per cent less myopia control was suggested by poor CEE performance.

Conclusions

In conclusion, a comprehensive understanding of both cognitive and visual processing, as well as the impact of chemicals and diseases and disorders on attention and cognitive function, is crucial for managing overall health. Chemicals such as Caffeine, cocaine, alcohol, and MDMA, as well as disorders or disease such as Schizophrenia, ADHD, autism, and Huntington's disease, can have a significant impact on attentional scope and visual perception. Understanding these effects can help in developing appropriate treatments for individuals struggling with attentional issues. Additionally, COVID-19 has highlighted the importance of managing myopia, which can be exacerbated by increased screen time and decreased outdoor activity. Chinese eye exercises have been effective in controlling myopia in East Asian populations, but further research is needed to determine its effectiveness in other populations and establish long-term effects. Continued education and advocacy are necessary to promote healthy habits and prevent vision impairments and related cognitive and attentional issues.

.

Competing Interests: The authors declare that they have no conflict of interest.

Acknowledgements: NA

Statements and Declarations: The authors have no relevant financial or non-financial interests to disclose

References

Smith, E. E., & Kosslyn, S. M. (2007). Cognitive psychology: Mind and brain. Upper Saddle River, NJ: Prentice Hall.

White, C., Edwards, M., Brown, J., & Bell, J. (2014). The impact of recreational MDMA 'ecstasy use on global form processing. Journal of Psychopharmacology, 28(11), 1018–1029.

Sangvatanakul, P., Tangthianchaichana, J., Tasanarong, A., Pabalan, N., & Tharabenjasin, P. (2019).

Influence of Chinese eye exercises on myopia control in an East Asian population: a meta-analysis.
1–23. https://doi.org/10.1101/19011270

Luft WA, Ming Y, Stell WK. Variable effects of previously untested muscarinic receptor
antagonists on experimental myopia. Invest Ophthalmol Vis Sci 2003;44:1330–8

Carr BJ, Mihara K, Ramachandran R, et al. Myopia-Inhibiting Concentrations of Muscarinic Receptor Antagonists Block Activation of Alpha 2A -Adrenoceptors In Vitro. Invest Ophthalmol Vis Sci 2018;59

Goodhew, S. C. (2020). The Breadth of Visual Attention.

Coleman, M. J., Cestnick, L., Krastoshevsky, O., Krause, V., Huang, Z.,

Mendell, N. R., & Levy, D. L. (2009). Schizophrenia Patients Show

Deficits in Shifts of Attention to Different Levels of Global-Local Stimuli:

Evidence for Magnocellular Dysfunction. Schizophrenia Bulletin, 35(6), 1108–1116. https://doi.org/10.1093/schbul/sbp090

Colzato, L. S., van den Wildenberg, W. P. M., & Hommel, B. (2009). Reduced attentional scope in cocaine polydrug users. PloS One, 4(6), e6043. https://doi.org/10.1371/journal.pone.0006043

Filoteo, J. V., Delis, D. C., Massman, P. J., Demadura, T., Butters, N., & Salmon, D. P. (1992). Directed and divided attention in Alzheimer's disease: Impairment in shifting of attention to global and local stimuli. Journal of Clinical and Experimental Neuropsychology, 14(6), 871–883. https://doi.org/10.1080/01688639208402541

Filoteo, J. V., Delis, D. C., Roman, M. J., Demadura, T., Ford, E., Butters, N., Salmon, D. P., Paulsen, J., Shults, C. W., & Swenson, M. (1995). Visual attention and perception in patients with Huntington's disease: Comparisons with other subcortical and cortical dementias. Journal of Clinical and Experimental Neuropsychology, 17(5), 654–667. https://doi.org/10.1080/01688639508405156

Franceschini, S., Lulli, M., Bertoni, S., Gori, S., Angrilli, A., Mancarella, M., Puccio, G., & Facoetti, A. (2020). Caffeine improves text reading and global perception. Journal of Psychopharmacology, 34(3), 315–325. https://doi.org/10.1177/0269881119878178

Giles, G., Mahoney, C., Brunye, T., Taylor, H., & Kanarek, R. (2013). Caffeine Promotes Global Spatial Processing in Habitual and Non-Habitual Caffeine Consumers. Frontiers in Human Neuroscience, p. 7. https://www.frontiersin.org/article/10.3389/fnhum.2013.00694

Harmer, C. J., Shelley, N. C., Cowen, P. J., & Goodwin, G. M. (2004). Increased positive versus negative affective perception and memory in healthy volunteers following selective serotonin and norepinephrine reuptake inhibition. The American Journal of Psychiatry, 161(7), 1256–1263. https://doi.org/10.1176/appi.ajp.161.7.1256

Harvey, A. J., & Tomlinson, D. A. (2020). Alcohol myopia and the distracting effects of hair in face recognition. Journal of Psychopharmacology, 34(2), 237–244. https://doi.org/10.1177/0269881119882856

Jaffe, A. E., Harris, C. M., & DiLillo, D. (2019). Observing Alcohol Myopia in the Context of a Trauma Film Paradigm: Differential Recall of Central and Peripheral Details. Alcoholism, Clinical and Experimental Research, 43(10), 2203–2211. https://doi.org/10.1111/acer.14156

Kalanthroff, E., Naparstek, S., & Henik, A. (2013). Spatial processing in adults with attention deficit hyperactivity disorder. Neuropsychology, 27(5), 546–555. https://doi.org/10.1037/a0033655

Koldewyn, K., Jiang, Y. V., Weigelt, S., & Kanwisher, N. (2013). Global/Local Processing in Autism: Not a Disability, but a Disinclination. Journal of Autism and Developmental Disorders, 43(10), 2329–2340. https://doi.org/10.1007/s10803-013-1777-z

Liu, Z., Wang, J., Xu, Q., Hong, Q., Zhu, J., & Chi, X. (2021). Research Progress in Vitamin A and Autism Spectrum Disorder. Behavioural Neurology, 2021, e5417497. https://doi.org/10.1155/2021/5417497

Mace, J. L., Porter, R. J., Dalrymple-Alford, J. C., Wesnes, K. A., & Anderson, T. J. (2010). Effects of acute tryptophan depletion on neuropsychological and motor function in Parkinson's disease. Journal of Psychopharmacology (Oxford, England), 24(10), 1465–1472. https://doi.org/10.1177/0269881109105721

Roman, M. J., Delis, D. C., Filoteo, J. V., Demadura, T. L., Paulsen, J., Swerdlow, N. R., Swenson, M. R., Salmon, D., Butters, N., & Shults, C. (1998). Is there a "subcortical" profile of attentional dysfunction? A comparison of patients with Huntington's and Parkinson's diseases on a global-local focused attention task. Journal of Clinical and Experimental Neuropsychology, 20(6), 873–884. https://doi.org/10.1076/jcen.20.6.873.1111

Song, Y., & Hakoda, Y. (2015). Lack of global precedence and global-to-local interference without local processing deficit: A robust finding in children with attention-deficit/hyperactivity disorder under different visual angles of the Navon task. Neuropsychology, 29(6), 888–894. https://doi.org/10.1037/neu0000213

White, C., Edwards, M., Brown, J., & Bell, J. (2014). The impact of recreational MDMA 'ecstasy' use on global form processing. Journal of Psychopharmacology, 28(11), 1018–1029. https://doi.org/10.1177/0269881114546709

Whitmer, A. J., & Gotlib, I. H. (2013). An Attentional Scope Model of Rumination. Psychological Bulletin, 139(5), 1036–1061. https://doi.org/10.1037/a0030923

Wong, C. W., Tsai, A., Jonas, J. B., Ohno-Matsui, K., Chen, J., Ang, M., & Ting, D. S. W. (2021). Digital Screen Time During the COVID-19 Pandemic: Risk for a Further Myopia Boom? American Journal of Ophthalmology, pp. 223, 333–337. https://doi.org/10.1016/j.ajo.2020.07.034

Yang, C.-J., Liu, C.-L., Sang, B., Zhu, X.-M., & Du, Y.-J. (2015). The combined role of serotonin and interleukin-6 as a biomarker for autism. Neuroscience, 284, 290–296. https://doi.org/10.1016/j.neuroscience.2014.10.011

Zappullo, I., Senese, V. P., Milo, R., Positano, M., Cecere, R., Raimo, G., & Conson, M. (2022). Specific Global–Local Visual Processing Abilities Mediate the Influence of Non-social Autistic-like Traits on Mental Rotation. Journal of Autism and Developmental Disorders. https://doi.org/10.1007/s10803-021-05412-y

Kumaran A, Htoon HM, Tan D, et al. Analysis of changes in refraction and biometry of
atropine- and placebo-treated eyes. Invest Ophthalmol Vis Sci 2015;56

Chia A, Lu Q, Tan D. Five-Year Clinical Trial on Atropine for the Treatment of Myopia
2: Myopia Control with Atropine 0.01% Eyedrops. Ophthalmology 2016;123.

Camfield, D. A., Stough, C., Farrimond, J., & Scholey, A. B. (2014). Acute effects of tea constituents L-theanine, Caffeine, and epigallocatechin gallate on cognitive function and mood: a systematic review and meta-analysis. Nutrition Reviews, 72(8), 507–522.

Wood, S., Sage, J. R., Shuman, T., & Anagnostaras, S. G. (2014). Psychostimulants and cognition: a continuum of behavioural and cognitive .activation. Pharmacological reviews, 66(1), 193-221

Van Os, J., Kenis, G., & Rutten, B. P. (2010). The environment and Schizophrenia. Nature, 468(7321), 203-212.

Faraone SV, Asherson P, Banaschewski T, Biederman J, Buitelaar JK, Ramos-Quiroga JA, et al. Attention-deficit/hyperactivity disorder. Nat Rev Dis Prim. 2015;1:15020.

Polanczyk GV, Willcutt EG, Salum GA, Kieling C, Rohde LA. ADHD prevalence estimates across three decades: an updated systematic review and meta-regression analysis. Int J Epidemiol. 2014;43:434–42.

Fayyad J, De Graaf R, Kessler R, Alonso J, Angermeyer M, Demyttenaere K, et al. Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. Br J Psychiatry. 2007;190:402–9.

Östberg, O., Horie, Y., & Feng, Y. (1992). On the merits of ancient Chinese eye acupressure practices. Applied ergonomics, 23(5), 343-348.

Gargaro, B. A., May, T., Tonge, B. J., Sheppard, D. M., Bradshaw, J. L., & Rinehart, N. J. (2018). Attentional mechanisms in autism, ADHD, and autism-ADHD using a local–global paradigm. Journal of attention disorders, 22(14), 1320–1332.

Knopman, D. S., Amieva, H., Petersen, R. C., Chételat, G., Holtzman, D. M., Hyman, B. T., ... & Jones, D. T. (2021). Alzheimer disease. Nature Reviews Disease Primers, 7(1), 1–21.

Brodaty, H., & Donkin, M. (2022). Family caregivers of people with dementia. Dialogues in clinical neuroscience.

Caron, N. S., Wright, G. E., & Hayden, M. R. (2020). Huntington disease.

Dayalu, P., & Albin, R. L. (2015). Huntington disease: pathogenesis and treatment. Neurologic clinics, 33(1), 101-114.

Illarioshkin, S. N., Klyushnikov, S. A., Vigont, V. A., Seliverstov, Y. A., & Kaznacheyeva, E. V. (2018). Molecular pathogenesis in Huntington's disease. Biochemistry (Moscow), 83(9), 1030–1039.

Page, J., Hinshaw, D., & McKay, B. (2021). In Hunt for Covid-19 Origin, Patient Zero Points to Second Wuhan Market–The man with the first confirmed infection of the new coronavirus told the WHO team that his parents had shopped there. The Wall Street Journal.

Tuck, S., & Francis, R. (2009). Testosterone, bone and osteoporosis. Advances in the management of testosterone deficiency, pp. 37, 123–132.

Bassil, N., Alkaade, S., & Morley, J. E. (2009). The benefits and risks of testosterone replacement therapy: a review. Therapeutics and clinical risk management, 5, 427.

Room, R., Babor, T., & Rehm, J. (2005). Alcohol and public health. The Lancet, 365(9458), 519-530.

Brust, J. C. (2010). Ethanol and cognition: indirect effects, neurotoxicity and neuroprotection: a review. International journal of environmental research and public health, 7(4), 1540–1557.

Auditory scope

Heldmann, M., Teichmann, S., Al-Khaled, M., Brüggemann, N., & Münte, T. F. (2019). Processing of local and global auditory deviants in Parkinson disease: electrophysiological evidence for enhanced attention capture. Cognitive and Behavioral Neurology, 32(1), 31-38.

Foster, N. E., Ouimet, T., Tryfon, A., Doyle-Thomas, K., Anagnostou, E., & Hyde, K. L. (2016). Effects of age and attention on auditory global–local processing in children with autism spectrum disorder. Journal of Autism and developmental disorders, 46(4), 1415–1428.

Justus, T. & List, A. Auditory attention to frequency and time: an analogy to visual local–global stimuli. Cognition 98(1), 31–51 (2005).

Sanders, L. D. & Poeppel, D. Local and global auditory processing: Behavioural and ERP evidence. Neuropsychologia 45(6), 1172– 1186 (2007).

Noyce, A. L., Kwasa, J. A., & Shinn- Cunningham, B. G. (2022). Defining attention from an auditory perspective. Wiley Interdisciplinary Reviews: Cognitive Science, e1610.

Kimura, D. (2002). Sex hormones influence human cognitive patterns. *Neuroendocrinology Letters*, *23*(4), 67–77.

de Menezes, R. F., Bergmann, A., & Thuler, L. C. S. (2013). Alcohol consumption and risk of cancer: a systematic literature review. Asian Pacific Journal of Cancer Prevention, 14(9), 4965-4972.

Krahmer, E., & Stapel, D. (2009). Abstract language, global perception: How language shapes what we see. In Proceedings of the Annual Meeting of the Cognitive Science Society (Vol. 31, No. 31).

Peng, M., Zhang, L., Wen, Y., & Zhao, Q. (2020). Internet-word, compared with daily-word priming, reduces attentional scope. Experimental Brain Research, pp. 238, 1025–1033.

Sutisna, M., Nurdiawati, E., Daningrum, D., Arifiati, N., Putri, S. O. E., & Prihayati, P. (2023). Factors Related to Eye Fatigue on Computer User Workers at PT. Krakatau Bandar Samudera in 2022. Journal of Industrial Engineering & Management Research, 4(1), 149-161.

Hübner, R. (2014). Does attentional selectivity in global/local processing improve discretely or gradually? Frontiers in Psychology, pp. 5, 61.

Mozolic, J. L., Hugenschmidt, C. E., Peiffer, A. M., & Laurienti, P. J. (2008). Modality-specific selective attention attenuates multisensory integration. Experimental brain research, 184, 39-52.

Krumbholz, K., Nobis, E. A., Weatheritt, R. J., & Fink, G. R. (2009). Executive control of spatial attention shifts in the auditory compared to the visual modality. Human brain mapping, 30(5), 1457-1469.

Förster, J., & Dannenberg, L. (2010). GLOMOsys: A systems account of global versus local processing. Psychological Inquiry, 21(3), 175-197.

Sheridan, H., & Reingold, E. M. (2017). The holistic processing account of visual expertise in medical image perception: A review. Frontiers in Psychology, 8, 1620.

Ji, L. J., Yap, S., Best, M. W., & McGeorge, K. (2019). Global processing makes people happier than local processing. Frontiers in Psychology, pp. 10, 670.

Pletzer, B., Scheuringer, A., Harris, T., & Scherndl, T. (2021). The missing link: Global-local processing relates to number-magnitude processing in women. Journal of Experimental Psychology: General, 150(3), 560.

Bankoti, B. P. S., Gupta, C. S., Bandyopadhyay, O., & Banerjee, M. (2019, December). Analysis of Multitasking in Divided Attention using Machine Learning. In 2019 IEEE Conference on Information and Communication Technology (pp. 1–5). IEEE.

Bonnel, A. M., & Haftser, E. R. (1998). Divided attention between simultaneous auditory and visual signals. Perception & psychophysics, 60(2), 179-190.

Chamberlain, R., Van der Hallen, R., Huygelier, H., Van de Cruys, S., & Wagemans, J. (2017). Local-global processing bias is not a unitary individual difference in visual processing. Vision Research, 141, 247-257.

D'Souza, D., Booth, R., Connolly, M., Happé, F., & Karmiloff- Smith, A. (2016). Rethinking the concepts of 'local or global processors': evidence from Williams syndrome, Down syndrome, and Autism Spectrum Disorders. Developmental Science, 19(3), 452–468.

Baumann, N., & Kuhl, J. (2005). Positive affect and flexibility: Overcoming the precedence of global over local processing of visual information. Motivation and Emotion, 29, 123-134.

Plaisted, K., Swettenham, J., & Rees, L. (1999). Children with autism show local precedence in a divided attention task and global precedence in a selective attention task. The Journal of Child Psychology and Psychiatry and Allied Disciplines, 40(5), 733-742.

Van Kleeck, M. H. (1989). Hemispheric differences in global versus local processing of hierarchical visual stimuli by normal subjects: New data and a meta-analysis of previous studies. Neuropsychologia, 27(9), 1165-1178.

Langner, R., & Eickhoff, S. B. (2013). Sustaining attention to simple tasks: a meta-analytic review of the neural mechanisms of vigilant attention. Psychological bulletin, 139(4), 870.

Lee, A. K., McLaughlin, S. A., & Larson, E. (2016). Switching of auditory attention. The Journal of the Acoustical Society of America, 140(4), 3046–3046.

Larson, E., & Lee, A. K. (2014). Switching auditory attention using spatial and non-spatial features recruits different cortical networks. Neuroimage, 84, 681-687.

Baumann, N., & Kuhl, J. (2005). Positive affect and flexibility: Overcoming the precedence of global over local processing of visual information. Motivation and Emotion, 29, 123-134.

Pletzer, B., Scheuringer, A., & Scherndl, T. (2017). Global-local processing relates to spatial and verbal processing: implications for sex differences in cognition. Scientific reports, 7(1), 10575.
Goldstein-Marcusohn, Y., Goldfarb, L., & Shany, M. (2020). Global and local visual processing in rate/accuracy subtypes of dyslexia. Frontiers in Psychology, 11, 828.