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Technological revolution in mental health- A vision from a historical perspective

Shaza Fahmawi
PhD in Public Health, Deputy CEO for Academic Affairs at Nazareth & Galilee College
academic_dceo@nazgc.org

Abedelrahman Abu-Dalu
Master's student in Clinical Psychology from An-Najah National University, Nablus, Palestine

Abstract

The digital revolution is evolving at an unstoppable pace. Alongside the unprecedented explosion of digital technology facilities and systems, mental health care is under greater pressure than ever before. With its emphasis on big data, computing power, mobile technology, and network information, digital technology is set to transform health care delivery. This article reviews the field of digital health technology assessment and intervention primarily in secondary service mental health care, including the barriers and facilitators to adopting and implementing digitally mediated interventions in service delivery. We consider the impact of digitally mediated communication on human interaction and its potential impact on various mental states such as those linked to mood, anxiety but also well-being. These developments point to a need for both theory- and data-driven approaches to digital health care. We argue that, as developments in digital technology are outpacing the evaluation of rigorous digital health interventions, more advanced methodologies are needed to keep up with the pace of digital technology development. The need for co-production of digital tools with and for people with chronic and mental health

difficulties, and implications of digital technology for psychotherapy practice, will be central to this development.

Keywords: Technological Revolution, Mental Health, Psychological Treatment Using Virtual Reality, Online Therapy, Chatbots.

Introduction

Prophecy is a tough profession. Its public relations are no slouch either. And yet I decided to put the word 'revolutionary' in the title of the article before you. The field of mental health, as far as I can tell, is facing a historic revolution – a technological revolution. The seeds of this revolution can already be seen in the changes that have taken place in the field with the introduction of online communication technologies and virtual reality, but the actual flowering of the revolution, which will probably come in the wake of the 'explosion' of artificial intelligence applications, is still ahead of us. What exactly the technological revolution will look like and whether it will be good or bad, we don't know. We can only try to offer conceptual and practical directions that will help us, we hope, leverage new technologies to improve the public's sense of well-being, and 'break the concept' that may have caused the crisis we are experiencing in mental health.

In the last decade, scientific literature and popular journalism have been overflowing with headlines warning about the psychological effects of new technologies. Dr. Mikha Goodman describes the concern regarding these effects well in his book "The Attention Revolution" (Goodman, 2021). The rapid pace of various technologies, the short and provocative posts and tweets on social media, and especially the intense competition for our attention as consumers, give new meaning to the title of Freud's book "Civilization and Its Discontents." The prevailing hypothesis regarding screen technologies and social networks.

The hypothesis attributing the deterioration of the public's mental state to screen technologies and social networks has also (similar to the previous hypothesis) gained a fairly consensual status. The leading journal of the American Academy of Pediatrics, JAMA Pediatrics, has recently published several studies claiming that screen use may disrupt the normal psychological development of children (e.g., Hutton et al., 2020; Madigan et al., 2019). These studies even claimed a connection between screen exposure and neurodevelopmental disorders that were previously considered congenital, such as autism spectrum disorder and attention deficit disorder (Heffler et al., 2020; Ra et al., 2018). It is therefore not surprising that health organizations around the world periodically publish severe recommendations for parents to reduce their children's exposure to screens (e.g., WHO, 2019).

The literature addressing the current mental health crisis offers a variety of explanations for the troubling rise in distress and psychiatric disorders, and it is difficult to judge which of these explanations "holds water." Nevertheless, in my view, we have a moral obligation to seriously examine the possibility that the previous revolution in mental health—the biomedical revolution that began in the last century and led us to understand and conceptualize psychological difficulties as physiological defects in the brain that require "balancing" or "management" through medication—unintentionally created this crisis. The experts who promoted it certainly did not intend harm, but in practice, biomedical thinking has likely led to the extensive medicalization of normative daily behaviors (often accompanied by the internalization of despairing biological-deterministic messages), a surge in misdiagnoses, and an enormous and unchecked use of invasive treatments—powerful psychiatric medications that interfere with brain processes and cause a variety of serious medical and psychological problems (Ofir, 2024). From this historical perspective, the aim of the current article is to help us adopt the new revolution that has arrived at our doorstep in a cautious and informed manner, so as

not to replicate, or heaven forbid, exacerbate the mistakes of the previous revolution. It would indeed be foolish to enhance existing diagnostic and treatment strategies with new technologies if those strategies are not effective, or worse, if they only worsen the situation.

Practically speaking, in this article, we have endeavored to thoroughly review some of the key new technologies in the field of mental health, so that we may gain a deep understanding of the tremendous opportunities they bring, alongside their vulnerabilities and risks. While the overall spirit of the article is quite optimistic—your faithful authors have dedicated about a decade to examining the positive aspects of technologies in mental health—nonetheless, We cannot ignore the foreign interests that may undermine the efficiency and safety of these technologies, or the risks associated with their implementation, such as the real risk of infringing on our privacy and autonomy as citizens. Therefore, in this article, we have formulated a series of recommendations aimed at maximizing the benefits of technology and ensuring that it indeed serves us, humans, rather than leading to a dystopian scenario where we serve it or the large corporations in the industry that profit from it.

Key New Technologies

Whether we like it or not, the technological revolution in mental health has already begun. While I stated at the beginning of the article that predicting the future is a tough profession, in this case, it's not such a great insight. Online psychological therapy, for example, which seems routine to us, is part of this revolution (for more details, see the section 'Online Therapy' below). Even artificial intelligence, which for many of us is perceived as a futuristic technology that has just entered our lives, has been serving us in mental health research for at least a decade (see, for example, the annual CLPsych workshop that deals with applications of computational linguistics in clinical psychology: Chim et al., 2024; Coppersmith et al., 2015). However, for those of us who are less exposed to technological innovations, we will

review in this section several key technologies that are already being researched or integrated into the field of mental health today.

Naturally, in an article titled 'The Technological Revolution', the review will focus on the potential benefits of the technologies that will be presented. Some of them, in my opinion, have the ability to significantly contribute to the public's sense of well-being and alleviate the burden on the mental health system. However, the review will not ignore the limitations and risks of the various technologies and will also include recommendations for the future. We do not claim that these are the best or most comprehensive recommendations that can be thought of at this stage. As mentioned, all wee seek is to lay the conceptual groundwork for a bold discussion that will help us avoid historical mistakes and perhaps succeed in breaking inefficient paradigms.

The Entry of Computational Models in Language Processing

The entry of computational models in language processing has led to a leap in the quality of predicting suicide risk compared to the previous prediction quality based on traditional statistical analyses (Schafer et al., 2021). Although the improvement in prediction has been observed in a research context rather than in the field, it is still difficult to overstate its importance. Study after study has revealed that using computational models to analyze posts and tweets from users on social media allows for the identification of suicide risk with a high level of accuracy.

The central methodological problem with these studies is that the risk itself is measured rather poorly. Often, the metric used by researchers to assess the level of suicide risk (i.e., to define the prediction criterion) relies on posts that include explicit suicidal content. Such posts are labeled by external judges as posts with suicide risk, while posts without such content are labeled as neutral. The role of artificial intelligence was to 'learn' the differences between these two types of posts (during

the training phase) and to use these differences to predict the level of risk in new posts (during the testing phase).

This measurement method is inadequate for two reasons. First, we do not know whether users who posted content with suicidal themes are indeed at risk (perhaps, for instance, it is an attempt at humor or drawing attention). Second, most people suffering from suicidal thoughts are actually quite cautious about their postings. They are not quick to post explicit suicidal content (Ophir et al., 2021). Therefore, even if the studies indicate high predictive quality, they will likely miss the users we are most concerned about—those who have not posted explicit suicidal content online.

The central recommendation in this field is, therefore, to expand the research to use a more valid prediction criterion, such as the users' own suicidal assessments rather than the posts they upload (Badian et al., 2023; Ophir et al., 2020). Similar studies should also be conducted outside of social media (for example, on texts from therapy sessions: Elyoseph & Levkovich, 2023) and in other areas of mental health; not just in suicide. In this way, it will be possible in the near future to develop automated monitoring software that will help identify signs of distress in social media users in advance, encourage them to seek treatment, and perhaps prevent the next suicide.

Our main reservation about this technology relates to user privacy. Currently, the identification of risk or distress is done within a research framework, under strict ethical guidelines that include informed consent from participants. But what will happen in the future when the technology reaches the field? How will the information we collect be preserved? How can we ensure that the information does not leak to business companies whose profit from patients is not their primary concern? How will we maintain medical ethics and ensure that users receive all the information they need to make the decision whether to share their data? These are just some of the issues we will need to regulate in the coming years.

Another reservation relates to issues of misdiagnoses and harmful treatments briefly reviewed in the introduction of this article and discussed in depth in my previous article on the harms of the biomedical revolution (Ophir, 2024). If artificial intelligence only leads to further inflation of misdiagnoses (because AI does what we taught it to do), and if the treatments offered to individuals identified by AI as having a diagnosis or risk are more harmful than beneficial, then we will find ourselves racing toward a dystopian future. This is why it was important for me to precede the current section with the part presented in the introduction and discussed in detail in my previous article (Ophir, 2024). In my view, there is a danger in blind technological advancement without a deep understanding of past failures.

Psychological Treatment Using Virtual Reality

From artificial intelligence, let us turn back in time to an 'ancient' technology—virtual reality technology. Virtual reality technologies in mental health have been known to us for about 30 years, and yet, we must admit that they have not yet 'taken' their rightful place. One reason for this is likely the cumbersome nature of the tool (compared, for example, to the convenience of a smartphone), but it is not advisable to hastily write off virtual reality Anyone who has never experienced a quality virtual reality experience has never tasted Hungarian wine in their life. With the right equipment, the illusion of the virtual environment is so powerful that it elicits real physical and emotional responses as if in a real environment. When we first tried virtual reality, we couldn't take a single step on solid ground while "standing" in the virtual environment on a rickety beam between two high-rise buildings. The virtual reality deceived my consciousness in an astonishing way.

The leading application of this technology is in the treatment of fears and anxieties—from specific phobias to social anxiety and generalized anxiety disorder (Kothgassner et al., 2023). Virtual reality therapy primarily relies on cognitive-behavioral approaches, which assume that the most effective strategy for dealing

with fears and anxieties is through gradual exposure to the frightening stimulus or event. However, while in 'regular' reality, people who feared flying, elevators, or interactions with others had to 'break the fourth wall' of the therapeutic setting and confront their fears outside, now they can practice gradual exposure in virtual reality within the therapy room, in a controlled manner and with the therapist's guidance. Just as a pilot can improve performance in a flight simulator that is grounded, so patients can practice "overcoming fear" using the therapeutic 'simulator.'

The central gap we see in this field is the ability to expand to other types of distress beyond anxiety. In depression, for instance, the use of virtual reality is less intuitive. However, there are promising developments even in depression. First, virtual reality allows for enhancing relaxation techniques through environments of nature, flowing water, and calming sounds that can reduce gloom and tension (Riches et al., 2023). Second, virtual reality can help overcome certain limitations characteristic of cognitive-behavioral therapy.

Through virtual reality, therapists can better illustrate cognitive interventions (which can sometimes be amorphous), and patients can 'train' their minds even from home, between therapy sessions. Especially in depression, virtual reality can enable patients to increase enjoyable activities (a central therapeutic strategy in behavioral therapy) relatively easily, due to the playful nature of many virtual reality programs. Additionally, this technology can be leveraged for attention training in Cognitive Bias Modification, which helps individuals minimize the importance and impact of negative events in their lives, and practice directing their attention to the 'half-full glass' and the more optimistic perspective.

Finally, there is a realistic possibility that the playfulness and excitement associated with using virtual reality will provide individuals suffering from depression with that same boost of vitality, capability, and motivation that is often lacking in traditional therapy. Many cognitive-behavioral therapists encounter this obstacle, where even

when the patient understands what they are supposed to do and agrees that this is the way to 'get out of depression,' they still struggle to do so due to feelings of heaviness, lack of motivation, and helplessness. This is one of the reasons many psychologists refer patients to psychiatric treatment—hoping that medication will provide the energetic 'boost' that is very difficult to give within the framework of psychological therapy. In this context, it is possible that virtual reality could replace the hope that many of us place in psychiatric medications, which are currently seen as the primary tool capable of 'physically awakening' individuals suffering from severe depression to physical activity or productive engagement.

Beyond common anxiety and depression disorders, virtual reality currently has a wide range of applications, from treating schizophrenia and neurodevelopmental disorders to addressing eating disorders (Freeman et al., 2017). These applications are quite established, and some can be found in a literature review published nearly 20 years ago (Gregg & Tarrier, 2007). For example, there are now targeted interventions to improve cognitive abilities in the elderly using virtual reality (Skurla et al., 2022).

Virtual reality also fits well into the current trend of promoting positive mental health (as opposed to the one that emerged from the biomedical revolution, which emphasized pathologies and disorders), through 'low-intensity' interventions aimed at instilling positive resilience feelings over time in non-clinical populations (Pira et al., 2023). In a sense, this represents a paradigm shift that could redraw the accepted landscape in mental health.

So, what should we do now? First, we believe that we need more research that sharpens the advantages of virtual reality therapy over previous treatments, as well as its limitations. Studies that identify the technology's limitations in advance are also important to assist in its implementation from the experimental-research framework into clinical practice with a wide range of populations (Valmaggia et al.,

2016). As research increases and technology improves, the use of virtual reality will become simpler and more intuitive, to the point where people can treat themselves at home quite effectively. But until then, the recommendation is to establish structured professional training for medical and therapeutic teams to learn to apply virtual reality beneficially.

Our central reservation about virtual reality therapy is related to one of its advantages—the potential to become a powerful self-help tool. On one hand, the ability to purchase a virtual reality headset for a one-time cost and use it to improve personal well-being, much like a home treadmill, is quite exciting. On the other hand, if its use without supervision leads to harm (given its powerful nature), then we would be losing more than we gain. This is another reason why it is important to conduct further research. We must ensure the effectiveness and safety of virtual reality treatments before disseminating them to the general public. Furthermore, during the implementation of these treatments, we need to persist in monitoring any issues that arise in the field and listen to feedback from end users, even if that feedback may not be pleasant for the developers and marketers of virtual reality treatments.

Alongside these reservations, we see significant potential in this technology, and we believe that further research in this field will open doors to therapeutic avenues we have not yet considered. This is because virtual reality enriches the therapeutic experience significantly and stretches the boundaries of reality—literally.

Online Therapy

Another technology that has been with us for generations is online communication. Unlike virtual reality technology, which has not yet made a significant impact in the field of mental health, online therapy and mental health support have become routine, partly thanks to the restrictions imposed during the COVID-19 pandemic, as

described in my previous article (Ofer, 2024). Online therapy has long ceased to be considered a taboo, but it is important to mention its historical developments to provide some perspective on the technological revolution.

Online Therapy: A Critical Perspective

In a representative article published 20 years ago by Professor Gabi Shafler, who then served as the chair of the Ethics Committee of the Israeli Psychological Association, it was summarized that: "There is no doubt that the internet is integrated into our lives in a way that does not allow us to avoid using it even in the field of mental health." However, in the same breath, Professor Shafler added a clear caveat: "we do not believe that all psychological activities can take place in the online space" (emphasis not in original). According to his view at the time, even if the use of the internet is a necessity, there will always be areas, "especially mental diagnosis and treatment, where like in other medical fields, there will be no substitute for the interpersonal space created between two or more people in direct and immediate contact" (Shafler, 2005).

We have presented these quotes as they are due to my immense respect for Professor Shafler's work. In certain aspects of my practice, we see ourselves as his students. However, at this point, his prophecy has not materialized, and it may reflect a known phenomenon called "technological panic." Many therapists now incorporate online sessions or conduct entire treatments online, and while some of us may critique these methods, such critiques often do not align with the research in the field.

Effectiveness of Online Therapy

Literature reviews conducted over the years generally indicate the effectiveness of online therapy, particularly that which relies on cognitive-behavioral approaches (Barak et al., 2014; Mallen et al., 2005; Sztein et al., 2018). In certain respects, online

therapy has several significant advantages over traditional therapy (Ofer et al., 2017; Omer, 2014).

- **Frequent Sessions**: Online therapy typically features more frequent sessions, often more than once a week, and a decrease in cancellations.
- **Accessibility**: It can provide support for individuals suffering from physical disabilities or social anxiety, and those living in remote areas.
- **Comfort**: Many patients participating in online therapy report feeling less threatened compared to those visiting a clinic. They likely feel more comfortable in their natural environment and may be more honest with their therapists.

Economic Advantages

Additionally, we cannot overlook the economic benefits and the potential to alleviate the bottleneck created by long waiting lists for face-to-face treatment in the public system. Online therapy expands the list of potential therapists and saves travel costs and ongoing expenses associated with maintaining and managing a clinic (Stoll et al., 2020).

Challenges of Online Therapy

These advantages do not, of course, eliminate the problems and challenges associated with online therapy. It complicates the provision of adequate responses in emergency situations (e.g., for a patient at immediate suicide risk living far from the therapist). Other vulnerabilities related to online therapy include issues of privacy and confidentiality, the informality that seeps into the therapeutic space (with patients in pajamas lounging on their beds), and the lack of sufficient professional training for therapists to deal with the unique characteristics of online therapy. Despite the fact that the COVID-19 pandemic forced all of us to experience online communication,

it is still not a natural mode of interaction for many, and we may be missing important non-verbal communication cues, such as the patient's body language and gaps that arise in interpersonal dynamics.

Initial Psychological Support and Emotional Assistance Online

The emergence of the internet has expanded the realm of "complementary psychology," which includes primary psychological assistance services, such as hotlines based on telephone communication. In Israel, organizations like ERAN, SAHAR, and NATAL are particularly well-known for providing invaluable remote support to many individuals. Even if, in the end, a person suffering from suicidal thoughts or severe trauma needs to seek "real" treatment, initial support can be life-saving.

Online Support for Non-Emergency Situations

Online support can also cater to individuals not in crisis. For instance, teenagers often need a listening ear or one-time advice—whether due to a breakup, legal troubles, or a conflict with parents that spiraled out of control. They do not always seek or require long-term formal treatment, and here, even social networks play a role.

The "Response Online" Project

About a decade ago, when Facebook was still a dominant platform among youth, we have the privilege of co-founding a project called "Response Online" under the Youth and Young Adults Advancement Division of the Jerusalem Municipality. In "Response Online," for the first time, professionals from education and therapy openly experimented, with systemic support, in providing first aid psychological assistance to teenagers on social networks. The social media intervention did not aim to replace the comprehensive psychosocial treatment often required; rather, it sought to enable teenagers and young adults to consult easily and confidentially with

professionals, free of charge, while maintaining their privacy. When necessary, the youth were referred to follow-up treatments, either within the youth advancement division or at outpatient clinics.

Importance of Informal Communication

We take pride in this initiative, but we did not invent it. It turns out that, beneath the surface, educators and therapists were already in some form of communication with students and clients on social networks, sometimes against the guidelines of the Ministry of Education. In a study we conducted at the Hebrew University in 2014 during Operation Protective Edge, we discovered that over half of high school students in the Gaza Envelope communicated with their teachers on social networks (including WhatsApp groups), with emotional support being the central theme of this communication. Not only did students appreciate this communication with their teachers, but they also viewed it as a helpful and calming intervention during difficult times (Ophir et al., 2016).

Strategies for Emotional Support

Practically, teachers employed various strategies to provide emotional support to their students on social media. These strategies included:

- **Demonstrating Care**: Showing genuine concern for students' well-being.
- **Writing Calming Messages**: Sending reassuring messages to help alleviate anxiety.
- **Encouraging Emotional Sharing**: Promoting an environment where students felt comfortable sharing their feelings.
- **Establishing a Sense of Belonging**: Fostering a community feeling among students.
- **Posting Distraction Content**: Sharing content that helped students worry less.

The central insight from our research was that the existence of a continuous online connection with teachers contributed to students' resilience and served as a form of psychological safe space (Rosenberg et al., 2018).

Limitations of Informal Support

Of course, such informal communication on social networks cannot adequately address the needs of adolescents requiring comprehensive and professional psychosocial support. However, when viewed from a prevention perspective, it may play a significant role in the broader mental health framework. Educators and therapists are already doing this in the field during regular times. They use social networks as a primary tool to reach at-risk youth and report significant advantages with this approach (Rosenberg et al., 2021). Therefore, it might be worthwhile to consider developing clear guidelines to help expand the use of various online communication channels for outreach, emotional support, and treatment, while also reducing the need for longer and more expensive follow-up treatments.

The Need for Oversight

It is important to note that the technological advantage can also reveal itself as a significant drawback. The informality characterizing online support can lead to dangerous boundary blurring and potentially harm clients due to insufficient professionalism among providers. Therefore, we believe it is essential to find a way to supervise the entities providing these services, regulate their legal responsibilities, and offer them structured training. For instance, we must ensure they are aware of the unique characteristics of vulnerable or marginalized populations and provide them with tools to establish supportive relationships (rather than, for example, patronizing ones).

Treatment via Artificial Intelligence (Chatbots)

Still, despite their potential, the technologies mentioned thus far alone will not, in my understanding, "release" the bottleneck created by the wait for quality therapeutic responses. Effective psychological treatment is a costly commodity that requires patience, and immediate, cheap psychiatric medications are a questionable solution, as discussed in the first part. Therefore, it seems we have no choice. We must "give a chance" to treatment through artificial intelligence.

The Role of AI in Psychological Treatment: A Critical Perspective

For many of us, the idea of a machine treating a person seems dystopian. As a member of Generation Y, we likely wouldn't rush to participate in such treatment. However, we would like to offer a perspective that might soften the apprehension some of us feel: the machine is merely a collection of human knowledge. When a person "consults" a large language model like GPT, they gain access to immense human wisdom. In this sense, the model serves as a conduit, which has its advantages. The individual does not need to feel embarrassed or fear judgment from the model regarding their desires or impulses. At most, the model will provide knowledge that challenges their choices. Importantly, the model is not a real entity and, therefore, does not pose a genuine threat or embarrassment.

The Evolution of AI Models

At this stage, free models still do not provide responses that are particularly profound or enlightening. However, we anticipate that conversations with them will improve over the years to the point where it becomes difficult to distinguish between interactions with AI and those with a human therapist. Furthermore, these models have the potential to create a fantastic playful space, allowing for the processing of difficulties and distress through narrative, artistic, and experiential means, making them particularly suitable for child therapy (for more information, I recommend

following the "Artificial Third" group that focuses on the intersection of artificial intelligence and mental health, as discussed in the article by the Hebrew Psychology Group: Bar et al., 2023).

Overcoming Emotional Resistance

In our view, if we can overcome our emotional resistance to "machine therapy" and address ethical challenges (such as client privacy or inherent biases within the model), then artificial intelligence has the potential to create genuine democratization in mental health services. Given the current technological knowledge, AI appears to be a central tool for making psychological treatment accessible to the general public (hopefully in a personalized manner) and alleviating the burden on mental health systems (Stade et al., 2023). However, since this is a new and revolutionary technology, we still have a long research and normative path to pave (Sedlakova & Trachsel, 2023).

The Need for Human Input

Despite the advancements in artificial intelligence, it still requires human input to define the factors underlying the effectiveness of psychological treatment. This is a "mega" question that has been extensively discussed in numerous journals and books. Until we provide a satisfactory answer, the effectiveness of AI-assisted treatment will likely remain quite limited (Grodniewicz & Hohol, 2023). The good news is that AI tools can help us unravel the "magic" that occurs in therapeutic sessions (a research direction we are currently pursuing in collaboration with the Psychotherapy Research Lab at the University of Haifa, led by Professor Sigal Zalka Mano). However, until that happens, it seems prudent to adhere to the foundational assumption in psychotherapy that the central element underlying treatment effectiveness is the therapeutic alliance—the unique (and mysterious) relationship formed between the therapist and the client in the therapeutic context. This

assumption immediately raises the question: Is such an alliance even possible in the relationship between humans and machines?

Summary and Discussion on Beneficial Innovation

Inspired by the classic musical Annie Get Your Gun, we can summarize the opportunities embedded in the technological revolution with the statement that everything we currently do manually [in the realms of identification, diagnosis, and psychological and psychiatric treatment] will likely be done better in the near future through new technologies, particularly artificial intelligence. The review presented in this article indicates that the technological revolution holds immense potential for enhancing public well-being—whether through suicide prevention apps, self-help therapies in virtual reality, or online treatments using AI, which will shorten waiting times for face-to-face treatment and create accessibility, and perhaps even democratization, of mental health services. However, all these advancements are insufficient and may even carry a risk, considering the possibility that some aspects of "what we currently do" manually contribute to the enormous crisis we are experiencing in mental health, as we argued in the introduction (for further expansion, see my previous article here, Ophir 2024).

The Future of Technological Revolution in Mental Health

Will the technological revolution succeed in overcoming past failures? Will it lead to a historical correction in thought and practice within mental health? The answers to these questions lie in our hands. At this point in time, we have a unique opportunity to leverage AI applications to identify existing gaps in the current practices and discover new insights and solutions.

To avoid leaving this hope in the realm of empty clichés, we will briefly outline two existing approaches to discovery and innovation:

1. **Top-Down Approach**: In classical scientific methodology, the primary way to discover new findings is from theory down to practice (top-down)—from theory to hypotheses derived from it (e.g., that a certain drug will enhance feelings of well-being), and then testing these hypotheses in the lab or field through controlled experiments or other observations. However, this approach makes it relatively difficult to discover groundbreaking innovations, as each such innovation typically follows a hypothesis that has already been derived from an existing theory, even if it was not fully developed.
2. **Bottom-Up Approach**: Conversely, an intuitive approach, "bottom-up," involves examining raw data without prior hypotheses while attempting to extract insights from it. This method tends to rely on guesses and can produce fictitious findings that cannot be replicated in further research (e.g., a database where eating potatoes is randomly associated with feelings of well-being: Orben & Przybylski, 2019). While there are several structured methodologies developed to facilitate inventions and discoveries without prior hypotheses (e.g., through logical flowcharts, brainstorming, divergent thinking, and systematic challenging of existing concepts), ultimately, they also rely on some form of guessing.

At this point, artificial intelligence (AI) can come to our aid. But how does AI actually work? Humans input vast amounts of data into it (for example, all of Wikipedia), and AI "learns" from this data, automatically extracting patterns embedded within it in a bottom-up manner. This contrasts with traditional statistical analyses, such as linear regression, which rely on predefined predictive variables that the researcher chooses to input into the model based on existing theories. This distinction has significant theoretical and practical implications.

Implications for Identification and Diagnosis

To illustrate, let's revisit the earlier section on identification and diagnosis using AI. The fact that computational models have been able to predict suicide risk more effectively than traditional statistical models suggests they have likely identified hidden patterns we were previously unaware of. In other words, they may reveal risk factors for suicide that we hadn't anticipated or couldn't adequately describe in terms of their interactions. This dramatic perspective on how AI operates has not been sufficiently discussed in the research literature, in my opinion. AI could potentially teach us new things about the human psyche or environmental risk factors that we could not learn before, except by chance or inspiration.

The Challenge of the Black Box

However, there is one "small" problem with this fantastic description—the black box issue. Unlike traditional statistical analyses, which are characterized by a limited number of predictive variables, AI models rely on an enormous number of subtle cues. On one hand, this is their strength; on the other hand, it is our weakness. It is difficult for us humans to understand what exactly happens inside the black box of AI (for those in the know: the vectors in language models based on Deep Contextualized Word Embeddings, which map texts within a multidimensional space, are vast, and we typically cannot articulate what each value in these vectors represents). Therefore, there is immense importance in interpretative research in the field of Explainable AI, which seeks to illuminate this black box.

Discovering Hidden Risk Factors

In a study we conducted in this interpretative spirit, we believe we discovered a hidden risk factor for suicide that has not been adequately researched: social media users at high risk for suicide exhibited expressions that hinted at experiences of boredom (Lissak et al., 2024). This finding surprised us because there is very little

literature on the direct (potential) link between boredom and suicide. Will this finding "survive" validation and replication studies? I cannot say. However, is this a good example of the discovery potential of AI? In my opinion, the answer is yes, definitely. The field of Explainable AI is still in its infancy, but as it develops, I believe our chances of extracting meaningful information from these massive models will increase, helping us uncover more layers of the human psyche and perhaps more layers of the concepts that led to the current mental health crisis (Ophir, 2024).

Responsibilities in Policy Making

None of this absolves us from the responsibility to formulate clear policies in which we:

- Define strict standards for testing the technological applications developed in the future to ensure their efficacy and safety before marketing them.
- Regulate issues of data collection and user privacy and establish clear guidelines for the appropriate use of data.
- Regularly monitor new technologies during their public implementation (and not rely on companies to do this themselves).
- Ensure that medical and therapeutic teams receive appropriate professional training in integrating new technologies.
- Strive to adapt technologies for minority and marginalized groups equitably and make them accessible at no cost or at a symbolic cost to the entire population.
- Maintain transparency: be open with the public about the limitations and risks associated with using these technologies, and perhaps also emphasize the importance of "human touch" in achieving that sense of well-being.
- Be prepared to "retract" and remove harmful technologies from the shelves, even at the cost of financial loss to developing companies.

Conclusion

Ultimately, as of the writing of these lines (June 2024), the appropriate approach to technologies in the field of mental health is to view them as complementary tools rather than a wholesale alternative to human treatment. Many in the public, including myself, fear the "rise of machines" and their "domination" over such a sensitive field as mental health. Therefore, all advancements in this area should be approached with caution. We must earn the public's trust and do so justly and honestly, based on research, without false promises and without hiding flaws and risks. If we do not, we may repeat past mistakes and find ourselves in an even more severe crisis than the one we are currently experiencing.

Notes

- **Dr. Yaakov Ophir** is a clinical psychologist, senior lecturer in the Department of Education at Ariel University, and a research fellow at the Center for Artificial Intelligence and the Human Spirit at the University of Cambridge.
- Important collaborators from the Technion on the research I conducted with Professor Reichart include:
    - Rafael Tikochinski
    - Shir Lisk
    - Nitai Calderon
    - Yael Badyan
    - Ilanit Sobol
- Additional key collaborators from other institutions include:
    - Professor Anat Bronstein-Klumek from Reichman University
    - Professor Il Prochter from the Mental Health Center in Ma'ale Adumim.

Appendix – Technology Panic

The fear of new technologies is completely understandable, and we strive to discuss it at length and seriously in the article. However, sometimes the fear of technology reflects 'moral panic.' Moral panic is a phenomenon where 'moral entrepreneurs' from various sectors of society (e.g., government offices, third-sector organizations, businesses, and media outlets) warn about phenomena or events that challenge the social order or accepted moral standards, sometimes using demagogic means including demonization (Cohen, 2011). This is not a conspiracy theory. Moral entrepreneurs do not necessarily have malicious or manipulative intentions. Even if they are in conflicts of interest, they often genuinely see themselves as the guardians of the "moral barricades" of culture and public cohesion.

Historical Perspective

From a historical perspective, in the realm of technology, moral panic appears to be a recurring cycle. It seems that every generation faces a technology that threatens to destroy us, and with each generation, we panic anew. This panic is referred to as 'media panic' or 'technology panic,' reflecting times when there is immense public concern about a specific technology, even if this concern lacks proper scientific basis. My colleagues and we have written extensively about the gap between what can be seen in 'science' and newspaper headlines, for example, in English journals (Ophir, Lipshits-Braziler, et al., 2019; Ophir et al., 2023; Ophir, Tikochinski, et al., 2019; Ophir et al., 2020) and in Hebrew psychology.

Historical Examples

We can imagine how in the 15th century, during the printing revolution, moral entrepreneurs would roam the world, proclaiming that printed books endangered human society. Books expose children and adolescents to information, which could corrupt their tender minds, disrupt the proper social order (which keeps knowledge

with the responsible adult), and endanger their cognitive development (as they would stop memorizing information orally).

The Cycle of Media Panic

Our colleague, Dr. Amy Orben from the University of Cambridge, describes the recurring cycle of media panic as follows:

1. The emergence of new technology (e.g., the home television) naturally evokes public fear of the unknown.
2. Politicians identify this fear and leverage it for political gains—they exacerbate the issue and ask scientists to investigate the harms of the technology and guide us on how to act in response.
3. The problem is that scientists tend to treat the new technology as if it were a completely new problem. They do not 'remember' that similar issues arose during previous technological innovations, so they 'reinvent the research wheel' and do not arrive at new insights. All they do is transfer fears from older technologies to the new ones.
4. Consequently, since the wheels of science typically grind slowly, politicians fail to formulate complex and balanced policies, and in the meantime, a new technology emerges that captures public attention and opens a new cycle of panic (Orben, 2020). For example, by the time Goodman's book, which sought to provide a nuanced response to the challenges of the social media revolution, was published, we had already entered the era of artificial intelligence.

Conclusion

Therefore, we must examine the dangers of technology with clear eyes, be cautious of unfounded fears, but also not dismiss them lightly.

We are now during an acute health crisis which calls for a grand upscaling of mental health resources. Technology provides a medium for delivering mental health services remotely and on a wide scale, which is particularly important during social distancing measures. Digital mental health tools should be affordable, accessible, and appropriate for a wide group of individuals with varying ages, languages, and digital literacy. The time to massively invest in high quality and accessible online and mobile mental health in the face of the COVID-19 pandemic, and possible future pandemics, is now.

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