Artificial Intelligence applications and psychology: an overview

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Psychotherapy endows a sense of control in patients gripped with emotional conflicts which allow them to handle their reflexes and regain composure through conscious and behavioral alterations. These transformational changes can be brought about by improving their listening skills, observational capacities, creating awareness, making them more attentive and intervening. Conventional psychotherapy calls for one-to-one sessions during treatment. Considering the increased access to information technology in our normal living, the thought of human interaction being replaced by IT tools came to existence. Specialized tools and techniques are employed through the course of therapy which not only alters but also accentuates their cognitive and effective understanding. The idea of amalgamating these two broad ambits – the complexities of psychology and dynamism of artificial intelligence has gained momentum in recent times. The previous reluctance of a few psychologists regarding inculcating expert systems into routine practice due to maybe employment-related insecurities or being swapped by a computer led to underutilization of the latent competence of using IT. Primarily, human behavior itself cannot be copied in totality by technology, and AI has a great deal to cover in this regards, but researchers are doing their best to deliver on these premises. Apart from this patient resistance to this encroachment of technology should also be looked at critically for gaining mass acceptance. This review focuses on how machine intelligence through computer-implemented psychotherapeutic tools can enhance self-awareness.

(Neuropsychopharmacol Hung 2019; 21(3): 119–126)

Keywords: Artificial Intelligence, applications, psychology, AI

INTRODUCTION

Artificial intelligence (AI) has been introduced in multiple fields including games, robots, law, stock trading, remote sensing devices, and scientific inventions to even diagnostic procedures [1]. Most of these advanced AI has trickled into routine applications, so much so that these AI applications cannot be distinguished individually, as is understood that once something is implemented as a general application and is of immense use, it cannot be specified as AI anymore. AI applications seem to have a ubiquitous infrastructural presence in any given industry. The late 90s and the beginning of the 21st century saw the intertwining of AI technological elements into that of the larger frame of systems [1]. Interest in artificial intelligence (AI) has primarily concentrated on autonomous systems that might replace people in the respective fields. Just as cognitive psychology may discover new avenues of investigation from algorithmic-instruction theory, algorithmic-instruction theory may have more practical implications as it assesses the complexity of human behavioral data. This human-centered focus is based on interdisciplinary synergistic research from cognitive neuroscience, psychology, and theoretical computer science [2]. In this golden age of technology, with no end, or limit, in sight; the moral and ethical repercussions of artificial intelligence have three sides to the argument. One opinion has it that many of us are already stricken by poverty without work and there is little or no reason to create mechanical laborers that can also think independently. While the other opinion is that, society cannot progress or derive benefits from resources without the help of machines that can think for themselves at least partially. Moreover, the third group is least bothered about these issues at all, as is typical of human society [1].

Many psychologists think that the science of artificial intelligence can integrate all of the phenomena generated by the human mind. This functionalist attitude witnesses the mind as a representational system and psychology as the offshoot of the various computational processes whereby mental representations are built, organized, and deciphered. Although it is under debate as to how various psychological phenomena can be justified in computational terms; as to which AI concepts are applicable for computer ¬modelling methodologies following psychologist's perspective is yet to be seen [3].

ARTIFICIAL INTELLIGENCE AND PSYCHOLOGY

A distinction is sometimes drawn between AI's engineering facet and its theoretical aspects. As an engineering discipline, the objective of AI is to devise and implement machines which can perform operations by practical means. Accuracy, efficiency, flexibility, and reliability are the primary criteria of success for such systems and information about human performance seems to be neither necessary nor desirable [4]. History of AI shows that program design and description has always relied on elements of human psychology. Assumptions about cognitive processes have been drawn from the intuitions or introspective analyses of AI workers, rather than from empirical studies. Important programs, such as Samuel's checker-player [5] were developed, applied, and tested without randomizing with any correlative studies of human performance. Perhaps part of the reason for AI's early disinterest in human studies was the indecisiveness for the full-fledged assimilation of psychology to underscore discrepancy in the constitution of intelligence. Gelernter's remarks affirm through the geometry-theorem proving program [6].

However, many AI workers have taken human studies into account; still, empirical psychology can be ignored in favor of intuition or introspection. Even those researchers who explicitly acknowledge the significance of individual data ignore psychological studies from their work. Winston (1979) suggested that the first of five steps in building an AI learning program is to examine or characterize some learning competence to be comprehended [7]. Winston's account of his program for replicating the application of simile in teacher-student interactions did not relate to any studies in educational psychology [8]. Instead, Winston rests on his intuition to describe the competence associated with such behavior. As ingenious as Winston's program is, it would be more compel-

ling if it was derived from the empirical foundation from psychology [7]. Thus calling attention for closer ties between AI and experimental psychology it will confer an improvement in both the aspects, i.e., in the principles of intelligent behavior as well as their respective computer applications. Raising psychological assumptions from the level of ad hoc intuitions to the level of systematic empirical observations will impart longitudinal improvement in terms of AI research quality and help to integrate it with related studies in other disciplines.

A PRECISION OF TASK DEFINITION AND DESCRIPTION

Past three ten have seen Artificial intelligence workers building (and reporting on) systems which utilize operation which they refer to as reasoning, understanding, problem-solving, decision-making, plan, concept-formation and so forth [9]. The terminological rendering often alters from project to project, creating a hodgepodge of terminological usage. For instance, the term-concept, as applied in the verbal description of semantic networks, has no less than five significant reading. Such a loose application of psychological terms gives rise to three problems. Firstly, the comparison between different AI projects becomes extremely difficult. Secondly, the nature of task specifications; AI prole are fond of using psychological terms to explicitly associate their programs to prospect of human noesis and thereby offer them with a pre-established theoretical framework [10].

If a research worker tries to conceptualize a program, it is not only because he wanted to improvise the effectuation of a well-understood task, but intends to comprehend the first carrying out. If the researcher characterizes his work as understanding, many multitude might be misled, not to citation himself [11]. Program definition (or task environment) in this particular approach brings about ambiguity because it tends to interest the psychological model while visiting fact it does not. This specific not only makes it incomprehensive the inherent not enough accuracy in the task specs, but it gives surge to the third issue: implicit reference to related cognitive properties. When emotional terms- belief or knowing are casually employed to define or describe an AI program, it is usually easy to succumb to be able to the temptation to designate a cluster of related cognitive properties to that. This is almost inescapable since the pre-theoretic or perhaps lay of psychological conditions occurs only regarding human being (or animal) cognition.

It is difficult to make sense regarding many of such terms with out presupposing a built-in background regarding cognitive phenomena but, any time we consider them in an AI context; such a background is missing [12].

THE USE OF HUMAN DATA AS A METHODOLOGICAL HEURISTIC

The distinction between AI an engineering discipline and AI as a philosophical inquiry is conducted in the light of the methods employed, rather than in the perspective of the tasks employed. For instance, one could take an engineering strategy to visual pattern recognition, game-playing, or natural language understanding, just as one could take a theoretical approach to automated programming, tree-searching, or even robotics. The task specifications or programming techniques are in no way responsible for the unlikeness of the two approaches to AI, on the contrary, it depends on the employed method and the researcher's objective [4]. However, commonalities between these two domains cannot be negated. One crossing point in psychology is the cognitive approach. Within this domain, applicability involves a simulation-based environment learning, computer-based emotion recognition, intra-group social interaction simulations, cognitive behavioral therapies, computer-based psychiatric therapy, electronic inquiries as well as automatic output generation, and so on. Findings from NICE, 2008 regarding the IT applicability in cognitive behavior therapy has yielded promising outcomes. Novel spheres of research like cyberpsychology have emerged reflecting the acceptance of IT in the fold of psychology by the research fraternity. Psychotherapy inpatient treatment has adopted two distinct levels of IT applications [13]. Firstly, the application is engaged in refining the efficacy, execution, and performance of the practicing therapist. Secondly, it is associated with complex systems that resolve issues the patient and the therapist might get enmeshed in during treatment. Once few reservations are clarified the expert systems are expected to solve low and medium complexity issues [14]. Today's youth, are more techno-savvy and more comfortable with different types of information technologies. Data retrieval in corporate offices is easier now at the click of a button. This easy accessibility to a broad purview of research data of thoughts, feelings and individual/group behavior by a psychologist is lacking and needs to be addressed [15]. Therefore newer tools are being embraced by psychologists to collate social psychology data as well

as related fields of psychology. Therefore, to bridge the gap, a coordinated intelligent interface comprising of expert and information retrieval system is the need of the hour with a requirement of an additional interface design agent [15].

INFORMATION TECHNOLOGY AND PSYCHOLOGY

The computer is gradually entering into the domain of psychology and psychiatry research or treatment. Not all experts consider this development as an utterly positive step [16]. These opinions are cross-examined with the intent to solve it. Direct patient-therapist interaction is the mainstay of psychotherapy this arrangement is, however, being substituted by IT tools due to the permeation of information society in our routine life. As a result, progressive human-computer interaction is only the beginning of things to come possibly even reduced cash flows of this class of experts. Adaptation to this scenario in the next two decades in order to attain a new equilibrium point is expected. Still, the computer has a long way to go in order to match the flexibility and dynamism of a human mind; quality might be the first casualty in the human-computer interaction. Readapting the treatment schemas could attempt to harness the benefits offered by the novel computerized system and suppress its undesired effects. Quality of treatment is the primary cause for concern in computer-assisted or computer-replaced psychotherapy; while longitudinally organizational resistance seems to pose as a minor problem associated with it [15]. Neither can patient resistance be underestimated, but as the time passes information technology will be integrated into people's life from inception, and human-computer interaction will only become secondary. This type of rejection among the clinician community was previously witnessed with the testing of Micyn – the very first automated diagnostic system [17]. Unfortunately, to steer clear of possible misdiagnosis Micyn use was not implemented [18, 19]. Diagnostic accuracy of 99 % is achievable by implementing an expert system, but in the similar circumstances practitioners might need a comprehensive record; thereby indicating their requirement only as an aid in the process rather than an option or replacement.

Nevertheless, a new field came into existence in social science, i.e. Cyberpsychology or the psychology of cyberspace. Studying people's reaction and their cyberspace behavior is another evolving concept created by computers and online networks [20]. Cyberpsychology research is directed to solve two main

aspects, i.e., enhanced applications of IT to counter various psychological issues and the consequences to the use and interaction of various tools of the cyber-space and associated psychological and psychiatric issues among the user.

With the merger of the information society in each aspect of routine life, this new concept was a natural progression with the ever-increasing and diverse studies related to the subject of applicability of IT by psychologists [17]. The justification of huge capital investments in the implementation of these complex systems and the dilemma with regards to the expected delivery of these systems in terms of the actual needs of the psycho/logy expert are inevitable in terms of complexity and purpose of the typical IT applications in real-world settings. The predicament of adaptability of the user to the system complexity is another problem faced in the given context. Tests on system efficiency by employing a minimal prototype can perhaps clear the first doubt. While user rejection an issue can be elucidated by implementing specific features for the human-computer interface – HCI. Although only on a gadget level, a good information system based on an expert system is needed without which even the electronic documentation known as- Help cannot resolve this issue.

A more interactive approach is expected from the application of Intelligent Tutoring Systems – ITS. An expert system dependent ITS with the touch of a finger from the massive combination between authoring event and psychology; to boost the competence in handling the customized help offered to the teacher to devise new materials and its appropriate application in the context of an ITS is needed [17]. Psychology-based computer applications are mainly referred to as psychotherapy. The computer at this juncture is far more relevant than human in a similar space. The roots of artificial intelligence in cognitivism have made the psychiatrists to employ the computer only as an ancillary support system during treatment. A battery of broad-based applications exists that can be classified as follows: dedicated internet sites for self-help; computer administered therapy; web-based applications for identifying and evaluating via the Internet;

advocacy; adjunctive palmtop computer therapy; consultation via the internet; virtual reality therapy; interactive voice messaging systems; biofeedback via ambulatory physiological monitoring; virtual support group sites. Basic advantages extended by the use of IT in psychotherapy are: more time gained by the patient for supervised treatment; shorter interaction with the practitioner; cost-effective treatment; devices might aid in making treatment decisions; the idea of employing the computer to support the expert is not novel for instance in the application of lengthier interviews [2].

The shortcomings of the application of computer in psychotherapy are primarily related to ethical issues; the patient-therapist bonding is where there lies a lacuna and the discretion of leaving an entire human being into this form of relationship is interrogated [21]. Secondly, considering the availability and easy access of the software to the patient at free will is akin to the case of drugs that can be used only under continuous medical supervision because of the predisposing risk factors. Computer models tend to oversimplify things, and the odds of reducing the adaptability and ability of the human expert are much higher. Consequently, with passing time there is a greater likelihood that the expert will not be able to comprehend patient-issues without the aid of the computer. Benefits of the computer-based application at any level in psychology cannot be ignored, but appropriate care is mandatory given the rising expectations from this particular approach. Given the gravity and complexity of psychological issues, limitations associated with the system cannot be neglected for instance problems like nightmares, compulsive gambling, tics, and enuresis have not been resolved till date. Meaning that despite the utility of these systems continuous updating is required, however, as of now substitution by the specialist is not feasible. The hypnotherapy may be carried out classically, but excellent outcomes are also gotten by the application of electronic techniques either partially or totally. Considering the computer have fully automated audio/video flow, thus reflecting the higher IT involvement. In Table 1, the techniques recommended for psychological issues and methods employed in conjunction with a computer are represented [22].

Table 1. Computer-based hypnotherapy application [15]

Psychological Issue	Anxiety, Depression, Stress, Phobias on various forms, Cognitive issues (e.g. positive thinking).
Techniques recommended	Self-hypnosis, Relaxation therapy, Hypnotherapy, Meditation, Stress management.
Applied methods	Interactive web applications, Interactive web applications, Stand-alone applications, Multimedia support, Mini mixing desks.

To help the psychotherapist health care services have allowed access to virtual reality; the specialists have approved the VR role and think that it might further refine and evolve the field of clinical psychology.

AI APPLICATIONS IN PSYCHOLOGY

The outcomes of the panic and phobia disorder treatment were not at par with the expectations from the computer-based application; even though, they were much economical.

Children's age-based educational games have become a regular and hold many potentials which the psychiatrists must explore. The concept of employing games in education with increasing level of complexity is being applied. These games are, more often than not, based on complex expert systems or a variant of advanced artificial intelligence. The psychologists have to integrate these strategies. Studies related to the applicability of 3D games as a resolute therapy instrument have been conducted [23]. The first outcome seems to be promising; nonetheless; it is an uphill task to find a general treatment solution. Therefore, psychiatrist-guided supervision of behavioral rule modification of the therapeutic games needs from time to time is required.

The superiority of AI dynamics as against that of psychology can be attributed to its strong mathematical backbone and its important industrial applications. The 1980s saw the rise in the use of an expert system as a market asset after that of production systems [24]. Expert systems and psychology cannot be separated. Over time the IT experts have realized that there is a need for competent rule extraction from people in order to devise new techniques. Here the repertory grid elicitation or the RepGrid which can yield data for analysis–quantitative and qualitative were identified and integrated into the historical understanding. From the psychological perspective, the expert systems can be implemented coupled with personal construct psychology. One must not forget that these psychologist approaches do not come cheap. So a middle path has to be taken for the expert system with generalized rules about human, and the thinking pattern is made, and later a form of self-acquiring guidelines from direct interaction with the patient will be implemented.

The expert systems are complex applications that select a set of guidelines based on the human expert experience in given circumstances. Apprehensions regarding its implementation exist but usually applied to the dimension of the set of guidelines and eventually to conferring clarity of this set. From the computing

dimensions, as of now, high-performance computing such as GRID or CLOUD can achieve great heights. However, human thoughts are a very complex subject to know especially it cannot be put down in words and in the absence of a communication channel, may further limit the knowledge transfer. From a theoretical point of view, the applicability of these systems is vast, because the basic idea behind the development of artificial intelligence – AI – was to be able to imitate human thinking; but to achieve this feat we have a long way to go. Various branches of AI are trying to copy parts of life behavior, right from genetic algorithms and neural networks to artificial life, fuzzy and game theory. Any expert system must comprise of three key components: first is the knowledge base, second the inference engine, and third the interface. The universal translator seems to be the first application in the pipeline. The level of knowledge offers to resolve a vast and varied database like Google and complemented by an equally formidable expert system. The expert systems application in speech therapy can further enhance its use. Researchers are also of the view that in the light of this improved fuzzy expert system can also be applied in providing at-home treatment of the patient [25]. Different AI techniques are used in general psychiatry. For instance, even low-quality input data is enough in the correct diagnosis of dyslexia, by merging the applicability of fuzzy and genetic algorithms. The passive voice itself can be used as an auxiliary source of information in creating a good anamnesis. Voice pathology is also being used in finding important psychological cues, outcomes of Massachusetts Eye & Ear Infirmary (MEEI) Voice Disorders Database is one such example [26]. These outcomes cannot be treated separately as multiple reasons can be responsible for the change in a patient's voice. Its use can give valuable information about the patient if used concomitantly with other measurements.

SOCIAL INFORMATION RETRIEVAL SYSTEM

Social sciences or psychology experts have to stay updated with the current cyberspace scenarios. Data collection of people or communities is central and newer ways must be devised, today information retrieval from the internet is also possible. Social life is either partially or fully being virtualized, so much so that, personal details can easily be accessed online. These set of information can be distinguished into explicit data or implicit data; the former is required by the social network so that the user knows about the content made public and is made aware about the

implications of making them partially or fully public; while the former data involves the information is given by way of interaction with all those acquainted via the social network platform.

Inability to distinguish between the virtual world and direct contact with the group members is the biggest threat to the user because he/she may not be discerning about the type and the confidentiality of the information made available. The virtual space has the information thereby an interface with the social network must be created. Accessing these personal details of the user without his/her consent is not possible without obtaining explicit permission. Two segments make the proposed system: first is the HCI-based interface using intelligent agents, and the second is the information retrieval system. The convenience of the use of the computer is possible by using expert systems and HCI techniques. Too much investment is not required to gain direct or indirect benefits in case of higher emotional intelligence in some individuals. Therefore, a computer capable of emulating these kinds of abilities is what is stressed on by experts.

AN INFORMATION RETRIEVAL SYSTEM – IRS

The IRS system comprises of the data gathering, indexing and searching, and presentation. The data gathering is done by retrieving information from the internet or local networks as per the user-set rules. Occasionally, it is applied as the solution of search by using independent units that will transfer the information to the central database. This case may require a data normalization process and also, some pre-indexing algorithms. Second is indexing; here immediately searchable database is looked at. Although varied indexing approaches exist the relevance of each depends mostly on the data size. Therefore, a traditional database management system (DBMS) is used to store data. The Third is searching – wherein a dedicated set of AI-based operations are used for each implicit DBMS users. Fourth is presentation – here the graphical user interface employed in graphical data representation is made; clustering methods are also used. Cyberpsychology is a related research field still in infancy with unlimited potential due to the high speed of technological development [27].

PSYCHOTHERAPY AND AI ALIGNMENT

The process of familiarising with the patient involves the designing of mental models based on small bits of available information. Artificial intelligence pri-

oritizes modeling of knowledge since understanding human behavior is integral for the machine to imitate. Knowledge Geometry is the computer-designed model of representation based on concepts (intuition) and vice versa (reification). The professional patient on assesses the patient behavior patterns and map them on the clear conditions and subjects them to brief psychotherapy. Theoretical concepts of psychotherapy are applied in cases where conflicts arise between the prepared psychotherapy maps and the individual in question. The reification operation is a process of inference where analogies and isomorphism database is used as a resource. By analyzing each process and family pattern, it can be cross-examined and novel methods devised to the system. The mechanism of feedback and maintenance does not allow the system to obtain newer experiences and learning, thus stunting its development or solving the conflict in question. This is referred to as case-based reasoning and is done by first-order logic. While the psychotherapist tries to simplify the patient's symptom and associate it to the broader interactional system, that is, and link it to the global scenario, it reflects the intuition operation of Knowledge Geometry. This particular phenomenon is later applied as ancillary support for understanding a broader pattern in this case; Artificial Intelligence calls a process akin to machine learning. The systemic-linking method is a step forward in the application of computational intelligence as an auxiliary tool in evaluating the behavioral pattern of couples, families, and individuals. Among the numerous strategies of Artificial Intelligence, first-order logic, automatic theorem prover, and fuzzy logic [24] can be used to match the associated psychotherapy interventions linked to the characterization of essential areas, genogram creation, self-determination assessment, cognitive interaction pattern testing, improved self-awareness and modifications [28]. Despite these developments, the opinion that artificial intelligence investigations have not yet evolved as a universal method for sophisticated formulation of problems need not be overlooked [26].

DISCUSSION

As with any emerging technology, caution needs to be used judiciously to overcome optimistic biases and, primarily, always to serve the best interests of the people for whom the technology is designed to help. Not to mention that Artificial intelligence (AI) is here to stay. Further emphasizing that the organization must stay attuned to the economic and social changes of the society; otherwise, it will fade away.

Nevertheless, psychology will always be a constant source of help to individuals struggling with insecurities and societal adjustments. Moreover, the advanced technological development has not in any way altered the mutual stimulus established by patient-therapist interaction. Technological advancements influence psychologists in many ways however the effect of the advancement in technology on psychology is associated with its own set of positive and negative aspects for which the clinicians, therapists, counselors, researchers must be well-equipped to handle.

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A pszichológiában alkalmazott mesterséges intelligencia alkalmazások: áttekintés

A pszichoterápia valamiféle kontrollérzetet nyújt az emocionális nehézségekkel küzdő pácienseknek, ami lehetővé teszi, hogy kezeljék saját reflexeiket és visszanyerjék nyugalmukat tudatos és viselkedéses változások segítségével. Ezek a transzformatív változások odafigyelési készségeik, megfigyelőkapacitásuk fejlesztésével, a tudatosság kialakításával, és figyelmességük és közbenjáróképességük növelésével segíthetők elő. A konvencionális pszichoterápia személyes találkozásokra épül a kezelés során. Tekintve, hogy mindennapi életünkben is egyre inkább hozzáférünk az információtechnológiához, felmerül az emberi interakciót helyettesítő IT gondolata is. A terápia során speciális eszközöket és technikákat alkalmaznak, ami nemcsak megváltoztatja, de hangsúlyozza és felerősíti ezek kognitív és hatékony megértését. E két tág cél – pszichológia komplexitásának és a mesterséges intelligencia ötvözésének gondolata nemrégiben kapott lendületet. Korábban egyes pszichológusok vonakodása azzal kapcsolatban, hogy professzionális rendszereket vezessenek be a mindennapi gyakorlatba, talán a munkájuk elvesztésével kapcsolatos bizonytalanságból vagy abból fakadóan, hogy lecserélik őket egy számítógépre, az IT-ben rejlő kompetenciák alkalmazásának kihasználatlanságát eredményezte. Alapvetően az emberi viselkedés nem másolható le teljességében a technológia által, és e tekintetben a mesterséges intelligenciának sok a behozni valója, azonban a kutatók minden megtesznek e területek fejlesztése érdekében. Emellett a páciensek a technológia ilyen területekre való behatolásával szembeni ellenállását is kritikusan kell szemlélni, ha el akarjuk nyerni a tömegek elfogadását. A cikk témája, hogy a gépi intelligencia hogy tud hozzájárulni az én-tudatosság növeléséhez számítógép által végzett pszichoterápia segítségével.

Kulcsszavak: mesterséges intelligencia, alkalmazások, pszichológia, AI