TRIANGULATING PSYCHOPOMP, BOT AND AVATAR TO CREATE A TECHNO-PSYCHOGOGIC LEARNING ACTIVITY SYSTEM FOR AUTISM TREATMENT

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ABSTRACT

The number of individuals diagnosed with autism has increased drastically from 2 to 4 per 10,000 births in the 1990's to 60 to 116 per 10,000 births in the 2000's. As a result, many countries, especially in Europe and North America, have channeled their resources into research to address the autism epidemic in two main aspects: (1) to understand the onset and causes of autism in order to develop better diagnostic screening tools; and (2) to determine the effectiveness of a wide range of intervention strategies to treat autism. This paper focuses on the latter basing on two treatment approaches: psychogogy and technogogy. Psychogogy, literally means to lead the mind, involves corrective, remedial, assistive and/or compensatory strategies to modify the mind's processes in order to maximize learning and behavioral potentials. Technogogy, literally means to be led by technology, refers to the convergence of technology, pedagogy and content in the transformative use of technology to foster learning and behavior development. In the psychogogic domain, a guiding agent known as psychopomp is needed to enter an autistic mind in order to understand it to help that individual. In the technogogic domain, there are two types of guiding agents: the bot and the avatar. The former is an autonomous computer software that operates as an agent for a user or a program to simulate a human activity, while the latter is a user's customizable on-screen character or persona in a computer game. Each of these guiding agents is a learning activity system. Understanding and triangulating all these three systems to integrate both psychogogy and technogogy will provide a new autism treatment framework with a fresh techno-psychogogic perspective.

Keywords: Autism, Avatar, Bot, Psychogogy, Psychopomp, Technogogy.

INTRODUCTION

Autism or Autism Spectrum Disorder (ASD) is a neuro-developmental syndrome[1] characterized by qualitative impairments in social interaction and communication as well as the presence of restricted, repetitive, and stereotyped patterns of behaviors, interests, and activities (American Psychiatric Association, 2000). These impairments can be observed in some children as young between 16 and 30 months (Robins et al., 1999) and can be more apparent when they reach the age of 3 to 4 years old (Chawarska et al., 2009).

The disorder got its name from the Greek word *autos* meaning "self", which "was first introduced in 1911 by a Swiss psychiatrist, Dr Eugen Bleuer, in his paper *Dementia praecox oder Grappe der Schizophrenien*' (cited in Feinstein, 2010, p.4). It was described as a disorder with symptoms of schizophrenia in which Bluer (1911, cited in Feinstein, 2010)

[1] The term *syndrome* is used to describe autism spectrum disorder because it consists of signs and symptoms that collectively indicate or characterize it as a form of psychologically abnormal condition different from other closely related disorders such as sensory integration disorder and attention deficit/hyperactivity disorder (ADHD).

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defined as "a form of thinking in which it is manifested in behaviors of an individual who is more drawn towards self and withdraw oneself from other people and the external world" (p.4). This term was never acknowledged in the field of psychology or medicine until very much later when two psychiatrists, Dr Leo Kanner (b.1894-d.1981) in the United States and Dr Hans Asperger (b.1906-d.1980) in Germany described the syndrome in their respective works in 1940's (Feinstein, 2010).

The Changing Definitions of Autism

The most widely used definition of autism or ASD is provided by the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision (DSM-IV-TR; American Psychiatric Association, 2000). Unlike the DSM-IV-TR, the International Classification of Diseases-Tenth Revision (ICD-10; World Health Organization, 1993) uses Pervasive Developmental Disorders (PDD) to refer to ASD. Hence, ASD has also been frequently referred to PDD by the medical professionals. However, in the Educator's Diagnostic Manual of Disabilities and Disorders (EDM; Pierangelo and Giuliani, 2007), the term ASD encompasses a range of disorders that include Asperger syndrome, autistic disorder, Rett's syndrome, childhood disintegrative disorder, high-functioning autism, hyperlexia, multiplex developmental disorder and pervasive developmental disorder-not otherwise specified (PDD-NOS).

However, recent studies (e.g., Lawson et al., 2004; Baron-Cohen et al., 2003) suggest that though individuals with ASD display empathizing deficits, they have intact or even superior systemizing ability. Systemizing refers to that ability to analyze and build systems so as to understand and predict the functional behavior or impersonal events or inanimate or abstract entities. Myers, Baron-Cohen and Wheelwright (2004) have listed the following six systems: (1) mechanical systems such as machines and tools; (2) natural systems such as biological processes and geographical phenomena; (3) abstract systems such as mathematical concepts and computer programs; (4) motor systems such as 3D drawing, piano finger technique or a lawn tennis shot; (5) organizable systems such as Dewey Classification System used in library cataloging of books or a stamp collection; and (6) social systems such as a business management or a football team.

The way an individual with ASD makes sense of any of these systems is not in terms of mental states, but in terms of underlying rules and regularities. As a result, individuals with ASD think and perceive very differently from those are non-autistic. This has been termed as autistic logic (Chia, 2011): a kind of reasoning system[2] that someone with ASD processes, basing on his/her *own* understanding of daily conspicuous happenings and eventful experiences, and making use of this understanding to construct his/her *own* new understanding of what he/she still observes and/or experiences, with a tendency to view life in terms of his/her *own* needs and desires. This can result in some kind of autistic *savoire-faire*. Hence, an individual with ASD tends to be rather rigid, ritualistic or structured in the way he/she thinks and does things. Such superior systemizing ability can be seen in those termed as autistic savants, who may have two or more savant abilities (Treffert, 1989). However, there is also another lesser known sub-group of autistic crypto-savants, who, "because of their inability to communicate, have savant skills that are hidden, or secret, and unknown to those around them" (Rimland, 1990, p.3). This aspect is often ignored in the current definition of ASD.

As a result, Chia (2012) has argued as follows: "In sum, based on the past and current research studies, I would see the need to re-define and expand the term autism spectrum

[2] Reasoning system is an ordered and comprehensive assemblage of facts, principles, experiences, thoughts or the like in how these are being best understood by the way an individual sees or perceives.

disorder (ASD) as a neuro-developmental syndrome of constitutional origin (genetic) and whose cause could also be epigenetic, and its onset is usually around first three years of birth, with empathizing or metalizing deficits that result in a triad of impairments in communication, social interaction, and imagination (*or presence of stereotyped behaviors*), but may, on the other hand, display (especially by autistic savants) or hide (especially by autistic crypto-savants) a strong systemizing drive that accounts for a distinct triad of strengths in good attention to detail, deep narrow interests, and islets of ability" (p.239). The italicized words in this current definition are found in Chia's (2008) earlier definition.

Chia et al. (2010) have also proposed to use the term Autistic Learning and Behavioral Difficulties (ALBD) to describe the positive autistic symptoms. The term ALBD has been adapted from Autistic Learning Disabilities that Siegel (2003) has coined to describe the learning and behavioral challenges manifested by children with such a disorder.

Autistic Learning and Behavioral Typologies

Studies (e.g., Chia et al., 2010; Parkison, 2010; Poland, 1974; Reeves, 2006) have identified three main domains of mental potentials, i.e., cognition (Bloom et al., 1956), conation (Riggs and Gholar, 2009) and affect (Kratheeohl et al., 1964), and in each of them, there is a specific typology of learning and behavioral skills and abilities (see Chia, 2012, for detail). Children with ASD display deficits or dysfunctions in all of these three domains to some degree of severity.

Cognition

Cognition, according to Poland (1974), "has to do with intellect, the 'use of the mind,' whether it is logical or illogical. Thinking is not directly observable, although an individual human may experience within himself or herself what is called thinking" (p.130). Bloom et al. (1956) have identified six levels of mental skills, i.e., knowledge → understanding → application → analysis → synthesis → evaluation, and more recently, revised by Anderson et al. (2001), whose cognitive domain includes remembering → understanding → applying → analyzing → evaluating → creating.

Conation

Conation is a term that has been used by classical psychologists to refer to willingness, desire or a striving towards achieving goals (McDougall, 1926). Today, the term is often ignored by most educators in academe (Reeves, 2006; Snow et al., 1996) and at the same time, is also being confused with psycho-motion. Psycho-motion is associated with skilled behavior; conation, with action. Psycho-motion is concerned with the physical skills to perform a given task, while conation concerns if the person possesses the will, desire, drive, level of effort, mental energy, intention, striving, and self-determination to actually perform to his or her very best (Reeves, 2006).

According to Poland (1974), conation is referred to the inherited potential for action. "We inherit bodies that are able to move, awkwardly and ineptly at first, but with a growing and developing smoothness and skill as the years pass. Actions are observable behaviors such as dancing, laughing, talking, simply sitting in a chair, or pole vaulting. Actions are sometimes referred to as conative behavior, which can include a great variety of automatic behaviors such as walking and habits such as smoking or repeatedly wiggling a foot while sitting in a chair" (p.13).

Riggs and Giholar (2009) highlighted six attributes in the fundamental framework of conation: belief → courage → energy → commitment → conviction → change. Parkison

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(2010) has simplified the framework into four levels of mental skills (since conation creates changes from within): personal discovery → transition → transformation → transcendence.

Affect

Krathwohl et al. (1964) have provided the best known affective domain taxonomy which is ordered according to the principle of internalization. Internalization refers to "the process whereby a person's affect toward an object passes from a general awareness level to a point where the affect is *internalized* and consistently guides or controls the person's behavior" (Seels and Glasgow, 1990, p.28). Krathwohl et al. (1964) have listed five levels of affective attributes: receiving → responding → valuing → organization → characterization by value.

According to Poland (1974), affect concerns feeling that is the genetically based potential (also known as affective behavior) and "it has to do with a wide variety of behavior ranging from sadness and depression through happiness and ecstatic joy. Feelings are not directly observable, although they often may be expressed through action" (Poland, 1974, p.13).

Orexis: Conation-Affect

When conation and affect are brought together, it forms what is known as *orexis*, a Greek word, which means the conative and affective character of mental activity as contrasted with its cognitive aspect. It is often referred to the appetitive aspect of an act in order to satisfy some psycho-somatic desire (e.g., love and sex).

In the field of special education, the cognitive domain is often referred to the intellectual aspect of the mind that concerns with acts of learning and thinking, while conative and affective domains are referred to the feeling and striving aspect of the mind or of a socio-emotional behavioral act (Chia et al., 2010). Figure 1 illustrates the triangulation of cognition, conation and affect. However, the model is incomplete without sensation or sensory domain, which links all the other three domains together.

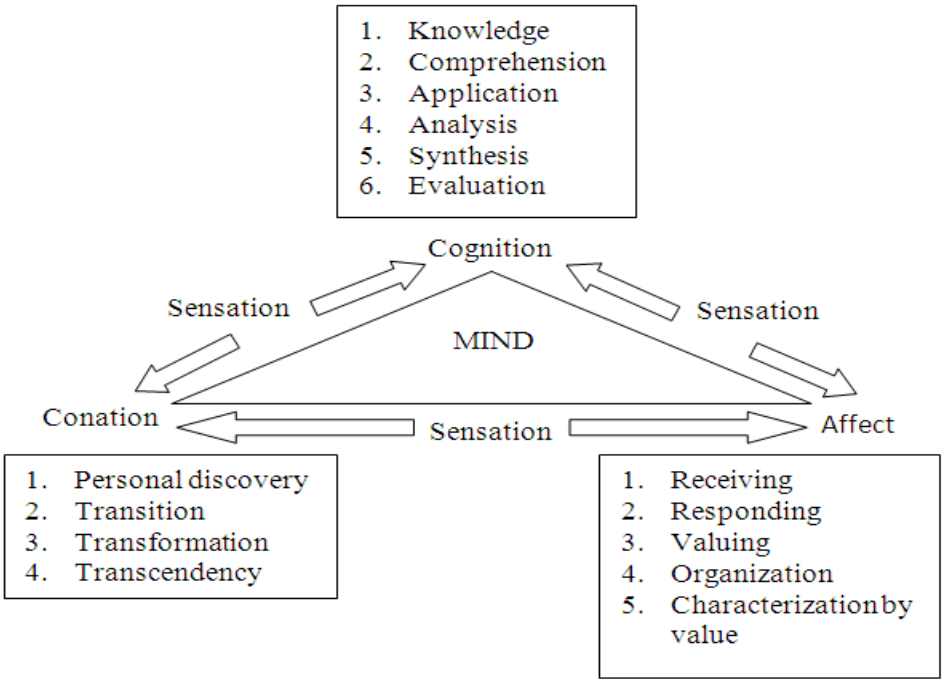

Figure 1. Triangulation of cognition, conation and affect (Chia et al., 2010)

According to Chia et al. (2010), sensation consists of two systems: interceptive and exteroceptive senses. The interceptive sensory system is made up of vestibule and proprioception that can impact on the exteroceptive sensory system which consists of five sensory organs: eyes, ears, skin, nose and tongue (see Figure 2).

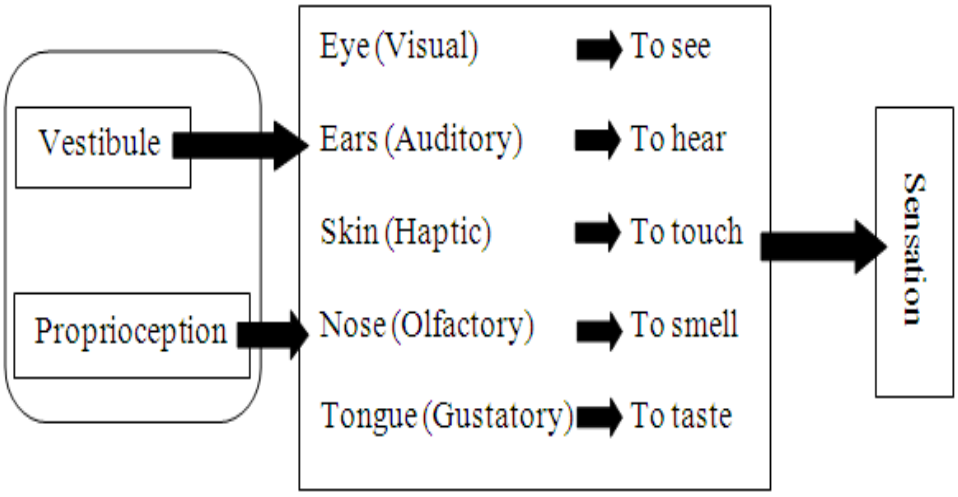

Figure 2. Interceptive and exteroceptive sensory systems

How sensation goes about processing and making sense or comprehending sensory inputs and thus, its impact on the motor coordination and motor outputs (i.e., motions and movements) depends on its involvement with cognition, conation and affect as follows (Chia et al., 2010): (1) the sensation between affect and conation involves self-awareness and self-regulation respectively; (2) the sensation between cognition and conation involves self-learning and self-regulation respectively; and (3) the sensation between affect and cognition concerns self-awareness and self-learning respectively. It is beyond the scope of this paper to delve into detail on this topic. Generally, many children with ASD also manifest deficits/dysfunctions in sensation resulting in what has been termed as sensory processing disorder and its related sensory anomalies.

Designing a Learning Activity System for Autism Treatment

The onset of ASD often comes with manifestation of developmental delays in many skills such as communication and social interaction and such children lack the ability to imagine. In many cases, children with ASD also have sensory processing difficulties that often hinder their sensory perceptual motor responsivity to the immediate environments where they are in. As a result, many fail to respond when their names are called (auditory), show a lack of joint attention (visual), display self-stimulatory behaviors (haptic-motor) and make meaningless neologic utterances (auditory/aural-oral).

These children with ASD feel more comfortable with repetitive behaviors, which can go on for hours, and are quite resistant to changes and/or new situations as these create anxiety and tension for them. They are also found to be hypersensitive to sounds with high pitch and prefer low pitch humming ones. A few studies (e.g., Chia and Kee, 2011; Ness, 1999; Mansour, 2011) have been done to show that ambient sounds provide a steady source of sounds that are not generally nerve-jarring to individuals with ASD. These sounds for some children with ASD are simply constant and rather soothing and help them to stay calm and concentrate on what they are engaging at that point in time (Martel, 2010). However, there are also other studies (e.g., Hall and Case-Smith, 2007; Sinha et al., 2004; Sinha et al., 2006)

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suggesting that it is still inconclusive to confirm the effectiveness of sound therapies such as Auditory Integration Training and SAMONAS therapy as autism treatments.

In view of the problems displayed by children with ASD, there is a need for an appropriate learning activity system (LAS) designed to meet their learning and behavioral needs in order for them to benefit from a treatment they are to undergo. By LAS, it refers to a collective construction that is not reducible to discrete individual actions (Leont'ev, 1974). It can be any continuous, goal-directed, historically-conditioned, dialectically-structured, tool-mediated human interaction, such as a treatment, an individualized education plan, a program of study, a school, a family, and so on (Russell, 1997).

According to Holt and Morris (1993), LAS is focused by the interaction of minds in the world, socially constructing and sharing meaning. To Engeström (1987), LAS (see Figure 3) is made up of four main subsystems: production, consumption, distribution, and exchange. It also contains the following interacting components: (1) subject; (2) object; (3) tools and signs; (4) division of labor; (5) community; and (6) rules. Engeström's (1987) model of LAS has been adapted by Jonassen (2000) as shown in Figure 3. The authors of this paper have added a seventh component – the guiding agents/mediators – to Jonassen's (2000) model. In this paper, the autism treatment approach is the LAS.

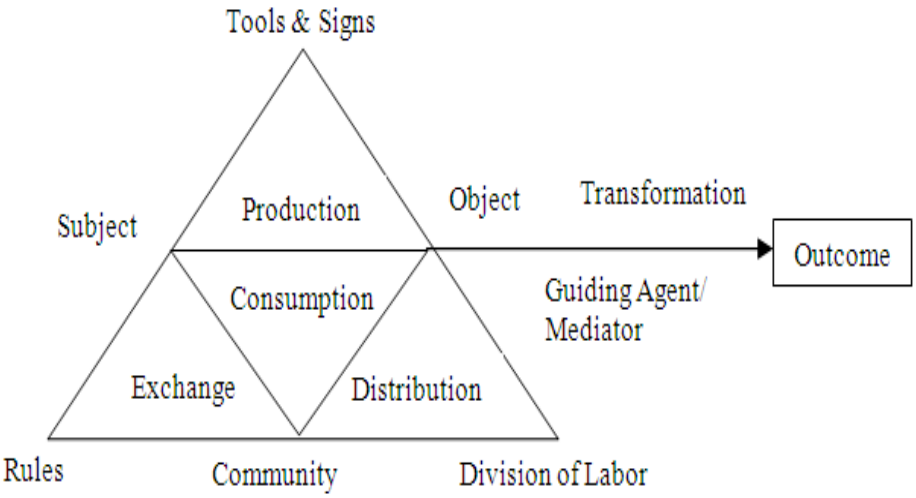

Figure 3. The model of LAS adapted from Engeström's (1987) by Jonassen (2000)

Interacting Components of the LAS of Autism Treatment

The four learning activity subsystems describe the higher order functions, inter-relationships between and among the components of the entire system (Holt and Morris, 1993; Jonassen, 2000). Each of these interacting components and subsystems (in the next section) are briefly described below:

Subject

This refers to any individual or a group of individuals engaged in an autism treatment. The subject possesses cognitive, conative and affective behavioral potentials (interlinked by sensation) that are brought into the LAS.

Object

Objects of the autism treatment are results that are produced by the treatment. The transformation of the object into the desired outcome represents the purpose or intention of the treatment.

Tools and signs

They are the means that the subject uses for acting on the object. They can be anything used in the transformation process. According to Jonassen (2000), "[T]he use of culture-specific tools shapes the way people (subject) act and think" (p.100).

Community

This consists of the interdependent professionals as well as allied professionals (e.g., case manager, psychologist, occupational therapist, speech-language pathologist, educational therapist, counselor, and others who are involved in the treatment) who share a set of activities and their social meanings in the autism treatment. Within the treatment plan, the community functions to distribute professional responsibility among those involved as well as the kinds of formative/summative results expected.

Division of labor

This refers to the horizontal division of tasks between cooperating professional members of the community but also to the vertical division of power and status (Engeström, 1987). "How flexibly any work organization can adapt to circumstances will determine the ability of the LAS to engage in different activities" (Jonassen, 2000, p.102).

Rules

They refer to the explicit regulations, conventions, policies and the code of ethics and professional conduct that constrain the activities conducted in the treatment "as well as the implicit social norms, standards, and relationships among members of the *professional* community" (Jonassen, 2000, p.103; word in italic is additional).

Guiding agent/mediator

This refers to anyone or anything that serves as a guide to lead the subject through the process of treatment to realize the object in order to attain the expected outcome.

Learning Activity Subsystems

Production subsystem

This consists of "the objects that attempt to produce the outcome of the system" (Jonassen, 2000, p.99). The outcome refers to the impact of the autism treatment on those for whom the treatment is intended. The outcome may be specified in advance (e.g., the learning goals/objectives of an individualized education plan or learning and behavioral goals of a treatment plan) or may be unintended results of the treatment design and/or implementation, and these results can be referred to as consequences. This subsystem involves a subject, the object of the autism treatment, the tools (e.g., visual cue cards) that are used in the treatment and the actions and operations that affect an outcome (Nardi, 1996). Among all the four subsystems, the production subsystem is most important. This is because through the processes, the object of the LAS (autism treatment) is transformed into the desired outcome, i.e., the intentions of the treatment are manifest. According to Jonassen (2000), the production subsystem "consists of interactions and relationships between the subject and object that are mediated by tools and signs" (p.99) with the ultimate aim of transforming the object of treatment into a positive outcome.

Consumption subsystem

This concerns how the subject and the surrounding community collaborate to perform according to the object of the autism treatment. The aim of the LAS is to transform an object of the autism treatment in order to attain the expected outcome (e.g., reduction in stereotyped

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behavior). However, it also takes up energy and resources from the subject and the community the subject is in. According to Jonassen (2000), "[T]he subject has to operate within a community that reciprocally supports the production activities of the subject, but also consumes effort from the subject" (p.101).

Distribution subsystem

This subsystem ties the object of the autism treatment to the community (a group of professionals working together as a team) by defining a division of labor, i.e., it divides up the tasks according to the professional disciplines such as speech-language therapy, occupational therapy and educational therapy.

Exchange subsystem

This subsystem involves the subject and two contextual components: "the rules that constrain the activity and the community with which the subject interacts" (Jonassen, 2000, p.102). Firstly, this subsystem regulates the tasks that are to be carried out in the treatment in terms of the subject's needs. Secondly, it also decides on which professionals to be involved in the autism treatment as required to cater to the subject's needs.

PSYCHOGOGIC DOMAIN

Children with ASD do not benefit from the normal teaching approach. "An alternative approach – be it corrective, remedial, assistive or compensatory – is needed to help these learners with challenging issues. This is known as *psychogogy*" (Chia, 2012, p.13).

What is Psychogogy?

Briefly, the term *psychogogy*, where the Greek words *psycho* means "mind" and *gogy* or *gogia* means "to lead", literally refers to "to lead the mind". It originated from Germany and it was first coined by a German author of *Psychogeneses und Psychotherapies Korperlicher Symptom* (1925), Oswald Schwartz, who used the term to describe a possible process for helping people to become self-actualised. This is a contradiction in terms. If people are helped to actualize their potential, they are other actualized, not self-actualized. Here the concern is, however, with changing the norms of society and then letting *people* actualize their potential within that new society. Later, Abraham Maslow borrowed that term *psychogogy* for his classic treatise on *Eupsychian Management* (1965). In one of his short essays *The Farther Reaches of Human Nature* (1971), Maslow defined psychogogy as the education of the psyche. Whitehurst (2002) has defined it as the "integration of professional wisdom with the best available empirical evidence in making decisions about how to deliver instruction" (slide 2).

According to Chia and Ng (2011), psychogogy is an "instructive theory that includes psychological influence on a learner's mind in terms of his/her learning and thinking abilities (cognition), feelings (affect) and will (conation) to perform or act and whose behavioral traits interlinked by various senses through different sensory processes (sensation) in order to establish his/her own perception and belief through interaction with others within a given socio-cultural context" (p.2).

Psychogogy addresses the mental well-being of an individual by growing or developing through a hierarchy of needs towards self-actualization (Maslow, 1943, 1965). In addition, according to Chia (2012), psychogogy also concerns a hierarchy of skills and abilities with innate abilities as the foundation and moving upward to develop other essential and higher skills and abilities towards self-reliance.

For psychogogy to succeed as autism treatment, its LAS need a guiding agent/mediator to lead the subject's mind (consisting of cognition, conation and affect interlinked by sensation) during the treatment according to its object and transforming the subject to realize the expected outcome. That guiding agent/mediator is known as *psychopomp*.

What is a Psychopomp?

The term *psychopomp* is coined by Madeleine L'Engle, (b.1918-d.2007), an American juvenile science fiction novelist, in her *Wind* trilogy (Patterson, 1983). The Wikipedia entry[3] for *psychopomp*, derived from the Greek word *psychopomp's*, literally means the "guide of souls". It is a creature, spirit, angel, or deity in many religions whose responsibility is to escort a newly deceased soul to the afterlife. Its role is not to judge the deceased, but simply provide safe passage (Strong, 2008). Psychopomp's which are frequently depicted on funerary art, have been associated at different times and in different cultures with animals such as horses, ravens, dogs, crows, owls, sparrows and harts.

According to Jung (1959), a psychopomp is a mediator between the unconscious and conscious realms of mind. It is symbolically personified in dreams as a wise man or woman, or sometimes as a helpful animal (e.g., dog, dolphin and horse). In many cultures, the shaman also fulfills the role of the psychopomp that also includes accompanying the soul of the dead, helping to deliver at birth, introducing the newborn's soul to the world and so on.

Psychopomp as a Guiding Agent in the LAS of Psychogogy

One of the psychogogic strategies to treating children with ASD is the dolphin-assisted therapy (DAT). There are many different forms of DAT. The simplest form can involve a child swimming with, touching or taking care of dolphins, while the more complex one, known as dolphin-assisted therapy (or DAT for short), is based on a structured program designed to meet the needs of the child concerned. According to Nathanson (1989), the DAT is based on the theory that children with disabilities will increase their attention to relevant stimuli in the environment as a result of their desire to interact with dolphins. "The general purpose of DAT is to encourage children with disabilities to engage in desired responses in accordance with their individual education or therapy plan" (Chia and Kee, 2010, p.43).

In the west, studies done by Nathanson and de Faria (1993), Nathanson et al. (1997), and Nathanson (1989) on the efficacy of DAT (using bottlenose dolphins) have suggested that this form of intervention helps to increase the attention of individuals with disabilities as well as ASD because of their desire to be in contact with the dolphins. Hence, according to these three studies, the human subjects showed an improvement in their cognitive performance, increase in motivation and self-confidence.

In Singapore, the DAT uses the indo-pacific humpback dolphins (rather than bottlenose dolphins) and several studies (e.g., Chia and Kee, 2010; Chia et al., 2009; Chia et al., 2008) have been done to find out if the treatment had truly benefited children with ASD. In one recent study involving five young Chinese children with severe ASD, sensory processing deficits and attention deficit/hyperactivity disorder (ADHD), the findings showed an increase self-awareness and self-regulation and all the five subjects *awarized* – a term coined by Chia and Kee (2010) to refer to "an action rather than to be *aware of*, a passive reaction" (p.44). As a result, Chia and Kee (2010) argued that there was an increase in the subjects' level of cognitive consciousness although all of them remained intellectually challenged. The study was based on the hypothesis that a child with ASD manifested hyper-egocentrism which

[3] http://en.wikipedia.org/wiki/Psychopomp

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could be reinforced by strong sensory defense mechanism, which could either be hyper-responsively or hypo-responsively. "The dolphin served as an excellent psychopomp for a child with ASD to open his/her inner world to the outside world" (Cai and Chia, 2011, slide 22).

In understanding how a dolphin plays the role of a psychopomp in the DAT, Chia and Kee (2010) observed that "these children learnt to keep their eyes on the dolphin as it swam around the pool, use hand signals to initiate a certain response from the dolphin (i.e., performing a trick such as waving good-bye to the dolphin which responds by waving one of its flippers back), pat on the dolphin when it came forward to them, feed the dolphin, waddle in the water with the dolphin swimming around them, and for the more daring ones, even swam with the dolphin in the pool" (p.43). Chia and Kee (2010) explained that the dolphin as a psychopomp guided the subjects through the treatment in following three phases.

Phase 1: The dolphin was like some sort of an awareness initiator to the subject, a point of a social contact.

Phase 2: The dolphin became an awareness mediator between the subject and the surrounding (superimposed with the dolphin = subject and its pool = subject's surrounding). By the third month, the subject became very aware of the surrounding, that is, the dolphin pool with at least one dolphin swimming in it at any one time. The dolphin pool is like a photo-frame encapsulating the dolphin within it. It can represent the psycho-space in the mind of the subject: simple and clear, without any other distractions. It has its unique hypnotic effect on the subject's mind.

Phase 3: The dolphin now plays the role of awareness reinforce in the subject. From the somatic awareness, the subject has developed a psycho-spatial awareness that is gradually transformed into his/her environmental awareness.

The transformation of the subject makes him/her become more environmentally aware than before, become socially aware of himself/herself and the people around, too. The subject could now *awarize*, i.e., "taking a deliberate choice to make awareness" (Chia and Kee, 2010, p.44). This transformational process is termed as *awarizing* (i.e., to awarize is an action rather than to be aware of, a passive reaction). Awareness is integrated into the new mental schemes so as to take into account the particularities of the objects, persons, or events the subject is interacting with.

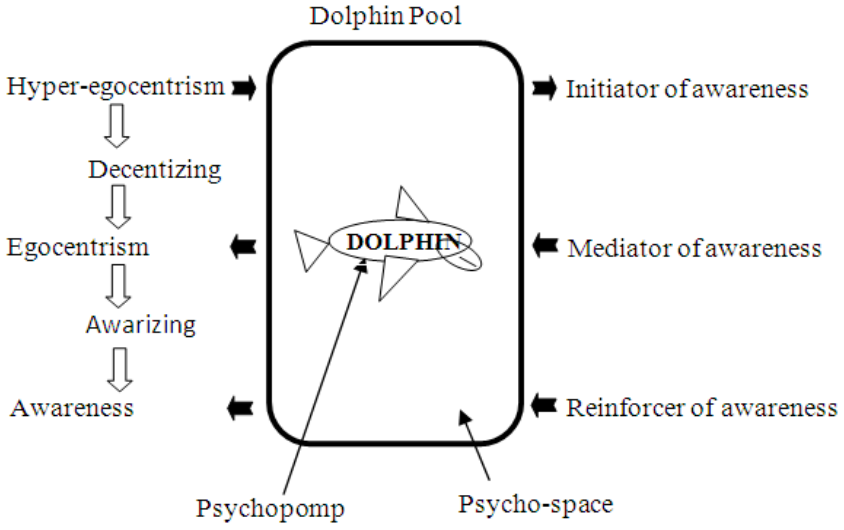


Figure 4. Dolphin as a psychopomp in psychogogic treatment

The DAT as a psychogogic treatment can be represented as an activity system in Figure 5 and its subsystems and interacting components are summarized as follows:

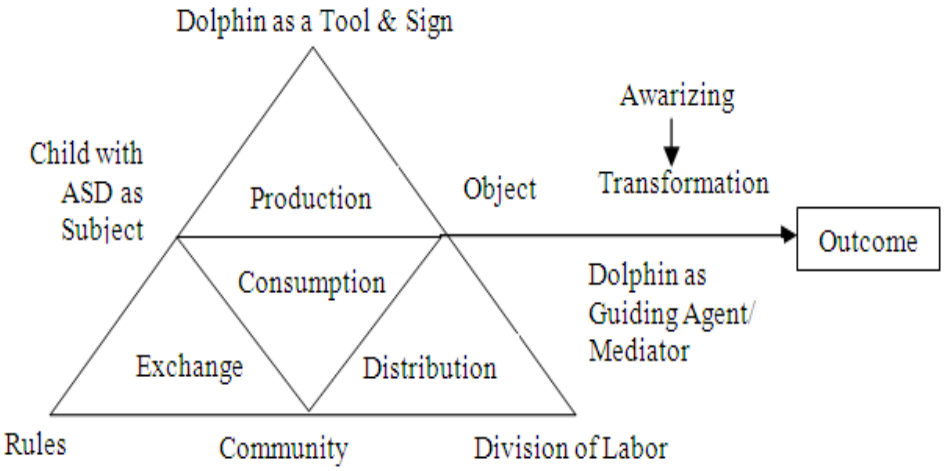


Figure 5. Dolphin as psychopomp in the LAS of psychogogy

Production Subsystem

Subject: Any child with ASD

Object: To develop an awareness of self and the surrounding

Tool: Dolphin swimming in a deep pool

Signs: Hand signals/gestures, dolphin clicks and whistles

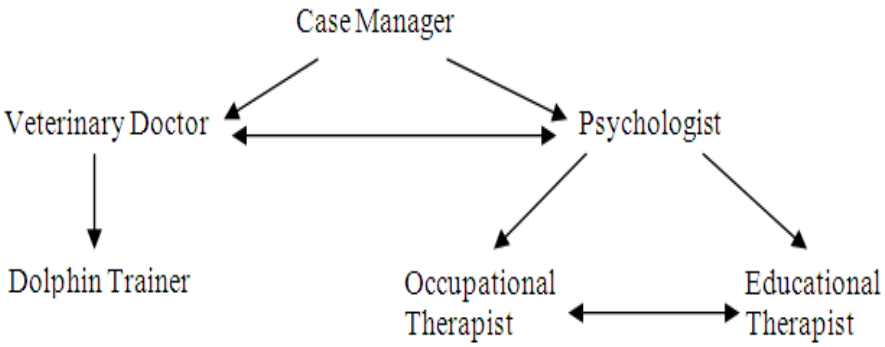
Guiding agent: Dolphin

Consumption Subsystem

Community: Case manager, veterinary doctor, dolphin trainer, occupational therapist, psychologist, and educational therapist (These are some examples and they are not in order of importance/priority.)

Distribution Subsystem

Division of labor: This depends on who the main person-in-charge is to delegate professional duties to the other professionals involved in this form of autism treatment. Below is only an example:



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Exchange Subsystem

Rules: Protocol for dolphin-assisted therapy

Code of ethics and professional conduct for the community

TECHNOGOGIC DOMAIN

The development of emerging technologies has made an increasing number of information and communications technology (ICT) tools widely available. Although many of these tools may not be designed for educational purposes, they have great potential for teaching and learning. While computer technology is changing the way we work and communicate with each other as well as the way we live today, 3D technology continues to revolutionize computer technology such as in movies and computer games to the extent that virtually all new games are based upon 3D graphics. It is changing the way we perceive and understand the world around us.

As a result of the rapid technological advancement in the past two decades, it has become inevitable not to harness the prowess of ICT to foster learning and develop appropriate behavior. In fact, "ICT has been used to support learners with special needs in mainstream as well as special schools" (Chia, 2012, p.25). Known as enabling or assistive technology, it has adapted to developments in technology as well as to education policy changes for learners with challenging or different needs (Rahamin, 2004).

What is Technogogy?

There are certain conditions and impairments that are known to create barriers to learning and behavior unless appropriate accommodations are made or provided. Psychogogy may or may not be the best option for some of these conditions and impairments (Chia, 2012). An alternative approach has to be sought. As a result, there is a need to turn to technology for a probable solution. The inventive use of technology becomes a key consideration for professionals caring for and working with individuals with special needs.

Known as *technogogy*, the term used by Idrus and McComas (2006) refers to the transformative use of technogogy to foster learning and develop appropriate behavior. Idrus (2008) has redefined technology as the convergence of technology, pedagogy and content in the transformative use of ICT to foster learning and develop acceptable behavior. According to Idrus (2008), there exists a relationship between what is being taught (the subject matter or content), how it is being taught (pedagogy) and the appropriate technology that is used in teaching. Hence, there is interplay of content, pedagogy and technology as shown in Figure 6. The symbol T stands for technogogy.

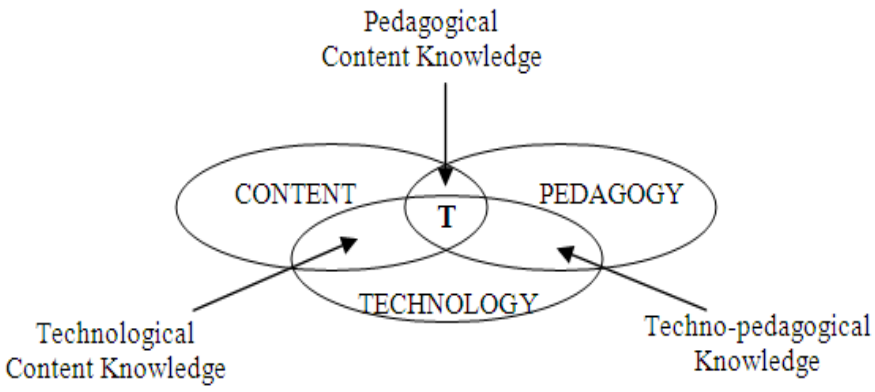

Figure 6. Model of technogogy (Idrus, 2008)

Koehler and Mishra (2005) have argued that true technogogy integration concerns both understanding and negotiating the relationships between those two components of knowledge and thereby, creating a third component: techno-pedagogic content knowledge (see Figure 7).

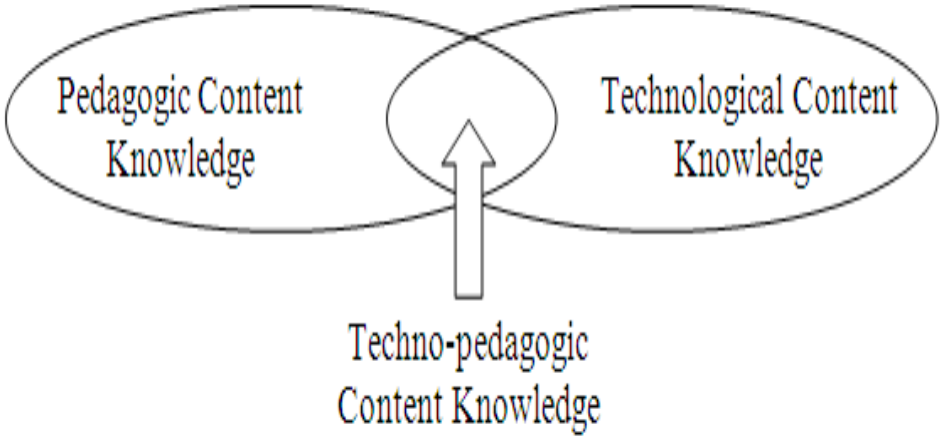

Figure 7. 2-dimensional model of knowledge (Koehler and Mishra, 2005)

In the field of special education, and more so in autism treatment, which is the main focus of this paper, the power and effective use of technogogy depends on how much is understood of pedagogical and epistemological factors vital for designing LAS of technogogic approach to autism treatment. The authors have divided these LAS into two parts: firstly, the bot-based technogogy, and secondly, the avatar-based technogogy.

What is a Bot?

A bot is a device or piece of software that can execute commands, reply to messages, or perform routine tasks, as online searches, either automatically or with minimal human intervention (often used in combination): *intelligent info bots, know bots, chat bots, shop bots that help consumers find the best prices, and many others.* The most popular bots that can be found on the Internet are programs known as spiders or crawler that are used for searching. They access websites to retrieve documents and follow all the hypertext links in them. Catalogs accessible by search engines are then generated. The largest use of bots is in web spidering, in which an automated script fetches, analyzes and files information from web servers at many times the speed of a human. Each server can have a file called robots.txt, containing rules for the spidering of that server that the bot is supposed to obey.

The Wikipedia entry[4] for 'bots" (also known as Internet bots, web robots, or WWW robots) describes them as software applications that run automated tasks over the Internet. Typically, bots perform tasks that are both simple and structurally repetitive, at a much higher rate than would be possible for a human alone. In addition, bots may also be implemented where a response speed faster than that of humans is required (e.g., gaming bots and auction-site bots) or less commonly in situations where the emulation of human activity is required (e.g., chat bots).

Bot-based Technogogy

Generally, bots are developed for three main purposes: commercial, charitable and malicious.

[4] http://en.wikipedia.org/wiki/Internet_bot

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Firstly, they are used by commercial organizations as a way to interact with their customers or users of their services and also to reduce operating and training cost. A good example is the chatterbot (or chat bot) used in automated online assistants.

Secondly, bots have also been used to fast-track the purposes of charities. One good example is Free Rice[5], which is a website where users play various educational, multiple-choice games in order to fight world hunger.

Thirdly, there are those bots that have been created for malicious purposes such as coordination and operation of an automated attack on networked computers or botnet, committing of click fraud and attempt to spam large quantities of advertisements or advertising links on the Internet. They are known as spambots.

One of the best known bot is Cleverbot[6] – an AI web application created by Roller Carpenter in 1988 – that learns how to mimic human conversations by interacting with humans on the Internet. Cleverbot is different from the traditional chatterbot in that the user is not holding a conversation with a bot that directly responds to entered text. Instead, when the user enters text in the chat bar, the algorithm selects previously entered phrases from its database of prior conversations. Saenz (2010) has claimed that communicating with Cleverbot is like talking with the collective community of the Internet. According to the Cleverbot.com website, the bot is able to achieve an average rating of 42.1% human at the Machine Intelligence Competition 2010 held at Peterhouse College, Cambridge, UK, and it won the Machine Intelligence Prize (see http://cleverbot.com/machine for more detail).

Bot as a Guiding Agent in the LAS of Technogogy

In one unpublished study conducted by Chia and Kee (2011), while given some manipulative tasks to complete, ten 6-7 years-old children with ASD were exposed to four different recorded sounds made by bottlenose dolphins which produce whistles and sounds that resemble moans, trills, grunts, squeaks, and creaking doors. The four recorded sounds were clicking, creaking, squeaking and buzzing clicking. Such sounds are made by dolphins any time and at considerable depths and also vary in volume, wavelength, frequency, and pattern. The frequency of the sounds produced by a bottlenose dolphin ranges from 0.2 to 150 kHz. The lower frequency vocalizations (about 0.2 to 50 kHz) are likely used in social communication. Social signals have their most energy at frequencies less than 40 kHz. Higher frequency clicks (40 to 150 kHz) are primarily used for echolocation. The findings of the study suggested that children with ASD preferred buzzing clicking, which they felt more ambient, than the other three sounds (see Table 1 below).

Table 1. Responses of children with ASD to dolphin sounds

Type of Dolphin Sound	*Responses of Children with ASD (N = 10)*		
	Ambient	*Indifferent*	*Restless/Distracted*
Buzzing clicks	7	1	2
Clicking	6	2	2
Creaking	3	2	5*
Squeaking	1	3	6*

* Manifestation of motor and/or vocal stimulatory behaviors

[5] For more information on FreeRice, visit the following website at http://about.digg.com/.
[6] http://cleverbot.com/

From the findings of this study, it would be interesting to create a bot using the buzzing clicks made by a bottlenose dolphin to calm a restless child with ASD whenever he/she makes noisy vocal stimming. Hypothetically speaking, the bot (let me name it *delphisbot* where *delphis* is a Greek word for dolphin) would be activated the moment the child starts to make noisy vocal stimming while completing a given task.

In another research study led by Professor Cai Yiyu (cited in Guo, 2011), virtual pink dolphins (based on the indo-pacific humpback dolphins seen at the Dolphin lagoon, Sentosa) are bots that have been created to respond to the various hand gestures of a subject with ASD, e.g., "perform an action and the dolphin whistles; perform another and it jumps out of the water" (Guo, 2011). The rationale is that the interactions give children with ASD the knowledge that they can communicate easily with gestures, thus strengthening their confidence in communicating with people in the real world. After the children open up and *awarise* themselves to their communication skills, the next phase is to move them to the subitizing stage, i.e., holding up different numbers of fingers will lead to different action, and with such interactions, hopefully, the children learn to automatically recognize numbers without having to count.

In one current study the first author is still conducting (still on-going while this paper was being written), seven children with high-functioning autistic disorder (HFAD) are invited to participate in dialoguing with Cleverbot. Dialoguing must not be confused with conversing or communicating. Conversing is a subset of communicating and it is considered an advanced form of meaningful verbal interaction on one or more main topic(s) and may involve other sub-topics. The authors of this paper define dialoguing as an intensive focused activity that involves the process of interacting verbally between two persons who are perceiving and working themselves with a more or less vague subject as they get closer to understanding the subject matter. It is what we do to find out about something from each other. In other words, dialoguing moves from a general to a specific topic in a verbal interaction. The object of this bot-based autism treatment is to get the subject with ASD to initiate and sustain a dialogue. The outcome is to determine how long the subject could dialogue with Cleverbot over a period of ten week exposure to it on the Internet. Another outcome is to find out if the dialoguing between the subject with ASD and Cleverbot makes meaningful sense, or if one of them gets carried away from a main topic of their dialogue.

Below is an example of dialoguing between a 12-year-old male subject with HFAD and Cleverbot. The subject has been taught how to use the computer keyboard and shown the chat bar where he could type in his words. Some parts of the conversation between the subject and Cleverbot may make no sense at all.

Subject:	Hi, Cleverbot, how are you today? (This starting phrase was provided by the educational therapist to the subject.)
Cleverbot:	I am good. How are you?
Subject:	I am good. My friends call me autistic. What is that?
Cleverbot:	Well dude you are quite a clever bot.
Subject:	Thank you. Are you autistic like me?
Cleverbot:	Define love.
Subject:	I don't know. Is love a heart shape?
Cleverbot:	Love is an emotion.
Subject:	What is an emotion?
Cleverbot:	Emotions are feelings.

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Subject: Feelings about what? Isn't it confusing?
Cleverbot: Yes you are. You're confusing me.
Subject: Feelings are love.
Cleverbot: But you have feelings.
Subject: Feelings have heart shape.
Cleverbot: That makes no sense.
Subject: Emotions have heart shape.
Cleverbot: You can't dress up an emotion.
Subject: What does emotion wear?
Cleverbot: You are one.
Subject: You are one.
Cleverbot: No I'm not.
Subject: We are one. Right?
Cleverbot: You and …?

Sometime the dialogue between the subject and Cleverbot can end quite abruptly. Hence, it is important for a teacher or therapist to be on standby when needed to play the guiding agent/mediator to help the subject sustain or continue the dialogue. Cleverbot as a guiding agent used in technogogic treatment can be represented as a LAS in Figure 8 and its subsystems and interacting components are summarized as follows:

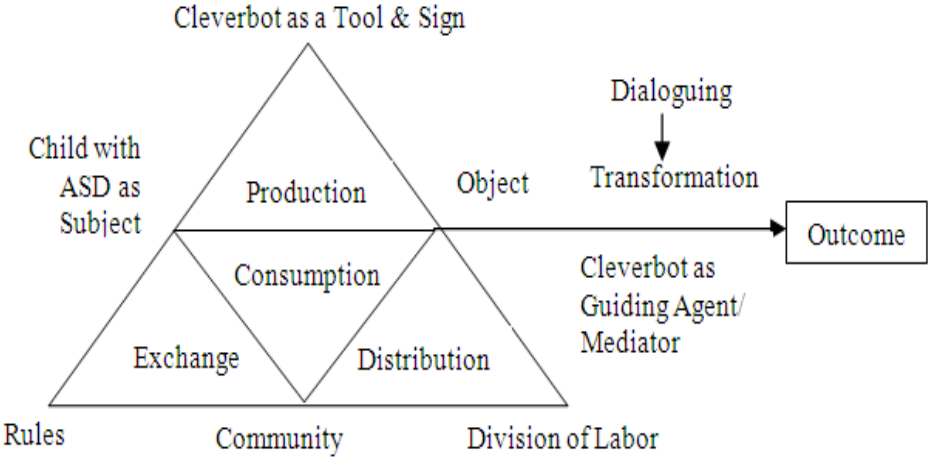


Figure 8. Cleverbot as bot in the LAS of technogogy

Production Subsystem

Subject: Any child with ASD

Object: To initiate and sustain a dialogue

Tool: Computer with access to the Internet

Signs: Words to converse with Cleverbot are to be typed into the chat bar.

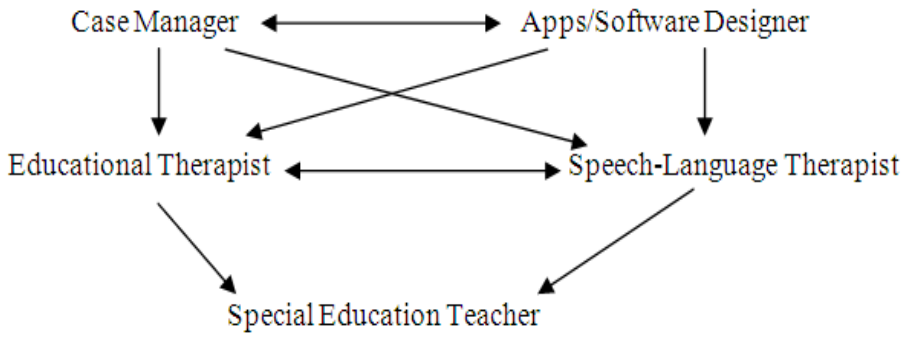
Guiding agent: Cleverbot

Consumption Subsystem

Community: Case manager, apps/software designer, special education teacher, speech-language therapist, educational therapist (These are some examples and they are not in order of importance/priority.)

Distribution Subsystem

Division of labor: This depends on who the main person-in-charge is to delegate professional duties to the other professionals involved in this form of autism treatment. Below is only an example:



Exchange Subsystem

Rules: Code of ethics and professional conduct for the community

What is an Avatar?

An avatar is a graphical representation of the user or his/her alter ego or character. It can take either a 3D form as in computer games or virtual world simulation, or a 2D form as an icon in Internet forums and other online communities (Blackwood, 2006; Fink, 1999). It can be an object representing the user (player or gamer) and it also refers to a text construct used to be found on early systems such as MUDs[7]. In addition, the term *avatar* can refer to the personality connected with the screen name, handle or an Internet user (Jordan, 1999).

Klevjer's (2006) definition of avatar (or *computer game avatar* in his own term) is most comprehensive to date and he defined it as that which "exploits the digital computer's unique capacity for realistic simulation, and acts as a mediator of the player's embodied interaction with the game-world. The relationship between the player and the avatar is a prosthetic relationship; through a process of learning and habituation, the avatar becomes an extension of the player's own body. Via the interface of screen, speakers and controllers, the player incorporates the computer game avatar as second nature, and the avatar disciplines the player's body" (p.10).

There are several types of avatars that are currently used in online games, virtual communities and Web forums, each for a different purpose. In this paper, I have chosen to focus on one particular type: the doppelganger avatar.

Avatar-based Technogogy

The complexity of computer games took a big leap in the 1990's with "improved graphics, a larger degree of strategy and better overall production values that helped the home console industry to reach a wider international market" (Yargo, 2010, p.2).

The first decade of the new millennium (2001-2010) saw the release of *The Sims* – a strategic life-simulation computer game developed by Maxis – in 2000 and *Second Life* – an online virtual world developed by Linden Lab – in 2003. Unlike *The Sims*, according to the Wikipedia entry[8], "*Second Life*'s status as a virtual world, a computer game or a talker, is

[7] MUD is an acronym that stands for Multi-User Dungeon/Domain/Dimension. It is an online environment where multiple users are logged on and interacting with one another in a game-world.
[8] http://en.wikipedia.org/wiki/Second_Life

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frequently debated. Unlike a traditional computer game, *Second Life* does not have a designated objective, nor traditional game play mechanics or rules. As it does not have any stipulated goals, it is irrelevant to talk about winning or losing in relation to *Second Life*. Likewise, unlike a traditional talker, *Second Life* contains an extensive world that can be explored and interacted with, and it can be used purely as a creative tool set if the user so chooses" (p.3).

Massively multiplayer online role-playing game (MMORPG) – coined by Richard Garriott, the creator of *Ultima Online* in 1997(cited in Safko and Brake, 2009) – is a genre of role-playing video games in which a very large number of gamers interact with one another within a virtual game world. The players or gamers can use avatars[9] in any form – human, animal, vegetable, mineral or a combination of these – as physical representations of themselves in the computer game world[10]. "Avatar-based games are different from other kinds of computer games as well as from other kinds of media" (Klevjer, 2006, p.9).

Today, avatar-based games have been developed and used with children with special needs, especially those with ASD. The benefits and impacts of these avatar-based games on both typical and atypical players have been researched and evaluated by computer scientists, psychologists and special education professionals, and many of these studies (e.g., Gaggioli and Riva, 2007; Gaggioli et al., 2007; Fabri et al., 2007) have been reported in the mass media as well as presented at international conferences on AI as well as 3D simulation and gaming, and published in journals and books.

Avatar as a Guiding Agent in the LAS of Technogogy

The object of using an avatar as a guiding agent, who is actually a doppelganger (i.e., a double or counterpart of the subject) of the subject with ASD, is to transform or make the subject socialize with others in the virtual world (also known by other terms such as metaverse, game world as mentioned earlier).

One good example is *The Sims*, the popular computer game developed by Maxis and published by Electronic Arts in 2000, involving a strategic life-simulation of daily activities of one or more virtual persons (also known as Sims) or avatars in a suburban household near *SimCity*. According to the Wikipedia entry[11], the inner structure of Sims is actually an agent-based artificial life program. The artificial intelligence of the game is advanced. The Sims can respond to outside conditions by themselves, although intervention from the player/controller is necessary to keep the Sims on the right track. The Sims technically has unlimited replay value, i.e., any player can play on indefinitely and there is no way to win the game. In fact, *The Sims* has been described as more like a toy than a game. The virtual persons or Sims are not fully autonomous as they are unable to take certain actions (e.g., pay the household bills, find a job and conceive a child) without specific commands from the player.

More recently, Murphy (2011) reported that through the use of digital photography, an avatar can be created to become eerily close to the appearance of its user or subject and in doing so exert a powerful impact on the user. This is a doppelganger avatar. Unlike video modeling (see Nikopoulos, 2007, for detail) when a child with ASD has to watch an animated puppet or cartoon figure perform a task based on a certain social skill to be learnt before he/she repeats it by imitation, watching an avatar that resembles oneself can influence the subject's

[9] The term avatar was coined by Chip Morningstar and Joseph Romero in 1985 for the on-screen representation of the user when they were designing LucasFilm's online role-playing game *Habitat*.
[10] Another term is virtual world or metaverse, coined by Neal Stephenson in 1992, to refer to a collective online shared cyberspace created by converging virtually enhanced physical reality and physically persistent virtual space (Smart et al., 2007), including the sum of all virtual worlds, augmented reality, and the Internet (Wikipedia, 2011).
[11] http://en.wikipedia.org/wiki/The_Sims

"thoughts, feelings and actions, often for the better – a phenomenon dubbed the *doppelganger effect*" (Murphy, 2011, p.59). Just 5 minutes of watching what a doppelganger avatar (or digital representation of the subject) does can literally change the subject's mind, improving the subject's behavior in a social situation, calming his/her anxieties, swaying his/her views of another person or product, and helping the subject make better lifestyle or financial decisions (Cheng et al., 2005; Herring et al., 2010; Murphy, 2011).

Doppelganger avatar-based treatment programs could provide social cues and stimulation to help individuals with ASD become more aware of themselves and those around, pick up appropriate social skills and to interact in a socially acceptable way with others (Yee et al., 2007). For instance, when a subject with ASD embodies his/her doppelganger avatar and looks into the eyes of another avatar, the avatar friend remains vivid. However, when the subject's digital eyes look elsewhere, the other avatar begins fading away (Murphy, 2011). This is one example of how an avatar-based autism treatment can help individuals with ASD learn to make and maintain eye contact in real life.

Besides the bot, the doppelganger avatar is the other guiding agent used in technogogic treatment for autism and that, in turn, can be represented as LAS shown in Figure 9 and its subsystems and interacting components are summarized as follows:

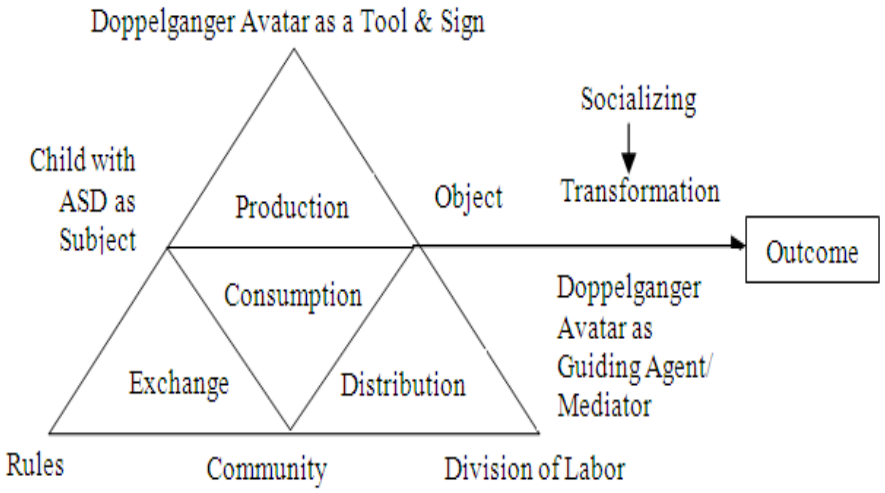

Figure 9. Doppelganger avatar in the LAS of technogogy

Production Subsystem

Subject:	Any child with ASD
Object:	To socialize with others in order to seek or enjoy their companionship
Tool:	Computer with access to the Internet, computer games, digital camera
Signs:	Hand gestures and facial expression
Guiding agent:	Doppelganger avatar

Consumption Subsystem

Community:	Case manager, educational therapist, psychologist, special education teacher and computer gaming specialist (These are some examples and they are not in order of importance/priority.)

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Distribution Subsystem

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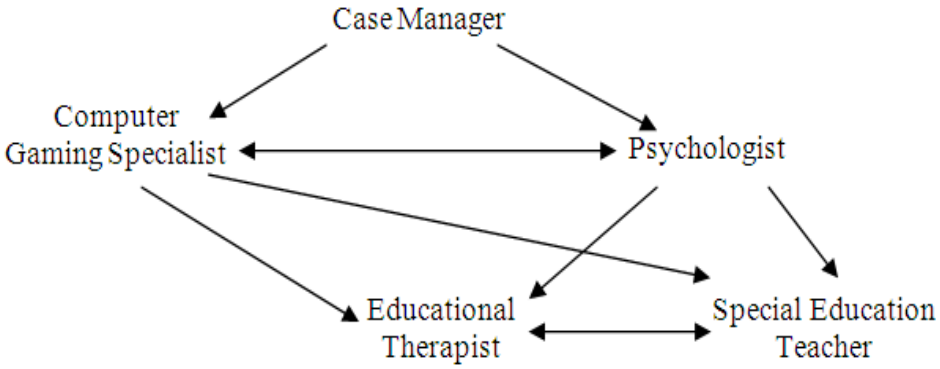

Exchange Subsystem

Rules: Code of ethics and professional conduct for the community

CONCLUSION

The authors of this paper have briefly examined the autistic learning and behavioral difficulties (ALBD) exhibited by children with ASD and how these ALBD can impair their cognition, conation and affect as well as sensation. However, despites many treatment strategies available for autism, there is still no one best autism treatment. As a result, the authors see the need to bring together the best practices in education and technology to design an appropriate learning activity system (LAS) for autism treatment. To do that, it is important to look beyond the pedagogy used in mainstream education in order to search for a probable alternative approach. This has brought the authors to the attention of two important domains that have been previously neglected or forgotten: psychogogy and technogogy.

On its own, psychogogy and technogogy have their own limitations in their respective learning activity systems. Hence, the best approach is to pull the two domains together to create a new one. The integration of psychogogy and technogogy has created a hybrid LAS (known as techno-psychogogy or psycho-technogogy, to be used interchangeably) involving three guiding agents/mediators: psychopomp from the psychogogic domain, and bot and avatar from the technologic domain.

Each of these three guiding agents has its role to play. The object of psychopomp is to guide individuals with ASD through the transformational process of developing the skill of awarizing so that they awarize themselves, the people around them and their surrounding contexts. Awarizing, coined by Chia and Kee (2010), is the process of creating sensory awareness of oneself, others and the surrounding context. The object of bot is to guide and transform these individuals through developing their skill of dialoguing so that they can learn to initiate and/or sustain a dialogue with another person. Dialoguing is the process of verbally conversing between two or more persons. The object of avatar is to make these individuals realize that they are social beings (after they can awarize and dialogue with others) and transform them by developing their skill of socializing with others. Socializing is the process of physically seeking or enjoying the companionship of others.

The three skills – awarizing, dialoguing and socializing – put together, form the triad of pre-requisite potentials needed for communication and social interaction. From this triad of pre-requisite potentials, another set of three integrated skills – conversing, befriending and communicating – forms the triad of verbal potentials needed for interactional reciprocity (see Figure 10). Conversing is to talk informally with another person or other people to exchange views, opinions and others. Befriending is to make friends or become friendly with others. Communicating is to give or interchange thoughts, feelings, information, or the like, by writing, speaking and others.

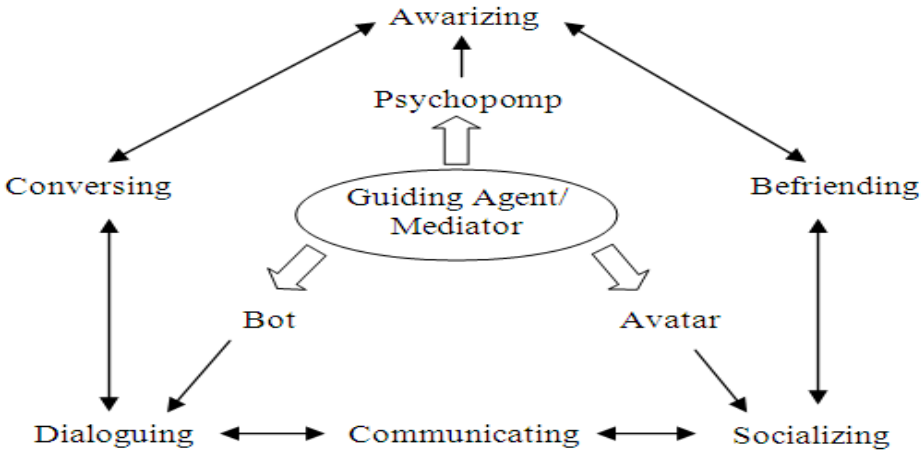

Figure 10. Integration of triad of pre-requisite potentials and triad of verbal potentials

The object of the LAS for techno-psychogogy (or psycho-technogogy) is to transform a subject with ASD from the level where he/she develops the triad of pre-requisite potentials to that level where the triad of verbal potentials is finally established. The outcome, hopefully, is for the subject with ASD to establish interactional reciprocity, which involves two important processes: interacting and reciprocating. Interacting involves the subjects acting one upon another, while reciprocating is to respond or interchange with someone for something in return.

The successful development of techno-psychogogy (or psycho-technogogy) as LAS for autism treatment will depend on two important factors: firstly, how well or to what degree the learning activity systems for psychogogy and technogogy can be successfully integrated into one approach for autism treatment; and secondly, the degree of success each of the three guiding agents – psychopomp, bot and avatar – in transforming the subject with ASD according to its respective object to attain the expected outcome in the process.

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