I M.Sc. Psychology

Subject name: Cognitive psychology
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UNIT-I –INTRODUCTION

Cognitive psychology is the scientific investigation of human cognition, that is, all our mental abilities – perceiving, learning, remembering, thinking, reasoning, and understanding. The term “cognition” stems from the Latin word “cognoscere” or "to know". Fundamentally, cognitive psychology studies how people acquire and apply knowledge or information. It is closely related to the highly interdisciplinary cognitive science and influenced by artificial intelligence, computer science, philosophy, anthropology, linguistics, biology, physics, and neuroscience.

History

Cognitive psychology in its modern form incorporates a remarkable set of new technologies in psychological science. Although published inquiries of human cognition can be traced back to Aristotle’s ‘’De Memoria’’ (Hothersall, 1984), the intellectual origins of cognitive psychology began with cognitive approaches to psychological problems at the end of the 1800s and early 1900s in the works of Wundt, Cattell, and William James (Boring, 1950).

Cognitive psychology declined in the first half of the 20th century with the rise of “behaviorism" –- the study of laws relating observable behavior to objective, observable stimulus conditions without any recourse to internal mental processes (Watson, 1913; Boring, 1950; Skinner, 1950). It was this last requirement, fundamental to cognitive psychology, that was one of behaviorism's undoings. For example, lack of understanding of the internal mental processes led to no distinction between memory and performance and failed to account for complex learning (Tinklepaugh, 1928; Chomsky, 1959). These issue led to the decline of behaviorism as the dominant branch of scientific psychology and to the “Cognitive Revolution”. The Cognitive Revolution began in the mid-1950s when researchers in several fields began to develop theories of mind based on complex representations and computational procedures (Miller, 1956; Broadbent, 1958; Chomsky, 1959; Newell, Shaw, & Simon, 1958). Cognitive psychology became predominant in the 1960s (Tulving, 1962; Sperling, 1960). Its resurgence is perhaps best marked by the publication of Ulric Neisser’s book, ‘’Cognitive Psychology’’, in 1967. Since 1970, more than sixty universities in North America and Europe have established cognitive psychology programs.

Assumptions

Cognitive psychology is based on two assumptions: (1) Human cognition can at least in principle be fully revealed by the scientific method, that is, individual components of mental processes can be identified and understood, and (2) Internal mental processes can be described in terms of rules or algorithms in information processing models. There has been much recent debate on these assumptions

Approaches

Very much like physics, experiments and simulations/modelling are the major research tools in cognitive psychology. Often, the predictions of the models are directly compared to human behaviour. With the ease of access and wide use of brain imaging techniques, cognitive psychology has seen increasing influence of cognitive neuroscience over the past decade. There are currently three main approaches in cognitive psychology: experimental cognitive psychology, computational cognitive psychology, and neural cognitive psychology. Experimental cognitive psychology treats cognitive psychology as one of the natural sciences and applies experimental methods to investigate human cognition. Psychophysical responses, response time, and eye tracking are often measured in experimental cognitive psychology. Computational cognitive psychology develops formal mathematical and computational models of human cognition based on symbolic and subsymbolic representations, and dynamical systems. Neural cognitive psychology uses brain imaging (e.g., EEG, MEG, fMRI, PET, SPECT, Optical Imaging) and neurobiological methods (e.g., lesion patients) to understand the neural basis of human cognition. The three approaches are often inter-linked and provide both independent and complementary insights in every sub-domain of cognitive psychology.

Sub-domains of Cognitive Psychology

Traditionally, cognitive psychology includes human perception, attention, learning, memory, concept formation, reasoning, judgment and decision-making, problem solving, and language processing. For some, social and cultural factors, emotion, consciousness, animal cognition, evolutionary approaches have also become part of cognitive psychology.

- **Perception:** Those studying perception seek to understand how we construct subjective interpretations of proximal information from the environment. Perceptual systems are composed of separate senses (e.g., visual, auditory, somato sensory) and processing modules (e.g., form, motion; Livingston & Hubel, 1988; Ungerleider & Mishkin, 1982; Julesz, 1971)

and sub-modules (e.g., Lu & Sperling, 1995) that represent different aspects of the stimulus information. Current research also focuses on how these separate representations and modules interact and are integrated into coherent percepts. Cognitive psychologists have studied these properties empirically with psychophysical methods and brain imaging. Computational models, based on physiological principles, have been developed for many perceptual systems (Grossberg & Mingolla, 1985; Marr, 1982; Wandell, 1995).

- **Attention:** Attention solves the problem of information overload in cognitive processing systems by selecting some information for further processing, or by managing resources applied to several sources of information simultaneously (Broadbent, 1957; Posner, 1980; Treisman, 1969). Empirical investigation of attention has focused on how and why attention improves performance, or how the lack of attention hinders performance (Posner, 1980; Weichselgartner & Sperling, 1987; Chun & Potter, 1995; Pashler, 1999). The theoretical analysis of attention has taken several major approaches to identify the mechanisms of attention: the signal-detection approach (Lu & Dosher, 1998) and the similarity-choice approach (Bundesen, 1990; Logan, 2004). Related effects of biased competition have been studied in single cell recordings in animals (Reynolds, Chelazzi, & Desimone, 1999). Brain imaging studies have documented effects of attention on activation in early visual cortices, and have investigated the networks for attention control (Kanwisher & Wojciulik, 2000).
- **Learning:** Learning improves the response of the organism to the environment. Cognitive psychologists study which new information is acquired and the conditions under which it is acquired. The study of learning begins with an analysis of learning phenomena in animals (i.e., habituation, conditioning, and instrumental, contingency, and associative learning) and extends to learning of cognitive or conceptual information by humans (Kandel, 1976; Estes, 1969; Thompson, 1986). Cognitive studies of implicit learning emphasize the largely automatic influence of prior experience on performance, and the nature of procedural knowledge (Roediger, 1990). Studies of conceptual learning emphasize the nature of the processing of incoming information, the role of elaboration, and the nature of the encoded representation (Craik, 2002). Those using computational approaches have investigated the nature of concepts that can be more easily learned, and the rules and algorithms for learning systems (Holland, Holyoak, Nisbett, & Thagard, 1986). Those using lesion and imaging studies investigate the role of specific brain systems (e.g., temporal lobe systems) for certain

classes of episodic learning, and the role of perceptual systems in implicit learning (Tulving, Gordon Hayman, & MacDonald, 1991; Gabrieli, Fleischman, Keane, Reminger, & Morell, 1995; Grafton, Hazeltine, & Ivry, 1995).

- **Memory:** The study of the capacity and fragility of human memory is one of the most developed aspects of cognitive psychology. Memory study focuses on how memories are acquired, stored, and retrieved. Memory domains have been functionally divided into memory for facts, for procedures or skills, and working and short-term memory capacity. The experimental approaches have identified dissociable memory types (e.g., procedural and episodic; Squire & Zola, 1996) or capacity limited processing systems such as short-term or working memory (Cowan, 1995; Dosher, 1999). Computational approaches describe memory as propositional networks, or as holographic or composite representations and retrieval processes (Anderson, 1996, Shiffrin & Steyvers, 1997). Brain imaging and lesion studies identify separable brain regions active during storage or retrieval from distinct processing systems (Gabrieli, 1998).
- **Concept Formation:** Concept or category formation refers to the ability to organize the perception and classification of experiences by the construction of functionally relevant categories. The response to a specific stimulus (i.e., a cat) is determined not by the specific instance but by classification into the category and by association of knowledge with that category (Medin & Ross, 1992). The ability to learn concepts has been shown to depend upon the complexity of the category in representational space, and by the relationship of variations among exemplars of concepts to fundamental and accessible dimensions of representation (Ashby, 2000). Certain concepts largely reflect similarity structures, but others may reflect function, or conceptual theories of use (Medin, 1989). Computational models have been developed based on aggregation of instance representations, similarity structures and general recognition models, and by conceptual theories (Barsalou, 2003). Cognitive neuroscience has identified important brain structures for aspects or distinct forms of category formation (Ashby, Alfonso-Reese, Turken, and Waldron, 1998).
- **Judgment and decision:** Human judgment and decision making is ubiquitous – voluntary behavior implicitly or explicitly requires judgment and choice. The historic foundations of choice are based in normative or rational models and optimality rules, beginning with expected utility theory (von Neumann & Morgenstern 1944; Luce, 1959). Extensive analysis

has identified widespread failures of rational models due to differential assessment of risks and rewards (Luce and Raiffa, 1989), the distorted assessment of probabilities (Kahneman & Tversky, 1979), and the limitations in human information processing (i.e., Russo & Dosher, 1983). New computational approaches rely on dynamic systems analyses of judgment and choice (Busemeyer & Johnson, 2004), and Bayesian belief networks that make choices based on multiple criteria (Fenton & Neil, 2001) for more complex situations. The study of decision making has become an active topic in cognitive neuroscience (Bechara, Damasio and Damasio, 2000).

- ‘’’Reasoning:’’’ Reasoning is the process by which logical arguments are evaluated or constructed. Original investigations of reasoning focused on the extent to which humans correctly applied the philosophically derived rules of inference in deduction (i.e., A implies B; If A then B), and the many ways in which humans fail to appreciate some deductions and falsely conclude others. These were extended to limitations in reasoning with syllogisms or quantifiers (Johnson-Laird, Byne and Schaeken, 1992; Rips and Marcus, 1977). Inductive reasoning, in contrast, develops a hypothesis consistent with a set of observations or reasons by analogy (Holyoak and Thagard, 1995). Often reasoning is affected by heuristic judgments, fallacies, and the representativeness of evidence, and other framing phenomena (Kahneman, Slovic, Tversky, 1982). Computational models have been developed for inference making and analogy (Holyoak and Thagard, 1995), logical reasoning (Rips and Marcus, 1977), and Bayesian reasoning (Sanjana and Tenenbaum, 2003).
- **Problem Solving:** The cognitive psychology of problem solving is the study of how humans pursue goal directed behavior. The computational state-space analysis and computer simulation of problem solving of Newell and Simon (1972) and the empirical and heuristic analysis of Wickelgren (1974) together have set the cognitive psychological approach to problem solving. Solving a problem is conceived as finding operations to move from the initial state to a goal state in a problem space using either algorithmic or heuristic solutions. The problem representation is critical in finding solutions (Zhang, 1997). Expertise in knowledge rich domains (i.e., chess) also depends on complex pattern recognition (Gobet & Simon, 1996). Problem solving may engage perception, memory, attention, and executive function, and so many brain areas may be engaged in problem solving tasks, with an emphasis on pre-frontal executive functions.

- **Language Processing:** While linguistic approaches focus on the formal structures of languages and language use (Chomsky, 1965), cognitive psychology has focused on language acquisition, language comprehension, language production, and the psychology of reading (Kintsch 1974; Pinker, 1994; Levelt, 1989). Psycholinguistics has studied encoding and lexical access of words, sentence level processes of parsing and representation, and general representations of concepts, gist, inference, and semantic assumptions. Computational models have been developed for all of these levels, including lexical systems, parsing systems, semantic representation systems, and reading aloud (Seidenberg, 1997; Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Just, Carpenter, and Woolley, 1982; Thorne, Bratley & Dewar, 1968; Schank and Abelson, 1977; Massaro, 1998). The neuroscience of language has a long history in the analysis of lesions (Wernicke, 1874; Broca, 1861), and has also been extensively studied with cognitive imaging (Posner et al, 1988).

Applications

Cognitive psychology research has produced an extensive body of principles, representations, and algorithms. Successful applications range from custom-built expert systems to mass-produced software and consumer electronics: (1) Development of computer interfaces that collaborate with users to meet their information needs and operate as intelligent agents, (2) Development of a flexible information infrastructure based on knowledge representation and reasoning methods, (3) Development of smart tools in the financial industry, (4) Development of mobile, intelligent robots that can perform tasks usually reserved for humans, (5) Development of bionic components of the perceptual and cognitive neural system such as cochlear and retinal implants.

Cognitive Approach in Psychology

Cognitive psychology is the scientific study of the mind as an information processor. It concerns the way we take in information from the outside world, how we make sense of that information.

Cognitive psychologists try to build up cognitive models of the information processing that goes on inside people’s minds, including perception, attention, language, memory, thinking, and consciousness.

Cognitive psychology became of great importance in the mid-1950s. Several factors were important in this:

1. Dissatisfaction with the behaviorist approach in its simple emphasis on external behavior rather than internal processes.
2. The development of better experimental methods.
3. Comparison between human and computer processing of information.

The emphasis of psychology shifted away from the study of conditioned behavior and psychoanalytical notions about the study of the mind, towards the understanding of human information processing, using strict and rigorous laboratory investigation.

Basic Assumptions

Mediational processes occur between stimulus and response:

Behaviorists rejected the idea of studying the mind because internal mental processes cannot be observed and objectively measured.

However, cognitive psychologists regard it as essential to look at the mental processes of an organism and how these influence behavior.

Instead of the simple stimulus-response links proposed by Behaviorism, the mediational processes of the organism are important to understand. Without this understanding, psychologists cannot have a complete understanding of behavior.

Psychology should be seen as a science:

Cognitive psychologists follow the example of the behaviorists in preferring objective, controlled, scientific methods for investigating behavior.

They use the results of their investigations as the basis for making inferences about mental processes.

Humans are information processors:

Information processing in humans resembles that in computers, and is based on based on transforming information, storing information and retrieving information from memory.

Information processing models of cognitive processes such as memory and attention assume that mental processes follow a clear sequence.

For example:

- Input processes are concerned with the analysis of the stimuli.
- Storage processes cover everything that happens to stimuli internally in the brain and can include coding and manipulation of the stimuli.
- Output processes are responsible for preparing an appropriate response to a stimulus.

Information Processing

The cognitive approach began to revolutionize psychology in the late 1950sand early 1960's, to become the dominant approach (i.e., perspective) in psychology by the late 1970s. Interest in mental processes had been gradually restored through the work of Piaget and Tolman.

Tolman was a 'soft behaviorist'. His book Purposive Behavior in Animals and Man in 1932 described research which behaviorism found difficult to explain. The behaviorists' view had been that learning took place as a result of associations between stimuli and responses.

However, Tolman suggested that learning was based on the relationships which formed amongst stimuli. He referred to these relationships as cognitive maps.

But it was the arrival of the computer that gave cognitive psychology the terminology and metaphor it needed to investigate the human mind.

The start of the use of computers allowed psychologists to try to understand the complexities of human cognition by comparing it with something simpler and better understood, i.e., an artificial system such as a computer.

The use of the computer as a tool for thinking how the human mind handles information is known as the computer analogy. Essentially, computer codes (i.e., changes) information, stores information, uses information, and produces an output (retrieves info).

The idea of information processing was adopted by cognitive psychologists as a model of how human thought works.

The information processing approach is based on a number of assumptions, including:

1. Information made available from the environment is processed by a series of processing systems (e.g., attention, perception, short-term memory);
2. These processing systems transform, or alter the information in systematic ways;
3. The aim of research is to specify the processes and structures that underlie cognitive performance;
4. Information processing in humans resembles that in computers.

The Role of Schemas

Cognitive processing can often be affected by schemas (a mental framework of beliefs and expectations developed from experience). As you get older, these become more detailed and sophisticated. **A schema is a "packet of information" or cognitive framework that helps us organizes and interprets information. They are based on our previous experience.**

Schemas help us to interpret incoming information quickly and effectively, this prevents us from being overwhelmed by the vast amount of information we perceive in our environment.

However it can also lead to distortion of this information as we select and interpret environmental stimuli using schemas which might not be relevant.

This could be the cause of inaccuracies in areas such as eyewitness testimony. It can also explain some errors we make when perceiving optical illusions.

Meditational Processes

The behaviorists approach only studies external observable (stimulus and response) behavior which can be objectively measured. They believe that internal behavior cannot be studied because we cannot see what happens in a person's mind (and therefore cannot objectively measure it).

In comparison, the cognitive approach believes that internal mental behavior can be scientifically studied using experiments. Cognitive psychology assumes that a meditational process occurs between stimulus/input and response/output.

The meditational (i.e., mental) event could be memory, perception, attention or problem solving, etc. These are known as mediational processes because they mediate (i.e., go-between) between the stimulus and the response. They come after the stimulus and before the response.

Therefore, cognitive psychologists' say if you want to understand behavior, you have to understand these mediational processes.

History of Cognitive Psychology

- Kohler (1925) published a book called, *The Mentality of Apes*. In it he reported observations which suggested that animals could show insightful behavior. He rejected behaviorism in favour of an approach which became known as Gestalt psychology.
- Norbert Wiener (1948) published *Cybernetics: or Control and Communication in the Animal and the Machine,* introducing terms such as input and output.
- Tolman (1948) work on cognitive maps – training rats in mazes, showed that animals had an internal representation of behavior.
- Birth of Cognitive Psychology often dated back to George Miller's (1956) "*The Magical Number 7 Plus or Minus 2*."
- Newell and Simon's (1972) development of the General Problem Solver.

• In 1960, Miller founded the Center for Cognitive Studies at Harvard with the famous cognitivist developmentalist, Jerome Bruner.
• Ulric Neisser (1967) publishes "*Cognitive Psychology"*, which marks the official beginning of the cognitive approach.
• Process models of memory Atkinson & Shiffrin's (1968) Multi Store Model.
• The cognitive approach is highly influential in all areas of psychology (e.g., biological, social, Behaviorism, developmental, etc.).

Basic Assumptions

Cognitive psychology is a pure science, based mainly on laboratory experiments.

Behavior can be largely explained in terms of how the mind operates, i.e., the information processing approach.

The mind works in a way similar to a computer: inputting, storing and retrieving data.

Mediational processes occur between stimulus and response.

Strengths

One strength of the cognitive approach is it has always employed highly controlled and rigorous methods of study in order to enable researchers to infer cognitive processes at work.

This has involved the use of lab experiments to produce reliable, objective data.

The cognitive approach is probably the most dominant approach in psychology today and has been applied to a wide range of practical and theoretical contexts.

Combines easily with approaches: e.g. Behaviorism + cognitive psychology = social learning theory; biology + cognitive psychology = evolutionary psychology.

INTELLIGENCE

Intelligence has been defined in many ways: the capacity for abstraction, logic, understanding, self-awareness, learning, emotional knowledge, reasoning, planning, creativity, critical thinking, and problem-solving. More generally, it can be described as the ability to perceive or infer information, and to retain it as knowledge to be applied towards adaptive behaviors within an environment or context.

Intelligence is most often studied in humans but has also been observed in both non-human animals and in plants despite controversy as to whether some of these forms of life exhibit intelligence.[1][2] Intelligence in computers or other machines is called artificial intelligence.

Different Theories Of Intelligence

1. Two-Factor Theory Of Intelligence

Charles Spearman, a British psychologist, came up with one of the earliest theories of intelligence. He studied the results of the test conducted by Binet and Simon. He noticed that students who performed well in one subject were likely to perform well in corresponding subjects.

For example, he saw that a student who performed well in math also performed well in music. He hypothesized that there's a single underlying factor that helps an individual utilize corresponding abilities. He called this 'generalized' form of intelligence the 'g' factor, which can lead to a 'specialized' form of intelligence called the 's' factor. In other words, the 'g' factor is the sum of multiple s-factor scores. This came to be known as the Two-Factor Theory of intelligence in psychology.

IQ or intelligence quotient tests, which measures one's general cognitive abilities, are derived from Spearman's theory of general intelligence.

2. Gardener's Multiple Intelligences

Howard Gardner, a developmental psychologist, was best known for his multiple intelligences theory. He believed that the traditional test of intelligence didn't accurately depict a person's abilities. He outlined eight major types of intelligence:

- **Naturalistic Intelligence**
  Having a strong connection with the outside world and the ability to categorize objects in nature.

- **Musical Intelligence**
  Having the ability to recognize and produce sound, rhythm, pitch and timbre.

- **Logical-Mathematical Intelligence**

The ability to think conceptually and use deductive reasoning to identify logical patterns or concepts.

- **Bodily-Kinesthetic Intelligence**
  The ability to control the physical form, like your bodily movements, and be effective physical communicators.

- **Verbal-Linguistic Intelligence**
  The ability to convey or communicate ideas, feelings or theories. There's sensitivity to sound and meaning of words.

- **Visual-Spatial Intelligence**
  The ability to relate well to the surrounding environment. It's the capacity to visualize thoughts and draw mental maps.

- **Interpersonal Intelligence**
  The ability to understand others by using emotional intelligence. It's the capacity to detect the mood and motivation of others.
- **Intrapersonal Intelligence**
  The ability to be self-aware and self-knowing. It's also called the intelligence of the self.

3. Triarchic Theory Of Intelligence

American psychologist Robert Sternberg proposed the Triarchic Theory just two years after Gardener's theory. It was a three-category approach that addressed the gaps in Gardner's theory of intelligence in psychology. He found Gardner's definition of intelligence as a much broader, single and general ability. According to Sternberg, the concept of intelligence involves three different factors:

- **Analytical Intelligence**
  It refers to a person's ability to assess information and how they use the information to analyze problems and arrive at solutions.

- **Creative Intelligence**
  The ability to do something in a novel or innovative way in order to create new ideas or experiences. It involves imagination and problem-solving skills.
- **Practical Intelligence**
  The ability to solve problems in daily life and adapt to changing environments. People with practical intelligence are also called 'street smart'.

Conclusion

Everybody's intelligence is unique and everyone thinks and reasons differently. If you ever find someone comparing their achievements to yours, remember that you can do things that person can't. What matters at the end of the day is how we use our intelligence.

Harappa Education's Thinking Critically course will help you put your intelligence to best use. The Ladder of Inference framework will help you understand how a four-step approach to learning can make your thought-process mature and measured. Start thinking strategically and start problem-solving effectively.

Emotional intelligence

Emotional intelligence (**EI**) is most often defined as the ability to perceive, use, understand, manage, and handle emotions. People with high emotional intelligence can recognize their own emotions and those of others, use emotional information to guide thinking and behavior, discern between different feelings and label them appropriately, and adjust emotions to adapt to environments.[1] Although the term first appeared in 1964,[2] it gained popularity in the 1995 best-selling book *Emotional Intelligence*, written by science journalist Daniel Goleman. Goleman defined EI as the array of skills and characteristics that drive leadership performance.[3]

Emotional intelligence refers to the ability to perceive, control, and evaluate emotions. Some researchers suggest that emotional intelligence can be learned and strengthened, while others claim it is an inborn characteristic.[*citation needed*]

Various models have been developed to measure EI. The *trait model*, developed by Konstantinos V. Petrides in 2001, focuses on self reporting of behavioral dispositions and perceived abilities.[4] The *ability model*, developed by Peter Salovey and John Mayer in 2004, focuses on the individual's ability to process emotional information and use it to navigate the social environment.[5] Goleman's original model may now be considered a *mixed model* that combines what has since been modeled separately as *ability EI* and *trait EI*. More recent research has focused on emotion recognition, which refers to the attribution of emotional states based on observations of visual and auditory nonverbal cues.[6][7] In addition, neurological studies have sought to characterize the neural mechanisms of emotional intelligence.[8][9]

Studies have shown that people with high EI have greater mental health, job performance, and leadership skills, although no causal relationships have been shown. EI is typically associated with empathy because it involves an individual connecting their personal experiences with those of others. Since its popularization in recent decades, methods of developing EI have become widely sought by individuals seeking to become more effective leaders.

Criticisms have centered on whether EI is a real intelligence, and whether it has incremental validity over IQ and the Big Five personality traits.[10][11] However, meta-analyses have found that certain measures of EI have validity even when controlling for IQ and personality.[12][13][14]

Components of emotional intelligence

1. Self-awareness

A key part of EI is a level of understanding and self-awareness of a person's own emotions. An individual with high EI is not only aware of what emotions they are feeling but can put words to

their feelings. They can also understand the consequences of their emotions and how they may change and shift over time.

2. Self-regulation

Once a person has achieved the first component, they can move on to self-regulation. An individual with a good awareness of their own emotions can better manage the emotions and behaviors that come along with them.

3. Motivation

Motivation is the process that stimulates and directs someone toward achieving their goals.

It is a key part of EI, 2016 research suggests. Motivation allows a person to remain true to their goals and persevere, even during challenging times.

A person with low motivation may be discouraged easily by any obstacle and give up. A person with high motivation realizes that the reward of their personal goals is worth the time and effort spent getting there, even when they face obstacles.

4. Empathy

Empathy refers to how tuned to the emotions of others a person is. Someone with high EI can accurately identify which emotions another person is feeling and can tell the difference between genuine and false emotions.

A person may do this by noticing certain facial expressions or changes in another person's voice or body language.

5. Social skills

A person with higher levels of EI may be better at interacting appropriately with others than a person with low levels of EI.

EI can help a person build relationships, communicate with others, and maintain friendships.

Why emotional intelligence is important

EI can help a person work with and supervise other people. It can also help them to cope with and be more resilient to stresses that they might face in life.

Research has shown that EI can be important in many aspects of a person's life. A 2019 study, for example, states that increased EI can improve a person's:

- work-related outcomes, including their teamwork and management skills and their overall job satisfaction
- psychological health and well-being
- physical health, including somatic complaints and HbA1c levels
- social relationships

What is artificial intelligence (AI)

Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.

How does AI work?

As the hype around AI has accelerated, vendors have been scrambling to promote how their products and services use AI. Often what they refer to as AI is simply one component of AI, such as machine learning. AI requires a foundation of specialized hardware and software for writing and training machine learning algorithms. No one programming language is synonymous with AI, but a few, including Python, R and Java, are popular.

In general, AI systems work by ingesting large amounts of labeled training data, analyzing the data for correlations and patterns, and using these patterns to make predictions about future states. In this way, a chatbot that is fed examples of text chats can learn to produce lifelike exchanges with people, or an image recognition tool can learn to identify and describe objects in images by reviewing millions of examples.

AI programming focuses on three cognitive skills: learning, reasoning and self-correction.

Learning processes. This aspect of AI programming focuses on acquiring data and creating rules for how to turn the data into actionable information. The rules, which are called algorithms, provide computing devices with step-by-step instructions for how to complete a specific task.

Reasoning processes. This aspect of AI programming focuses on choosing the right algorithm to reach a desired outcome.

Self-correction processes. This aspect of AI programming is designed to continually fine-tune algorithms and ensure they provide the most accurate results possible.

Why is artificial intelligence important?

AI is important because it can give enterprises insights into their operations that they may not have been aware of previously and because, in some cases, AI can perform tasks better than humans. Particularly when it comes to repetitive, detail-oriented tasks like analyzing large numbers of legal documents to ensure relevant fields are filled in properly, AI tools often complete jobs quickly and with relatively few errors.

This has helped fuel an explosion in efficiency and opened the door to entirely new business opportunities for some larger enterprises. Prior to the current wave of AI, it would have been

hard to imagine using computer software to connect riders to taxis, but today Uber has become one of the largest companies in the world by doing just that. It utilizes sophisticated machine learning algorithms to predict when people are likely to need rides in certain areas, which helps proactively get drivers on the road before they're needed. As another example, Google has become one of the largest players for a range of online services by using machine learning to understand how people use their services and then improving them. In 2017, the company's CEO, Sundar Pichai, pronounced that Google would operate as an "AI first" company.

Today's largest and most successful enterprises have used AI to improve their operations and gain advantage on their competitors.

What are the advantages and disadvantages of artificial intelligence?

Artificial neural networks and deep learning artificial intelligence technologies are quickly evolving, primarily because AI processes large amounts of data much faster and makes predictions more accurately than humanly possible.

While the huge volume of data being created on a daily basis would bury a human researcher, AI applications that use machine learning can take that data and quickly turn it into actionable information. As of this writing, the primary disadvantage of using AI is that it is expensive to process the large amounts of data that AI programming requires.

Advantages

- Good at detail-oriented jobs;
- Reduced time for data-heavy tasks;
- Delivers consistent results; and
- AI-powered virtual agents are always available.

Disadvantages

- Expensive;

- Requires deep technical expertise;
- Limited supply of qualified workers to build AI tools;
- Only knows what it's been shown; and
- Lack of ability to generalize from one task to another.

Strong AI vs. weak AI

AI can be categorized as either weak or strong.

- Weak AI, also known as narrow AI, is an AI system that is designed and trained to complete a specific task. Industrial robots and virtual personal assistants, such as Apple's Siri, use weak AI.
- Strong AI, also known as artificial general intelligence (AGI), describes programming that can replicate the cognitive abilities of the human brain. When presented with an unfamiliar task, a strong AI system can use fuzzy logic to apply knowledge from one domain to another and find a solution autonomously. In theory, a strong AI program should be able to pass both a Turing Test and the Chinese room test.

What are the 4 types of artificial intelligence?

Arend Hintze, an assistant professor of integrative biology and computer science and engineering at Michigan State University, explained in a 2016 article that AI can be categorized into four types, beginning with the task-specific intelligent systems in wide use today and progressing to sentient systems, which do not yet exist. The categories are as follows:

- **Type 1: Reactive machines.** These AI systems have no memory and are task specific. An example is Deep Blue, the IBM chess program that beat Garry Kasparov in the 1990s. Deep Blue can identify pieces on the chessboard and make predictions, but because it has no memory, it cannot use past experiences to inform future ones.
- **Type 2: Limited memory.** These AI systems have memory, so they can use past experiences to inform future decisions. Some of the decision-making functions in self-driving cars are designed this way.

- **Type 3: Theory of mind.** Theory of mind is a psychology term. When applied to AI, it means that the system would have the social intelligence to understand emotions. This type of AI will be able to infer human intentions and predict behavior, a necessary skill for AI systems to become integral members of human teams.
- **Type 4: Self-awareness.** In this category, AI systems have a sense of self, which gives them consciousness. Machines with self-awareness understand their own current state. This type of AI does not yet exist.