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Analysis of Games as a point of reference for building a learning-driven environment for children

By
Dr. Ajanta Sen
Prof. Ravi Poovaiah

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Content:

(1) Introduction – game as construct:

The use of game as a construct is part of our ongoing attempt to find ways at creating a computer-generated learning environment for children that will be both **engaging and motivational.**

The three aspects that we need to address ourselves in this context would be as follows:
(1.1) Assuming that game play is as a way of engaging children's attention for purposes of learning, can we draw from our understanding of *how games (both physical and virtual) function as a form of mental representation*, to help reinforce our notion that game can indeed be a valid construct for *combining fun and learning for children*

(1.2) Following from this, can we *define some of the boundary conditions* constrained by the given problem to help *locate key attributes from game as a construct,* and *leveraged by us* to create an effective (computing-driven) environment for purposes of learning for children? And,

(1.3) In aiming at a game-based learning solution, how may we locate *overriding values, suitability issues, goals, and objectives from an analysis of real world* games that could help sharpen the *correlates between games and learning*, and allowing them to be driven simultaneously from the same platform?
This exercise is being carried out with the full awareness that bringing game and learning together could pose opportunities as well as challenges, and that, the ultimate intent is to locate possible motivational advantages of a game-based solution that will draw children towards learning.

Needless to say, the definition of fun in learning is meant to go far "beyond sugar-coating *(sic)* to the full engagement that computer games seem to offer so many children today." **(Kirrimuir and McFrarlane, FutureLab Series 8).**

(2) Why games? Some generic attributes:

The choice of games (both physical and virtual) as a point of inspiration should be obvious considering that the dictionary meaning of gaming has the following to offer (2002):

Etymologically, at the very first level, game indicates the following attributes:
(2.1) in terms of a *pastime*, it means amusement, diversion, entertainment, frolic, fun, jest, joke, merriment, play, recreation, sport.

Moving on into the next level, viz.,
(2.2) in the sense of a *match*, where it provides the opportunity for competition, contest, event, a head-to-head, a meeting, a round of activities or a tournament.

But game, as a construct, can go beyond the obvious to indicate
(2.3) an idea of an *undertaking,* where game becomes an adventure, an enterprise, a line of activity, an occupation, a plan, a proceeding, or a scheme.

And furthermore, in even more complex and comprehensive terms, game could represent
(2.4) a *scheme* that points towards a design, a device, a plan, a plot, a stratagem, a strategy, or a tactic.

Effectively, game as a construct is meant to provide us with a tool to sharpen the mental representation of an idea or activity that we call 'play' that has historically captivated children into participation without the subterfuges of the proverbial 'beating stick'.
The singular issue for us here is, can we use this as an inspiration for problem-solving and as an instrumentality towards a solution, and ask the question: 'how can we combine fun and learning in a meaningful way to engage children's attention for cognitive purposes'?

(3) Why not games?

The multifarious nature of game - (i) variegated and (ii) complex:

The etymology of game play referenced above, though limited in scope and merely representative, not exhaustive, gives us a lead into the mental representational qualities embedded in games in terms of our core proposition: game as a way to build into fun and learning for children.
And even in its limited edition, the etymology of games outlined above begs the altering of our position of 'why games' to 'why not?' And clearly suggests the manifold faces of an idea that we call 'game'.

From the various faces of game outlined above, we may deduce two thoughts: that (i) games are **variegated** in appearance; and (ii) games are **complex** by nature.

(3.1) In extremely generic terms **(reference)**, 'game' as a concept may be defined by stand-alone singular notions of 'fun', frolic', 'diversion', 'entertainment' etc.
In reality, however, for a game to stand scrutiny as a an effective physical entity of activity/play, and for it to sustain a certain level of interest and participation in its players, a game will have to combine more than one of the stand-alone game descriptions listed above to become a game as we play it.

In other words, *games are highly multifaceted and multifunctional*, with their actualization as an activity usually possible only by combining several of the functionalities listed above.
Hence, to see game in monochromatic terms as being only 'entertainment' or only 'diversion', or only 'strategy' etc, would be highly reductive and misleading.
However, as matters stand, it is a fairly well understood and accepted that games are a multifaceted affair. It is with regard to the next proposition, the complex nature of games, that one needs to dwell on a bit since, by definition, something in the domain of 'play' is meant not to be complex. So, how do we deal with this paradox?

(3.2) It is the very slew of functionalities mentioned above underscoring games as an activity, and immediately imparting them with a multi-dimensional quality, is also what makes goes to make games to be *a complex affair.*
Going by the etymology, it is a complexity that also quite easily suggests the possibility for *taxonomically organizing the attributes of game in terms of levels of abstraction*, from the highly complex to the highly simplistic. In sheer taxonomy terms, therefore, one could view games as straddling the spectrum of complexity from the simple to the complex, from the mere 'frolic' to something far more multidimensional that we call 'strategy'.

So, technically speaking, a game could be driven by any one of the several situations outlined above, e.g., a game play undertaken to realize just merriment, or just a tournament, or just diversion from the task at hand. And continue to remain as valid a game, if not that compelling, as one that seeks to combine a slew of features stated under game definition.
In reality, however, it is fair to say that games that endear themselves to their players are those that are far *more complex and variegated in function* than those that combine just one feature each.
So typically, games tend to combine a clutch of the set of intent listed under its etymology in order to realize their end, rather than remain single purpose-driven. More often than not, a game will combine 'recreation' with 'strategy' to give us chess, or 'frolic' with 'tactic' to give us hide-n-seek, or amusement with plot to give us treasure hunt.

And further, it would be fair to assert that gaming usually reflects progressive levels of complexity depending on its user, this progression itself suggestive of a function of the progressive levels of cognitive needs embedded in its players, with the stratification of the cognitive levels most likely to be driven by an age parameter.
So, while children in the age group of 4-6 may like to play hide-n-seek, children of a higher age group may wish to engage themselves in something more cognitively demanding such as a game of 'carom'

or ‘monopoly’ or ‘hop scotch’. And children, further on the age hierarchy, wishing to play a game of football/soccer or ‘chess’.

In other words, it is important to recognize that embedded into the levels of complexity of games is an underlying structure that clearly demonstrates a corresponding order, ascending or descending, in their levels of abstraction of an idea*. Whereby, an idea at a more complex level will continue to hold within its folds the ideas conceived at the more simple levels plus more.*

This kind of a structure is best characterized by *‘nesting’ [footnote(1)]* - a geometric concept that refers to the ability of entities to nestle themselves one within the other, comfortably snuggled in or stacked up, to form a family of entities intrinsically connected to each other through size/syntactics.

In terms of planning or game strategy, nesting offers both opportunities and challenges for us.
The opportunities that this offers for design can be fantastic because of the inbuilt ability of ‘nesting’ as a concept to scale itself upwards or downwards depending on the players’ requirements.
But, this could also pose challenges in terms of getting into the trap of being reductive and linear by addressing single-layer attributes of a game at a time, without realizing that there are other attributes up and down the chain of abstraction and potentially in parallel play that may need to be factored into, even if those attributes are not immediately relevant to the game at hand.

Footnote (1) This tendency of entities to organize themselves around a given attribute, from the less complex to the more complex as a positive function of size, in a kind of stacking that allows for observation of clear hierarchies, was investigated for the first time by German economist Walter Christaller in his study of rural settlements in Southern Germany.
By applying this innovative concept to spatial planning, Christaller was able to offer a model that made it possible for planners to observe spatial patterns of distribution of goods and services across settlements, and allow a forecast of the way economic activities and services for settlements may be upscaled or downscaled with time, depending on demand created by the population threshold level attached to each settlement.
The efficacy of planning induced by this seminal study of agricultural farms in rural southern Germany had later prompted another economist, August Losch, to apply this model (named the Central Place Theory) to the study of facilities in urban settlements in the USA fifty years later. And since widely used worldwide in planning as a problem –solving tool for needs analysis and for forecasting of planning outlays.

(4.0) Scope of the problem vis-à-vis its two cornerstones:

(i) games and children; (ii) games and learning:

For the sake of achieving some clarity in the midst of a host of complex and seldom understood issues connected to cognition in children, we need to define the scope of our analysis of games by contextualizing our given problem around its two cornerstones, viz., (i) gaming and children; and (ii) games and learning
The aim of this exercise will be to add to our understanding of 'game' and its relationship to children, as well as its relationship to learning.

The two above aspects core to our problem, address issues that are of independent locus and yet interrelated to each other.
We will briefly address some convergences between the two aspects (game's connections with children and with learning) specific to the context of computing and other electronic media. And then move on to address the two aspects as separate entities in terms of their pedagogical implications for children.

There are two distinct schools of thought about computing and learning for children. One school has traditionally advocated the efficacy of the electronic media as being learning-friendly and facilitating for purposes of learning for children. The other has traditionally questioned the wisdom of using this as a dominant media for children's learning.

Leading the pack of early believers in computing as a medium of learning for children, **Seymour Papert** in his pioneering book *Mindstorms: Children, Computers and Powerful Ideas (1980)* had advocated that to make learning a joyous affair for children, what we needed to do was to apply the general precept that "the important kind of learning is bringing out what we know" rather than what we don't, upon which it is then possible for the learner "to make a further leap" from its particular position of knowing. To do this, Papert says "we have to *break down the barriers between school knowledge and ordinary life* out there."

The trick, according to Papert was to leverage simple information such as the fact that "even a small child knows how to walk around and find his way through the complexities of three-dimensional space and argue with people." **(Papert, 1980).** For Papert, this boiled down to one essential question: *can we leverage information already located in the child's world to help the child himself construct upon this layer further information with clues from his own environment?*

To experiment with this premise, Papert gave children computers and a programming language called 'Logo' driven by the bottom line design principle "low threshold and no ceiling", which would enable

any child "to get into it and quickly start being amused by doing things, and in time, be able to use it for anything that the computer can do – drawing, writing, doing math, making music." **(Stewart Brand, Inventing the Future at MIT, 1987)** This experiment was carried out at an inner-city Boston grade school, the Hennigan School in 1985, to explore what could be accomplished in an ordinary educational setting.

This facility for a child to be able to intervene in the learning process to construct themes starting with what he already knows, in the way that one builds modularly upwards, step upon step, out of a lego game, was able to establish to the community concerned with children's learning that, allowing a child the freedom to interpret his own environment through his own mental make-up also helped create opportunities for the child to use the right-side of his brain, the one triggers the faculty for perceiving pattern-orientations, such as manipulate spatial knowledge. This, as opposed to the traditional emphasis on the use of the left side and meant for language-driven linear quality of thinking, was a primary breakthrough in the world of children and pedagogy.
According to Negroponte, Hennigan was probably one of the most profound educational K (kindergarten) experimentation for its time.

The success of this experimentation with inner city kids who had no prior knowledge or even access to computing at the Hennigan Primary School catering to lower economic strata, underserved children in Boston in the eighties, had reinforced Pappert's charter of faith that children with their ability to use their spatial, dynamic, non-linear faculty to 'construct' information in response to their own environment actually shared with computing, the dynamic, interactive nature of this media.
Papert's early belief in children benefiting from the use of computers at a time when computers were seen as being distractive and counter-productive, had stemmed precisely from the above mentioned synergy with the shared modes of thinking between children and computer.

Post-'Mindstorms' and the Hennigan experimentation, researchers concerned with the pedagogical relationship between new media and learning for children, have debated over the relationship between
(a) informal and non-formal learning processes of children within their "computing gaming culture" on the one hand, and
(b) how may one systemize educational teaching effort aimed at leveraging this so called "media competency" as advocated by Pappert in the fifties, and of course tapping into the since emerging generations of computer literacy and ICT skills.

The other school of thought that did not vest their unqualified faith in the computer to further the process of children's learning, were initially of the opinion that new media was a bad educator, because its artifacts like video games "taught" children and young people

traits like violent behavior.
Researchers from the eighties, such as **Patricia M. Greenfield (1984), while** discussing possible pedagogical effects of media on the learning of children maintained that, at best, computers had the effect of introducing distractiveness and a lack of seriousness into pedagogy, since it had come to be associated with gaming in the context of children and the young.
Fromme (2003) says: "as far as I see, Greenfield was one of the firsts scientists who drew attention to the possible effects of watching television or playing video games" and continues, that Greenfield and others also addressed new media as "cultural artifacts" which demand *complex cognitive skills from the people who use them.* And hence cannot be given on the predication that no prior knowledge of computer was needed (a notion counter to Pappert's who believed otherwise).
Additionally, of particular relevance to our given project is something that is reflected in the work of these researchers, when they said that: "these skills and the related knowledge that come from using new media, are not obtained in the instructional contexts" of our schools, but are acquired informally" (Greenfield, 1984).

The situation since the eighties has obviously changed considerably in the West with schools beginning to use computers to teach people skills. But this also combines itself with opportunities for children to interface with more informal locations of new media to gather informal experiences with computer technology **(Greenfield et al, 1996)**

And this is where there are some emerging convergences between our situations (the West and countries like India) from which we could draw some early lessons. One of them being the finding that with the rise in informal experience with computers, most pupils at least from the inner school (for India, this is the municipal schools) situation seemed to have arguably learned about computers from informal systems outside the formal instructional system, even before their teachers or other educators engaged with instruction. It is also true that sometimes the pupils' skills even surpass those of the teachers.

Under the circumstances, how must one undertake to study children in order to help build the desired learning environments?

(4.1) Gaming and children – the need for a paradigm shift:
The importance of game as a reference point has gained momentum for different stakeholders at different points in time – for the academia since the seventies, for the media since the eighties, and for the market since the nineties.

Acknowledged by all of these stakeholders has been their collective lament about the difficulty of accessing credible information on children, the hurdles being mostly methodological while conducting empirical studies to access primary information directly from

children. Doubts raised by researchers on children's (Fromme, 2003) relate to:
(i) children's ability to fill in a written questionnaire
(ii) their varied levels of cognitive abilities coming in the way of comprehending the questions of an interviewer, and
(iii) their inadequate levels of linguistic (verbal) abilities to express what they wished to say

The end result has been an inability to collate data that can correspond to basic scientific standards of data collection such as objectivity, reliability and validity.
The obvious need for standardization of data collated from children at surveys and field trials and the inability to arrive at any standardized measurements had then forced players in the field to re-examine ways to study children.

This kind of methodological limitation impeding effective information from the user's/child's universe had eventually signaled a paradigmatic shift in the way one needed to view children in the first place, with childhood being viewed not merely as a development stage sandwiched between infancy and youth, but as an autonomous condition in its own right, and recognizing that this gave its subjects, viz., children, their own unique cultural milieus.
This highly debilitating trend in a lack of scientifically validated data resulting in the absence of a dedicated or informed perspective on children, was finally addressed in the nineties leading to the founding of an altogether new branch of understanding called the **"Sociology of Childhood"** set up by the American Sociological Association (ASA) in 1993, followed by the setting up of a working group called the 'Sociologie der Kindheit' by the German Association of Sociology (DGS) in Germany in 1995.
The intention was to be able to devise specific tools to understand various aspects of childhood, rather than have children conform to adult specifications or measures of the understanding of a given situation **(Fromme, 2003).**

The new Sociology of Childhood was founded because it no longer wanted "to seize childhood as an arrangement of protection, preparation and socialization, but as a social (and cultural) form of life" **(Zinnecker, 1996).** But position it as part of an ecology that modernized and redefined the contexts relating to children's learning universe.

It is as a result of this paradigmatic shift and subsequent developments in the field that we owe much of our understanding on games, children and the impact of games on the cognitive developments of children as they stand today. A large part of the credit for carrying out this paradigm shift must go to a research project carried out at the University of Bielefeld in Germany between 1995 and 1998 **(Fromme, Meder and Vollmer, 2000)**
Fromme (2003) says "we were inspired by the discussions to

establish a new sociology of childhood although its mainstream was somehow anti-pedagogical".
And goes on to state that it was the view of scholars that an educational (or pedagogical) science does not necessarily have to reduce children as a user group merely hyphenated with adults to be the "not-yet-grown-ups"
Some of the protagonists of the new sociology of childhood (e.g., Helga Zeiher from Germany or Glen Elder from the USA) had even assessed their approach in explicit opposition to the research concept of socialization, stating that they were exclusively interested in social interactions taking place among children alone, and would much rather describe the socialization as expressions of a cultural microworld.
This obviously posed a problem with mainstream sociological thoughts since it posed to be a reductionist concept of childhood, and demanded a degree of autonomy for the child that was unrealistic to ascribe to him/her. A middle path sought was that it would be more reasonable to accept that children develop their own cultural patterns and milieus, without having to deny a concept like socialization **(Zinnecker, 1996).** Under the revised concept of socialization, it was accepted that "the child may no longer be seen as mere putty to be worked on by external forces but as someone who actively participates in the ongoing construction and deconstruction of his social and cultural world." (Fromme, 2003)

One of the important considerations in this process of the scientific "discovery" of children as subjects of their own lives has been to recognize the transformation of childhood in late modernity terms by reviewing the concept of "individualization"- "Individualization" "refers to the shift away from traditionally important sociological determinants of identity and behavior towards more diversified notions of lifestyle" **(Livingstone, d'Haenens and Hasebrink, 2001)**
This transformation or shift from the traditional structures is particularly acute in the present atmospherics of the new media technologies. The democratization of the media, e.g., with its open source software and publishing modes, and the degree of independence assumed in the use of these modes as well as with the concepts of online chat and scrap books, that marks their world around the notion of 'My Media', calls for a heightened sense of individualization in the child, requiring a very considered review of the mainstream notions of what interventions will be necessary to help today's children manage their own life-courses.

(4.2) Games and learning – the pedagogical contexts and cognitive abilities related to children:

Recent literature on game thus suggests that there are various compelling reasons to try and map attributes of game on to our proposed modules of computing-driven learning environments.
Some of these factors would be:
(1) the market and its surge in interest in children since the nineties

as a dedicated target group for games software (representing **an economic perspective**)
(2) the nature of the new media and its ability to be dynamic, non-linear, interactive, multi-modal with text, graphics, sound, pictures, etc., and usually requiring not much prior knowledge to interact with this media (**a technical and design perspective**)
(3) USP of the player viz., the specific cognitive needs of children within the present media rich environments (**the user perspective**)
(4) pedagogy and its cultural artifacts such as instructional vs. constructivist learning, individual vs. collaborative learning, educational vs. edutainment – essentially encompassing the discourse about whether learning can be made to be fun and joyous without diluting knowledge. And how much of the knowledge can remain in the hands of the children to be re-constructed/fashioned by them in accordance with information from their own environment (**the content perspective**); and finally,
(5) the social and cultural relevance of media uses by the player – specifically in terms of the proliferation of media and information overload surrounding today's children, the ease with which children are able to adapt themselves to multiple media, and the essentially my-media notion in which children are embedded making for ever increasing individualization as well as pluralization of choices in their lifestyles (**the social context perspective)**

Keri Facer (2002) of Future Lab cites an increase in the number of researchers and teachers who are beginning to suggest that games seem to develop young people's thinking "in a way that we need to pay attention to."
And the proliferation of books, such as **Tapscott's 'Net Generation',** arguing that young people's minds are now being "reprogrammed" through playing computer games.
Summarized below by **Mark Prensky (2001)** are a set of cognitive abilities that are getting instilled into children through their regular and intensive interfacing with computer games:
(i) twitch speed vs. conventional speed
(ii) parallel processing vs. linear processing
(iii) graphics first vs. text first
(iv) random access vs. step by step
(v) connected vs. stand alone
(vi) active vs. passive
(vii) play vs. work
(viii) pay-off vs. patience
(ix) fantasy vs. reality
(x) technology as friend vs. technology as foe

But although the above cognitive abilities suggest the ability for children to 'think differently' based on their access to different models of thinking, Prensky also warns that we need to be circumspect about this assumption that we have a qualitatively 'new' generation growing up, as there are likely to be "plenty of people who do not prefer games as a way to learn"; as also the possibility of

a variable set of patterns in the frequency with which children like to play games (some regularly, some not); or even their preferences for games, ranging from strategy games to shoot-em-ups to puzzles. And most importantly for our context, the lower incidence of children's access to computers itself suggests a concomitantly lower level and frequency of game play, and hence a less widespread occurrence of signs of a 'net generation'.

In spite of the above sense of caution, or perhaps because of the odds stacked up against a difficult proposition that requires focusing on 'fun' by 'concealing the learning' within educational games, researchers have quite early on displayed an interest in exploring the conditions essential to inducing such a state of learning in children. Quite keen to find the right button, one of the approaches has been to find a mental representation of the essential condition underlying the pleasure-experience in game playing. **Malone (1980)** and **Csikzentmihalyi (1990)** took inspiration from the idea of the state of 'flow' as a potential mental representation to visualize if this was a way to construct learning material through gaming that would evoke pleasure and yet conceal the dynamics of learning.
Prensky (2001) summarises this as:
"In the flow state, the challenges presented and your ability to go solve them are almost perfectly matched, and you often accomplish things that you didn't think you could, along with a great deal of pleasure. There can be flow in work, sports, and even learning, such as when concepts become clear and how to solve problems obvious."

Further, the conditions likely to induce the flow state have been characterized by Malone as follows:
(i) the activity should be structured so that the player can increase or decrease the level of challenges faced, in order to match exact personal skills with the requirements for action;
(ii) it should be easy to isolate the activity at least at the perceptual level, from other stimuli - external or internal - which might interfere with involvement in it;
(iii) there should be clear criteria for performance: a player should be able to evaluate how well or how poorly he is doing at any time;
(iv) the activity should provide concrete feedback o the player, so that [s]he can tell how well [s]he is meeting the criteria of performance;
(v) the activity ought to have a broad range of challenges, and possibly several qualitatively different ranges of challenge, so that the player may obtain increasingly complex information about different aspects of her/himself.

Another inspiring study (Jones, 1998) reflecting on how to design engaging learning experiences, draws on these definitions of game and flow to propose eight characteristics as essential:
(i) task that we can complete
(ii) ability to concentrate on task
(iii) task has clear goals

(iv) task provides immediate feedback
(v) deep but effortless involvement (losing awareness of worry and frustration of everyday activity)
(vi) exercising a sense of control over our actions
(vii) concern for sense disappears during flow, but sense of self is stronger after flow activity
(viii) sense of duration of time is altered

While most of the above premises are considered a workable proposition, researchers now agree that an attempt to 'conceal' learning may not be entirely practical, because in trying to do so the experience might end up superficially resembling leisure-based 'fun' activities. Instead, it is argued that we try and understand the deep structures of the games play experience that contribute to 'flow' and build these into environments designed to support learning.
It is this need to attempt more incisive solutions that has been addressed by us under the idea of systems as a prerequisite for a viable dynamic, self-referential structure to drive learning through games for children.

The question that naturally arises out of the above set of information is: what are the facets of the learning process can we now expect to find in children exposed to self-motivated computer games, and that may be claimed as being different from those without the exposure? In other words, *the impact of gaming on the cognitive skills of the players.*

Keri Facer (2002) reports that primarily gameplay may be seen as a learning that *is now driven by the process of participation and practice* rather than a *process of acquisition of facts* or disconnected 'pieces' of information. Characterized more as *'doing' rather than as 'knowing'*, leaning skills acquired through computer game play can take on a variety of forms as follows:

(4.2.1) learning 'competencies' such as the development of logical thinking and problem-solving skills as supported by game playing **(Inkpen et al, 1995; Higgins, 2000, Whitebread, 1997***)* – with most of this shift away from the traditional act of being 'fed' information (within an instructional context), to 'taking on' material for problem solving arising out of the media's propensity to allow for a trial-and-error approach to help overcome challenges and obstacles. The emergence of 'strategy' or 'adventure games' remains testimony to the development of this learning competency.

In a related competency, gaming has also encouraged the use of computer-mediated information resources, making children versed with the modes of accessing such information from the computer, not only feel more confident about further use of the computer for more professional applications than those not versed in this competency. But has also had the effect of inducing in children the realization that, the difference between the linear progressive models for using

computer (such as for worksheets or computer manuals) vs. using the computer for more engaging tasks (such as interactivity-driven tasks, viz., chat, collaborate to create wallpapers and scrap books, etc.,) can be emotionally and cognitively more rewarding **(Mackereth, 1997).**
McFarlane (2002) summarizes the core skill development supported by game playing. Children begin to show a propensity for the following:
strategic thinking
planning
communication
application of numbers
negotiating skills
group decision-making
data-handling

However, none of these were reported to be appreciated by parents or teachers as being of any use within the contexts of formal instructional education and its curriculum requirements.

(4.2.2) learning to 'learn' through new approaches to collaboration, making games a facilitator for social, communication and peer activities, contrary to popular media opinion otherwise. Greenfield reports through an early study **(Greenfield, 1984)** that "half of all young people who spent time in video game arcades weren't actually playing games at all – rather, they were using the arcades as a social gathering space".
This idea of game-playing as an activity embedded in social interactions is reflected in the early development of a 'playground culture' of discussing, swapping, buying and selling games as an intrinsic function of socialization while gaming.
The collaboration element here usually played out through contributions to game magazines in the early years and then, since the nineties, through websites, and in the recent years through online forums. These activities have encouraged reading and discussion among game players.
Also reflecting in the social construction of the game itself, games have reinvented themselves to include multiplayer options, and these usually being positioned as 'social experiences.'
Apart from the Xbox and Moto GP experiences, there are games that are highly complex in keeping with the demand to provide inputs tat can allow for prolonged period of engagement with the computer without boredom setting in. An example of one such game suggested by Keri Facer is the ATITD (A Tale in the Desert) game, an online game with no combat, undertaken as a social experiment and featuring only art, architecture and thought.

Most importantly, this suggests that the more interesting relationship between computer games is not simply the interaction between the player and the game, but between player(s) and player(s) through "discussion, collaboration and reflection on games embedded in peer

group cultures", allowing children to not only "learn how to play, but perhaps learn in collaboration with others" *(Williamson and Facer, 2003).*

(4.2.3) learning to participate in practice through 'active learning':

Games also promote in children, the ability to study a situation on the ground in terms of its spatial and semantic connotations and take decisions according to the way a situation needs to be resolved through problem-solving.

Research findings in this area e.g., **James Paul Gee's book 'What Video Games can Teach us about Learning and Literacy' (Williamson, 2003)** suggests that through informal games, players learn to plug in to what Gee terms *as 'semiotic domains'*, a concept that is shaped by children's interaction with games text and with one another.

'Semiotic domains' are driven by groups of people with shared interests, to form *affinity groups* where the protagonists (in this case children), share knowledge, skills, tools and resources to form complex systems of interrelated parts. It is within these affinity groups that learners learn not only to identify their own needs gaps in order to map available resources required for one's own needs. Learners also learn to locate resources to match the needs of others, viz., that of fellow members within the semiotic domain to help them access information.

In other words, within an affinity group, learners gain resources from fellow members that equip them to solve problems from within, and perhaps outside of the specific domain.

Gee calls this *'critical learning'* because players have to learn to understand what they are doing and
develop their comprehension of at both levels of the learning system – (a) a game's structure, viz., its 'internal design grammar', or (b) the way its content is presented, viz., its 'external grammar'. Because of the pre-requisite of having to share, in turn presaging the need to optimize on domain level resources, children who play games learn to critique games at a systems level by recognizing all the activities and practices which comprise it. Such critical thinking allows players to look at the entire picture of the game and begin to strategize, rather than be driven by moment-by-moment play environments.

(4.2.4) the changing expectations of learning spawning new learning approaches :

It is now clear even if anecdotally from ongoing research into games, that learning outside school from computer games has encouraged children to learn in different ways that enhance their skills and confidence levels.

Most importantly are the new approaches children imbibe from these activities and expect to find in the milieus they interact with, and

which have been summarized by Mark Prensky, a leading advocate of games for learning (or training).
These include (Prensky 2001):
(i)children's ability to process information *very quickly*, rapidly determining what is and what is not important;
(ii) the ability to process information *in parallel* at the same time from different sources; the ability to look at information *'by jumping'* through a range of different information resources, *creating 'links'* rather than follow a story;
(iii) the tendency to access information prima facie *through images* rather than through text; being able to orientate and re-orientate to *geographically undefined boundaries* and see these spaces as networks of communications;
(iv) *looking at 'play' as a serious activity* that has the potential to expand one's mind rather than viewing it unequivocally as being 'frivolous' appended with no learning values;
(v) *expecting to be rewarded* for activities rather than not as a valid ideological position (as opposed to the 'Fabian' socialistic position of the generations earlier that since 'deficiencies' are fault lines that have got built into a system by default, the work undertaken to plug these may also have to be carried out by default, with no expectations of rewards. The newer generation's intolerance for deficiencies may also be understood partly in this light; and
(vi) having a mental model of *doing in order to learn* rather than learning in order to do. The charter of faith attached to the latter position is not something that we can any longer ascribe to the work ethos of the newer generation.

Facer cautions (an we agree) that while any attempt to define an entire generation of young people as having a shared set of expectations and practices may not be entirely valid, it does help one to theorize new approaches to learning, and helps raise interesting questions about how we currently conduct formal education in school (Facer, 2003).

(5) Scope of the problem – defining boundary conditions (as design constraints) to locate core attributes of game vis-a-vis:

(i) game's structure as system; (ii) game's adaptability to children and learning; (iii) the nature of media; (iv) the fantasy factor (narratives); (v) cultural contextualization

Given the central axis of our problem *'children-gameplay-learning'*, it is our intention to ask the question: can we locate a set of factors underlying the above axis that we anticipate as having a bearing on our future solution?
Can we use these as boundary conditions constraining our design problem?

And eventually ask the question*, can we find in games a point of inspiration that could convey a sense of what it might take to essentially engage children into their progressive levels of cognition.*

The five features that we recognize as being critical to understanding the attributes of gaming before drawing inferences about what to use and what to avoid for our own game solution, are based on broadly drawing up the contours of a game as we view it, viz.,
(i) Game's **Structure** as a System (a dynamic approach)
(ii) Game's **Adaptabilty i**ssues: Symbolic-Pretend Play and Adult Imagery vis-à-vis Cognition Levels
(iii) The **Medium** of the game
(iv) The factor of **Fantasy** and Narrative in building game
(v) The role of **Cultural Context** in Game

These factors, although of independent locus, may display overlapping areas of interest. Such as the reference to symbols, metaphors and myths that occur while discussing both structure as well as the fantasy factor of gaming. Or, adult imagery and the child's make-belief world that are connected as issues to both adaptability and, yet again, to the fantasy factor of gaming.
It is also instructive to remember that the above clutch of factors have a bearing on the following aspects of gaming:
(a) the genres of children's software, viz., **(Bruckman and Bradlow);**
(b) stakeholders to consider in the development of games **(FutureLab annexure**); as well as
(c) the definition of learning and learning theories relevant to our objective **(Smith, 1999)**

The features in detail:
(5.1) Game's Structure as a System: The inspiration for looking at games within the context of a system comes from the structuralist notion that human communications is anchored within a set of universals that we call 'deep structure', whereby a basic set of responses to the world around is assumed to be wired in into the human mind, and is eventually mediated by cultural and environmental factors to achieve differentiation.

This information native to the human mind (wired-in) and inherent to his existence, is termed by structuralists as 'sapienza poetica' (poetic wisdom) - first espoused by its author Giambattista Vico in 1725 in his seminal work 'The New science, which has had the effect of demolishing the stereotype that some cultures are 'primitive' while others are not. How?
It is *'sapienza poetica'* that "informs man's responses to his environment and casts these in the form of the 'metaphysics' of metaphor, symbol and myth". And since 'primitive' has always been in abundant possession of *'sapienza poetica'*, he has never been at a disadvantage vis-à-vis the 'modern' man, because they have both

negotiated the world and their cognition through this particular benchmark **(Terence Hawkes,1977)**

The reason for us to reference structuralism is *to tap into the propensity for children to be driven by their intuitive/primary responses to the world around them* rather than by their secondary/rational responses (as adults do). In the process, they carry the *'sapienza poetica'* in abundant doses that is reflected in their tendency to understand the world around them through myths, metaphors and symbols, as suggested by Hawkes.
In the words of **Vico himself ('New Science' translated by Bergin and Fisch, 1968)/Hawkes, p12** "it follows that the first science to be learned should be mythology or the interpretation of fables; for, as we shall see, all the histories of the gentiles have their beginnings in fables."

In other words, any study meant with children in mind and looks at something as primary as game, needs to look at games through the prism of myths, metaphors, fables, narratives, etc., because myths are the "civil histories of the first peoples who were everywhere naturally poets." (Vico, 1725 trans by Bergin and Fisch, 1968).
The core belief here, according to Hawkes, is that man constructs his own myths and social institutions as he perceives them to be, and in so doing constructs himself.
In this notion also lay *the first seeds of constructivism that we have so avidly used as a position to understand children and learning*.

It naturally makes sense to bring in, into this context, the lessons that constructivist Jean Piaget had drawn from Vico's work to enunciate his own ideas about 'constructing' identities and spaces. Most important of these was Piaget's lessons from Vico inspiring him to forefront the idea of 'structure' as being vital to these acts of constructing.
'Structure' according to Piaget would have to be an arrangement of entities which embodies the following ideas (Hawkes, 19…):

(5.1.1) the idea of wholeness, which is equivalent to a sense of **internal coherence** where the constituent parts of an entity, though independent in existence, are governed by a set of laws to be relationally guided to adhere to each other as a single whole.
The principle of 'nesting', already associated as an attribute of game, suggests this very **relational notion of whole and part** and obliges us to take the idea of 'wholeness' or 'gestalt' as a serious design constraint for building a game or even to study games.

(5.1.2) the idea of transformation follows automatically from 'wholeness' and the structuralist assumption that structure is not static. That, in order not to get reduced to a passive form, a structure must have the ability to constantly transform itself into new forms without compromising its fundamental structure. This **dynamic**

attribute associated with structuralism is mirrored in those games that are able to sustain interest across time by their transformational quality. In other words, we need to make sure that our own solution reflects this attribute.

(5.1.3) the idea of self-regulation follows from transformation as the need to allow the same internal and **self-sufficient rules** that help maintain internal coherence of an entity giving it 'wholeness' and causing the transformations to help sustain itself as a dynamic entity, to become an intrinsic part of an entity from regressing or becoming passive. Like language systems that **do not construct** their formation of words **with reference to patterns in 'reality' but with reference to their internal laws**, game requires that it, too, is guided by laws internal to its existence in order to survive across time.

The idea of a system was carried forth further by Noam Chomsky and Jerry Fodor into the seventies and the eighties, in the context of intelligence and computation to suggest that "the various specialized kinds of computational capacities of the mind are carried out, not by a single type of general-purpose device, but by a variety of computational devices, each specialized to deal with a particular form of information or to translate information from one particular form to another". They termed this specialization variously as "modularity" of the mind (Fodor, 1983)) and the division of the mind into "mental organs" *[footnote (2)] (*Chomsky, 1975)
(Jackendoff/p17)

For us, it becomes important to remember that decisions about the underlying structure of our own game solution have to be a considered one, and not accidental. In other words*, should the game solution be a dynamic, self-referential system where the*

footnote (2): The "mental organ" metaphor used by Chomsky refers to the biological organs of the body – heart, liver, blood, bones, immune system, etc.,- and alludes to the fact that underlying the highly differentiated nature of these organs and binding them on to a common platform remains the general principle of cell biology. Likewise, there are general principles of computation from which are built the specialized devices to that carry out the highly differentiated forms of mental representations of information through speech, vision and music/auditory responses.
So, there are the specialized devices of segmented phonology (sound structure), syntax (phase structure) or semantic/meaning (conceptual structure) connected to speech. Or the device of primal sketch (related to vision). Or that of prolongational reduction (related to music), and so forth (Jackendoff, MIT Press, 1992), p4-5

structure knows to scale itself upward or downwards, or is it a structure that is static and purposively bound by given objectives, and requiring interjection to scale itself upwards or downwards? The ability of a game to scale itself upward or downwards while designing our solution is to help build into the variable cognitive levels, often reflected in the variable interest levels that children display towards a learning object. And help them sustain interest in the game at various levels across time.
The question for us here is, given the connection between children, game, constructivist notions and structuralism, how can we plug into structuralist assumptions as a design constraint to examine the construct of game while building our own solution? And use this as a clue to determine the appropriateness of the structure that we should build into our game.

(5.2) Game's Adaptability issues vis-à-vis cognition levels:
In the crucial 'connect' between children and learning, the need to define adaptability as a boundary condition becomes compelling with Jean Piaget's definition of 'play'.
Proposing that *"forms of play emerged naturally in the cognitive development of the child"* **(Sherrod and Singer, 1979)**, in 1962 Piaget defined 'play' in formalistic (descriptive) terms rather than in causal, motivational terms or functional (goal) explanation terms. For him, play was "pure assimilation of the world to ego. (Where) play is behavior in which the external world is completely transformed to coincide with the internal world of the child and involves no accommodation of the child to the external world. (In this), play remains the opposite of imitation, which, on the other hand, is pure accommodation of the child to the external world. Most definitions of play do not conflict with Piaget's but expand and elaborate on these.

(5.2.1) Characterizations of play:
Piaget's characterization of plays into three types - mastery, symbolic and games with rules - is underscored by levels of the expansion of intelligence in children.

Mastery play, as enunciated by Piaget, has been interpreted by Sherod and Singer to mean an attempt by the child to gain motor control over the environment, and for which they cite as examples, building with blocks or learning to ride a tricycle.

Symbolic or pretend play is play involving the child's imagination, and specifically involves the translation of the external world into structures reconciliable with the child's schemas with the world. In this, **Fein (1975)** cites as an early example, a two-year old pretend-drinking from an empty cup and as a more advanced example, older children enacting out quite complex story sequences.

Games with rules involve structured organized activities such as hopscotch, checkers and board games, basketball**,** according to

Sherrod and Singer.

In terms of their mapping on to cognitive stages, mastery play is usually engaged in by the sensory-motor infant; symbolic play emerges with the appearance of the ludic symbol; and, games with rules make their appearance as the child begins to engage in social interaction to become less egocentric, and to comprehend the notion of rules structure.
In terms of their adaptive implications to game and cognition, we need to apply ourselves to a charter of faith that is technically termed by psychologists and cognitive scientists as **make-belief play and adult imagery**, and which is a core connect that exists between *adult forms of recreation* (football, chess, etc.,) and *fantasy activity* (such as day dreaming).
Researchers from gaming for children and learning believe that this singular feature - 'make-belief play and adult imagery' - a derivative common to the above categories of play, supports the idea that it is common to find the adolescents' interest in outdoor sports like basketball and football being carried indoors in the form of board games. And importantly, in Sherrod and Singer's words, "such games, although played according to formal rules, also evoke much fantasy and imagery."
E.g., Singer's experimentation in this regard had resulted in 10-14 year olds improvising board games called 'Off-Tackle Run' based on basketball and football, in which they were not satisfied in simply calling their game a play. Instead, they had created an entire make-belief atmosphere with players, each with his or her own style or career, such as simulating radio announcers describing the game and generating in themselves and the others the excitement of actually witnessing a game (Sherrod and Singer).

A real life example of how engaging make-belief play and adult imagery can be is cited from David Eisenhower's (of President Nixon's administration) obsessing with dice baseball in the "final days" of the troubled Nixon administration, and Newsweek attributing this appeal to *"part make-belief, part genius of the game. The sights, sounds, and the smells of the ballpark come alive."* **("Dice Baseball Fever", Newsweek, 1976)**
In yet another example of imagery transformations of make-belief in its adaptive implications for real life play, Richardson (1969) demonstrated that gymnasts in Australia who engaged in mental practice actually performed better than did athletes who occupied their minds with other activities**. Suinn (1972, 1976)** extends this approach to the systematic training of skiers to engage in mental "skiing of an entire

course", and cites for example, the great skier Jean-Claude Killy, who reportedly demonstrated one of his greatest performances by engaging in mental practice of an entire downhill course as he was recovering from an injury.

(5.2.2) Developmental stages and components of symbolic-pretend play:
Symbolic-pretend play as a credible basis for engaging children's interest in learning may need to be understood in its various aspects in some detail.

To begin with, symbolic-pretend play changes in character with the development stages of the child. It starts with being object-oriented with the child in its infancy (when about 12 months of age to about 3-5 years), to becoming centered around make-belief situations from story-telling or real life contexts of the child as it grows older until adolescence, after which symbolic-pretend play itself tends to give way to games with structured rules.

Sherrod and Singer maintain (as noted above) that the first appearance of pretend play occurs around 12 months of age and "consists of the functional use of a schema outside its normal context" such as drinking from an empty cup and pretending to go to sleep. In other words, "the origins of make-belief play lie in the early sensory-motor activity of the child."
By 18 months of age, pretend play begins to include activities directed to others rather than towards oneself alone, and becoming independent of the features of immediate simulation.
By 3-4 years of age, make-belief play seems to be deliberately used by children "as a means of transcending immediate space and time". E.g., the use of non-pretend objects (drinking from a full cup) to the make-belief use (drinking from an empty cup) to finally using a pretend cup to give an imaginary guest a drink, and moving on into conjuring up scenarios of characters far removed from one's context, such as pretending to be wild animals in a jungle and either devouring or rescuing human beings.

This movement away from
(a) being dependent on reality-based objects as anchor support (such as playing with objects identifiable in every day life, viz., the mug which is used to feed him water, to
(b) breaking representations into components from a given context (such as being able to look at a tree in terms of its branches, flowers, twigs, etc.,), to
(c) selecting relevant properties as primitives (such as selecting the use of a twig) to ultimately build a pretend object such as a rocket, has been characterized by Fein (1975) as *a shift from analog to digital processes.*

What this implies for our future solution is that, the shift to digital processes as a stage in pretend play development signals the *child's ability and propensity to move away from being object-centered* to being *centered around enactment of scenarios* (playing house-house, school-teacher/student, shepherds, villains, superman, etc.,). In other words, it is to be expected that, with age not only does the frequency of pretend play increase (Freyburg, 1973; Pulaski, 1973).

Additionally, make-belief play becomes "increasingly rich and elaborate and less dependent on external stimulation" especially after the child is five years of age and beyond.

And finally, as a further clue to what liberties we may or may not take while attempting our own game-solution, it is important to remember that play also becomes, with age, increasingly social and cooperative, and in Garvey's (1974) words, the following abilities underlie this blossoming of social play (with regard to both imaginative and non-imaginative play):

(a) the ability to distinguish play and non-play states (by 3.5 years of age);
(b) the ability to abstract the organizing rule of the play (by 5 years age); and
(c) the ability to identify a theme of the play and contribute to its development (by 5 years of age)

As already mentioned, all this is achieved by the adolescence stage, after which, children become totally involved with Piaget's third category of play, viz., games and rule involved structured and organized play. They become totally social and tend to move towards

(5.2.3) Components of symbolic/pretend/make-believe play – cognitive clues for a game-solution for children and learning:
Fantasy activity and pretend play underscore a set of mental skills and faculty that could help us in designing our solution in a way that gets to leverage these facilities.

The cluster of interrelated abilities and processes connected to imaginative abilities in children that may be displayed through pretend play are (Sherrod and Singer):
(a) the ability to form images (irrespective of specific sensory modality)
(b) skill in storing and retrieving the images already formed
(c) a store of images (quantity and quality) constructed in response to one's own environment, and which may be counted upon as a bank/compendium of visual information
(d) skill in recombining, integrating, etc., - generally employing these images as a source of internal stimulation – and divorcing them from realty; and
(e) reinforcement for skillful processing after the initial act of recombining and integrating images

In technical terms, not all the above cognitive skills driven by imaginative abilities in children may be considered as being exclusive to the idea of imaginative play and fantasy activity. Sherrod and Singer view (a) and (b) to be a function of the cognitive abilities that drive the faculty of imagery and memory, and (c) as primarily a faculty for constructing information in response to one's environment.
It is (d) and (e) that have been marked out by the authors as being

specifically driven by imaginative play and other fantasy activity, and is seen to be riding no other cognitive abilities.

In terms of what this *partitioning of imaginative abilities* could do for our own solution? It could encourage the potential solution to be driven by *the child's facility for processing imagery in layers.* Which remains a core attribute of the new medias.

(5.2.4) The importance and benefits of make-belief play in a child's life and implications for us:
The reason why Symbolic-Pretend Play and its quality of make-belief becomes an important element of consideration while looking at gaming as an instrumentality or platform for learning, is stated in Saltz and Johnson's (1977) assertion that "fantasy play is intimately related to cognitive development in the realm of representation and concept formation, where make-believe play helps children gain feelings of control over their environments".
Especially important for our purpose of a game solution are findings (Saltz, Dixon and Johnson, 1976) that establish *that make-believe play and cognition facilitate each other*.

And even more importantly, it is the case that the two must develop in parallel because they form bidirectional systems, not separate unidirectional ones. It is our understanding, that given a layered medium such as a computing driven platform, it is possible to make a non-unidirectional system like this take a life of its own through gaming in the hands of children.

Further, some of the meaningful relationships between imaginative play and cognitive development not only point to *an increase in skills related to representation and imagery (imagery capacity),* they also point to the need for these *in increasing verbal fluency, divergent thought and an ability to separate reality and illusion* (Singer and Singer, 1976 b).

In the context of game and learning for children through a computing environment, it could mean that several modalities of sensory(s) in the verbal, visual, audio and tactile medium may be put to play simultaneously.
Which means, depending on cognitively-driven needs, we could combine a range of the verbal (text, speech), visual (graphics, still and moving images, caricature, calligraphy, etc.,), audio (music, voice over, special effect sounds, etc.,) and tactile modes to make the game play (a) engaging, and (b) fruitful, as a learning exercise knowing that at a cognitive level these are seamlessly strung together in cause-and-effect relationships.

(5.3) The Medium of the Game – its nature:

The concept of medium in education has always been of concern to educationists and to those concerned with learning for children. For a long time, it was the print medium as a domain that had held sway and seen innovations in children's learning, especially with regard to story telling in print. Such as in the form of comic books, illustrated stories, pop-up books telling a story or teaching alphabet and objects of every day life to children, and of course, the text book in school carrying stories with illustrations about epics and fables (Ramayana, Panchatantra, Aesop's Fables, Helen of Troy, etc.,)

The arrival of the electronic media in the fifties with devices such as overhead projection systems, etc., which had reached the market as teaching "aids" by the seventies, had signaled the idea of supplementing the act of teaching with devices other than the printed book.

But, the electronic media was heralded less by the entry of these conventional devices than when it saw the entry of games into the homes of the common man in the early eighties in a widespread fashion in the West via television and gaming parlors.

By its ability to layer information and make it available in a non-sequential/non-linear manner, the electronic media had sought to replicate instruction in the classroom through devices such as moving images viz., films – both documentary and instructional; television – both open and close-circuit; programmed texts – with or without "teaching machines"; computer-based information banks; records and tapes in various forms of sophistication such as "language laboratories"; books, blackboards, microphones, and overhead projectors (Parsons/p.263/ Ralph Smith's Aesthetic Concepts and Education).

And, for the first time had forced a rethink in terms of the appropriateness of the use of the term 'aids' in education in favor of the use of the more comprehensive term 'media'.

The reason why the arrival of the electronic media had forced recognition of the importance of the choice and nature of media for education is because it had, for the first time, revealed possibilities of creating a world through *a genre of learning material that did not necessarily seem like learning material to children*. The facilities of sight (text, illustrations) could now be combined with sound (voiceover, music) to create a medium closer in sensibilities to the way children were apt to perceive and apprehend secondary forms of information.

This had also sought to redefine the term "aids" to suggest that there was more to the education process than was suggested by the word "aids".

Eloquently expressed by Parsons, this redefinition meant that 'aids' in education was "not merely ancillary to or illustrative of teaching in the classroom, nor did the teacher have a choice whether or not to

use them in his teaching. Instead, we now tend to think, there is a sense in which they are ever present in teaching, and inescapably so; if we are to teach we must choose among these devices, if only by default". Parsons adds, "*education, it seems, can proceed only through the offices of some medium: no medium, no education." (Parsons,…..)*

This highlights the fact that an understanding of the chosen medium of learning is crucial to generating the right solution to learning. Over the years, couched under the broader terms of "technology" or "media" have emerged educational tools proposing "teaching-learning options" through mediums such as instructional technology, instructional media, teaching technology, teaching media, learning technology, learning media, and the most frequently used terminologies educational technology and educational media, and finally media technology.
And obviously these terminological difficulties seem to have also been underscored by conceptual ones. E.g., "educational" as a term seems remains non-committal between "teaching" and "learning".
But without getting into the intricacies of this debate, what needs to be borne in mind about media in the context of game, children and learning is: what is it that the use of electronic media is going to engender in terms of learning in children?
This revolves around two essential questions about choice of media in education. First, the view that repeated use of a certain media can encourage certain manner of thinking, such as linear thinking if one is attached excessively to the print media. Or "visual thinking" if one were to be guided by visually dominant material, or non-linear thinking through the electronic media.
The use of media, therefore, raises the relative merit of linear thinking vs. non-linear thinking, visual thinking vs. non-visual thinking, a concept raised by Rudolf Arnheim in his path breaking work on visual perception and imagery connected to Visual Studies in the sixties and seventies.
Reinforcing this thinking are researchers like Patricia Greenfield whose concern for the pedagogical impact of new media on children had forced them to examine the aftermath of the diffusion of computers at homes of children. Their conclusion was that, increased contact with new media artifacts can lead to a rise of what may be called "visual intelligence", since modern video games demand special visual **skills (Greenfield and Cocking, 1996; Greenfield, 1998)**

It is also important to bring in here the notion of Greenfield and other researchers that new media are to be seen as "cultural artifacts". Since a lot of the knowledge and experience in this domain are acquired by children through informal sources outside of the formal instructional contexts, viz., the formal schools. It means that a better knowledge about informal learning processes and their background seems to be necessary in order to avoid a "clash of media cultures."

In other words, if the new media are to be seen as "cultural artifacts," then a better knowledge about informal learning processes and their background seems to be necessary in order to avoid a "clash of media cultures." Check this with the above para

In other words, new media, like the quality of all new media in their own respective times, has the possibility of acting as the message itself **(Marshall McLuhan, Understanding Media, 1963).**
This metaphoric notion of a "cultural artifact" and its ability to act as the message itself implies the following **(Fromme, 2003):**
(a) teachers, parents, and others engaged in education and tuition are members of a generation
which – during its primary socialization – has grown up in a different media culture and has different media experiences than the young generation today. These (informal) experiences do not only influence their private values and attitude towards new media, but they also have an impact on their educational concepts and actions.
The net result being that parents and teachers tend to address the media cultures of children (and youth) from their own generational perspectives, which is taken as an implicit norm in educational/pedagogical discourses **(Schaeffer, 1998; Wittpoth, 1999; Fromme, 2001);**
(b) it also means that in the context of 'new media' – a media someone did not grow up with at least in his/her formative years – it could be treated with distrust and skepticism by this generation, also the parent-guardian-teacher of the children. And this mindset posing as an obstacle in the adoption of new media related "teaching aids"; and finally
(c) part of this skepticism itself arising from the pre-new media generation's association with a work value that Max Weber of the Frankfurt School of the early 19th century had termed as a "protestant work ethic", which implies a rationalized lifestyle and a specific form of self-control.
In the context of new media use, this would translate into wanting their children to use their computer gainfully (to write texts, or for using educational or learning software, etc.,), rather than 'while away' on the computer playing computer games, which they are often likely to perceive as being an idle and unproductive use of one's leisure time (and perhaps even with corrupting influences on one's values given the violence that has come to be associated with games).

Overall, games and learning positioned on new media go to form digital environments, and which have been found to be supportive of new forms of learning. Even apart from games, new media definitely supports a range of alternate learning platforms such as 'situated learning' or 'learning by doing' - all of which are environments that can support both the mundane 'acquisition of facts' through drill and practice, and the complex acquisition of process skills through simulation. On the face of it, it would seem that games hold the

potential to both motivate and encourage diverse ways of engaging with learning.
But it's also necessary to mention here that many of these assumptions are purely theoretical, with evidence at best anecdotal

(5.4) The Role of Fantasy and Storytelling (Narrative) in Game:
The need to examine the role of Fantasy and Storytelling (Narrative) seems a natural concomitant of the findings connected to adaptability issues vis-à-vis cognitive development in children, and the role that fantasizing plays out in children's play and cognitive development, through the category called symbolic-pretend play. Fantasy and storytelling, as tools to engage children's attention, are as old as human civilization itself and cut across the medias, cultures, or even the age groups as platforms for communications. It is the versatility of a platform that commands such attention across the wide constituency of audiences that it does, is what attracts research and academic interest in storytelling from various different disciplines – literary studies, child psychology, education, design and visual studies, anthropology, cultural studies, semiotics and others.

Today, story telling has become a keen subject of understanding especially with practitioners from segments of the industry as diverse as those making comic books and pop-up books with nursery rhymes, to those in the business of illustrated and non-illustrated fiction books, to the gaming industry, to film-makers, be they *'auteur'* directors in film making or those who merely need a story to hypnotize hungry stomachs into slumber over a strong dose of mish-mash story telling that broaches neither ideological compulsion nor any language of the craft or the medium, except to set a film on its path to becoming a block-buster.

Who are the creators of stories? The earliest ones have and continue to work in the spaces created by oral tradition. Sensorially driven and mostly undocumented, these capture the essence of the themes and sentiments from one's own environment and surroundings and can be a veritable state of the mind statement for the community at any given point in time. But, they are hard to capture because they are spontaneously generated and are ephemeral by nature.

However, with the arrival of recordable technology, it is possible to locate the more documented versions of storytelling. These efforts tell us that across the decades, story telling has had the most compelling champions even, or especially, in those with impeccable creative as well ideological credibility. One such, viz., film maker Satyajit Ray, stoically maintains in his book **'Our Films, Their Films'**, that *what people look forward to at the end of the day is story-telling, with a story that is humane and plausible to the user's context. Everything else is mere icing.*
The reason why one considers this attempt to be stoic and a veritable defence in favour of storytelling, is because Ray was making films at

a time when story telling, in the larger discursive milieu of international film-making, had found a counter-point that eschewed story telling much for the same reason that communism eschews religion as being an opium for the masses. The 'nouvelle vague' (New Wave) with its triumvirate directors from France (Goddard, Chabrol and Truffaut) among others in the sixties and the seventies believed that the purity of the medium of film-making gets undermined when storytelling and narrative take over as an emphasis.

Needless to say, the politics and the language discourse of cinema as a medium of the moving image very quickly came to be confined within the ambit of its experts, leaving the viewing of films to the common man. Cinema as a popular medium had firmly established that the real power of the moving image is captured not without but within the context of the narrative. If anything, it helps to have a grand narrative. And if children were to become part of the audience, then storytelling would have to be the only way.
The verdict in favor of this had come from Satyajit Ray's powerful film musical 'Goopi Gyne Baagha Byne' (1967) about the imaginary land of the two characters Goopi and Baagha, and the unimaginably imaginary fruits of fantasy that their travel through this land had come to bear. A decade later, Ingmar Bergman's film 'Fanny and Alexander' had won critical acclaim (as had Ray's film earlier) for using fantasy to make the tortuous life of its protagonists Fanny and Alexander more bearable on these two children by helping them conjure up images of the fun days from their past, especially the magic shows that used to be displayed for the children of the house.

The magnum opus that these two films turned out to be are but examples of the power of fantasy in communicating messages of learning to children, and importantly, how it has the capacity to co-opt adults into its fold. Fantasy and storytelling created for children are often layered with meanings and parodies that are comprehensible to adults. Such as the politics of the king in the land visited by Goopi and Baagha from Ray's film.
While the former (children and fantasy) remains known as a familiar rite of passage, the latter (co-opting adults into fantasy land) is a position that could be of immense value in the various attempts today by educationists and others to find ways of co-opting the system to help build learning material that is not straitjacketed and so characteristically un-imaginary and boring as the learning material from the formal learning system has turned out to be.

The task of co-opting the adult mind into fantasy and story telling is not as formidable as we think it is. The proof comes from the adult use of fantasy and story telling, even or especially, in matters that are grave and distinctive. One of the best statements on the rape of Spain during the Spanish Civil War under Generalissimo Franco in the thirties came from **Pablo Picasso's** mural painting, the **'Guernica' (1937),** which depicted the ongoing story of oppression and torture under a cruel dictator.

For its time, 'Guernica' had seemed to become a mouthpiece for the muted thousands by simply dislodging most pieces of journalism and treatises on the Civil War, brilliant as they were from gifted writers such as Jean Paul Sartre, Andre Malraux and Albert Camus, in favor of depicting a story told poignantly about a place (Guernica) through the figurative representation of a violence with the use of red and jagged lines across a noticeably large physical space of a canvas.
The 'Guernica' was matched by its contemporary piece of creativity - **Ernest Hemingway's** novel **'For Whom the Bells Toll'-** an equally meritorious and poignant representation of Spain's Civil War and its atrocities through a love story.

Overnight, **Guernica** and **'For Whom the Bells Toll'** had become the voice of conscience, forcing these on the public psyche in a way so powerful that the world had to wake up and take notice of the atrocities. Suddenly, Spain's oppression had become part of the larger social consciousness through stories told in a humane way.
The reason to state the obvious with the above examples is only to find familiar grounds for exploring two different aspects of storytelling, viz.,
(i) storytelling vs. other media of communications and (ii) storytelling and the dynamic nature of its underlying structure, and the questions that these beg from us.

The questions:
(a) How did these two pieces of storytelling (from Spain, e.g.,) manage to leave such indelible imprints in the minds of the public to become the definitive statement of the Spanish Civil War?
How did this apparently common man's bedtime tool get to take precedence as a media of communications even when stacked up against the odds of other high voltage medias such as newspaper, news letters, books and the radio that are veritably characterized by high levels of articulation, intellectual sophistication and visibility in the public domain? And,

(b) What is that magic underlying the structure of story telling, which, apart from making it into such a compelling and engaging media across the age groups, has additionally enabled it to adjust itself to the ever changing face and structures of the emerging plethora of medias across the centuries - starting with the oral traditions right into the new media technologies, there isn't a single media that has not leveraged story telling to communicate its central thought.

And that would even include apparently discourse-oriented platforms such as religious pontifications or topical narratives (news and politics). Where, in the case of the former (viz., religious preaching/evangelism), its preachers have played around with parables to manipulate the public
Imagination (the parables of Jesus Christ, e.g.,), or in the case of the latter (news and politics), playwrights and cartoonists have used

satire and caricature to write plays (Macbeth, King Lear, 'Evam Indrajit' etc.,) and draw cartoons. A creative way to heap scorn and ridicule on offending subjects – usually a politician or a dictator or a corporate fat cat - through humor and irony rather than through cynicism, to make an otherwise gritty message seem more bearable amidst the everyday grind of the common man.

It is this overarching question, 'what is that structure innate to storytelling which has shaped it into a device/tool of communication honed to perfection across civilizational time?' is what we need to ask. And eventually come to grasp with the plethora of characteristics written into storytelling and fantasy. Especially storytelling's enormous structural flexibility, allowing it to seamlessly assimilate itself with the medias across time, starting with the oral traditions (that employ variable sensory inputs such as vision, audio, gesture, haptics), to the written traditions (print with text and visuals), to still images (the plastic arts), to voice media (radio and recorded sounds), to moving images (both broadcast/television and narrowcast/cinema), to the latest in broadcast with its myriad convergences of the medias, viz., the Net.

Story telling as a tool is simple to use but difficult to understand in terms of its character.
The difficulty lies not only in its connection with children (which makes it into a scarcely understood and complex subject). But also, in the fact that by the human's propensity to be drawn to story telling for a hundred myriad reasons - to generate excitement, to refresh one's mind, to kill boredom, to build associations and friends, to build games such as 'Chinese Story' out of this too, evolutionarily, story telling ends up being **an** *extremely ubiquitous and intuitive medium that broaches few fixed laws.*

In addition to accepting the logic that the human being is innately drawn towards story telling that makes people want to hear stories, and which then drives the industry to understand the magic behind the power of story telling, it is its highly intuitive nature and lack of dependency on artifacts to tell a story that can make it into an almost *'fly-in-the-wall' kind of an 'invisible'/tacit media.*
This is a vexing problem for an industry that would like evidences to reinforce its businesses. And yet, what compels the learning 'aids' and gaming industry to take up this vexed problem is the singular connection between make-believe play and fantasy arising out of theoretical positions led by the Piaget school of studies (1962) and reinforced by Freud (1933), Bruner (1964), Klinger (1969,1971) and Rosenbaum (1972) is today considered amongst the more obvious line of thinking connected to children's learning and game play.

However, if the connection between children, game and learning is to be understood in an incisive way, one needs to move out of areas familiar to gaming and children to look into areas that have explanations *for the origins of storytelling as a cultural device.*

The idea is to understand the reason why storytelling is so ubiquitous to human needs at a sensory and *visceral/intuitive level*, rather than at a clinical level of cause and effect.
The visceral level of understanding is crucial because it will probably find greater synergies with storytelling, given that storytelling is predicated on the use of sensory(s), and which are hard to explain as frames of logic.
The raging controversy on Ram, the epic hero from the Indian sub-continent, in recent times is a telling comment on how story telling is not about explanations. It is about a charter of faith that numbs the mind into believing situations that can sometimes have existed only in one's imagination, but whose larger context was drawn from the cultural premises and value systems of its people.

Is there a way to see what drives the locus of storytelling that makes it such a compelling part of one's life? And be able to arrive at a set of factors that can build a logical frame of understanding around something that defies any form of logic?

As already indicated, for this, we need to turn to sources less obviously referenced and less directly connected to the formal connotations of learning, but of seminal importance and understandably, thereby, of an earlier origin, and used widely in anthropological, urban and sociological and cultural studies, and perhaps itself a source of inspiration for cognitive and development psychology studies quoted above.

Chief among these would have to be Robert Redfield's seminal work from the thirties, located at the famous Chicago School of social thoughts based on the scholarship of the University of Chicago in the thirties. As also the works of the classical anthropologists Franz Boas and Branislaw Malinowski form the same period.
Most of the work by Redfield is connected to his concept of 'Folk Society.' And which affords us an incisive and comprehensive grasp of the triggers that evoke fantasy at a social-cultural level to become an element of public consciousness (as against the deeply personal psychological level of consciousness as studied by Freud). 'Folk Society' as an instrumentality could help us understand how inner thoughts at an individual level can become part of the collective psyche so that the daily rhythms of the common man ends up becoming the template of the workings of community life itself.

Redford's 'Folk Society' was an attempt at understanding society by constructing an 'ideal type' where 'primitive' or folk society is contrasted with modern urbanized society, and an attempt is made to put together the mindsets typical to these two categories of settlements into constructs that help to look at communities not as locations rooted to geographies (India, China, Sweden, etc.,), but rather as mindsets that defy geography (the West, the emerging markets, the cosmopolitan space, the multicultural, multilingual space).

For our purpose, it means that a certain condition/mindset may be found to be coexistent within a given geographical boundary. Such as the existence of communities such as the polygamous Mormons in Utah or the anti-technology, back-to-nature proponents known as the Amish community from Pennsylvania and Iowa in the USA. Both these communities are bound by 'primitive' customs, juxtaposed against the context of a 'modernized society'
Redfield says that in generalized terms, "folk societies (so-called 'primitive'), are small, isolated, nonliterate, and homogenous in character (with regard to the distribution of knowledge, attitudes and functions among the population), with a strong sense of group solidarity. The ways of living are conventionalized into that coherent system we call culture. Behavior is traditional, spontaneous, uncritical, and personal; there is no legislation and habit of experimentation and reflection for intellectual ends. The sacred prevails over the secular; the economy is one of status rather than of the market." And altogether, one may characterize this set of conditions as representing a "folk mentality".
(Folk itself being used as a term to mean rustic and peasant-like).

Under these circumstances, an important fallout is that knowledge in such communities is not critically examined or objectively and systematically formulated. It means that the value of every traditional act or object or institution is something which the members of the society are not disposed to call into question. This particular characteristic of the folk society may be referred to as being a 'sacred' society, because it requires its people to view knowledge as being sacrosanct, rather than being questioned.
This sets in habituation, whereby the individual adjusts itself to certain habits – both motor and mental. And, of course, to certain associations between one activity and another, or between certain sense experiences and certain activities, to the point where it becomes almost physiologically uncomfortable to change or to entertain the idea of change.
In time, this imparts a sacredness to social objects, requiring these to represent both holiness and dangerousness, and laden with strong symbolic value. Such as the way rice is personified through the goddess 'Annapurna' ('anna' – food; ‚purna' – fulfilled) in the rice eating geographies of India, or the sword being worshipped as part of a dedicated festival amongst warrior communities such as the Sikhs, the Rajputs or Coorgs.
This disposition to regarding objects as '*sacred'* then *sets in a chain of anecdotal experiences articulated through stories* to be recanted as songs, pictures on the walls of homes, meditative chants, or games played for ceremonies. To quote an example from the Navajo Indian society, where corn is worshipped, and a young Navaho says:
"My granduncle used to say to me, if you are walking along a trail and see a kernel of corn, pick it up. It is like a child lost and starving. According to the legends, corn is just the same as human being, only

it is holier……When a man goes into the cornfield he feels that he is in a holy place, that he is among Holy People……Agriculture is a holy occupation. Even before you plant you sing songs. You continue this during the whole time your crops are growing. You cannot help but feel that you are in a holy place when you go through your fields and they are doing well." **(Hill, W.W. 'The Agricultural and Hunting methods of Navaho Indians, Yale University Publications in Anthropology, Yale University Press, 1938).**
Redfield uses the above example above to say that "in the folk society ideally conceived, nothing is solely a means to an immediate end. All activities, even the means of production, are ends in themselves, activities expressive of the ultimate values of the society".

What this condition translates itself into as a mental activity in every day life has been dwelled upon by two of the best minds in anthropology**.**
Franz Boas (1937), the author of the Baffin Island experimentation on Eskimos, in his classic 'The Mind of the Primitive Man' says that, man in folk society is driven by a set of mental associations which are personal and emotional rather than abstractly categoric or defined in terms of cause and effect. Where man views "every action not only adapted to its main object, every thought related to with other ideas, often of a religious or at least a symbolic nature". And why he ends up giving them a higher significance than they seem to us to deserve. To give this representation in real life, man attributes them with powerful symbols and recants his experiences as stories, which begin as narrations as the voice of the impresario, and in time transforms into stories laden *with myths and symbols*, where the boundary between fact and fiction are meant to diminish because the subject(s) of the narration are situated at a plane higher than everyday preoccupations.

The other classical thinker-anthropologist **Bronislaw Malinowski (1925),** known for his work in Polynesian islands says that in the folk society effective technical action is much mixed with magical activity. Bringing in *'magic'* as a tool for encrypting these mental states, a state brought about by knowledge that is apparently shorn of systematic or reflective thinking, the customary solution to problems of practical action tend to be expressed as a mental state called magic, which according to Malinowski is based on "specific experience of emotional states, in which truth is revealed not by reason but by the play of emotions upon the human organism. Magic is founded on the belief that hope cannot fail nor desire deceive." The end result is the form of a drama that is, in effect, a picture of what is desired but not necessarily attained. It takes the form of symbolism as a short-cut of thought. Instead of looking for the relation between two things by following the hidden detours of their causal connections, thought makes a leap and discovers their relation, *not in a connection of cause and effects, but in a connection of signification or finality.*

What all this means in the context of game and learning for children is that, children reside in a world of magic and symbols, with Piaget's articulation of symbolic play being a direct result of this recognition. The concept of adult fantasy, as stated under the section of adaptability, itself suggests that the adult man himself lives partly within a folk society idiom. Lewis Carrol's 'Alice in Wonderland' being an allegory of the paradoxes from real life explained as a story (e.g.,Alice realizing the idea of going round and round while still rooted on to a single point).
The fact also remains that human beings have routine methods of distinguishing fact from fantasy (**Julienne Ford, 'Paradigms and Fairy Tales', 1975).** And so, he feels free to use metaphors to depict reality as fantasy (and not vice versa).

Games, built by adults, tap into this facility of the adult to invoke mental states from his nascent folk society mindset. Children, on the other hand, live in a folk society mindset and have to be actively cajoled into the 'truth' through story telling. Any attempt at undermining this condition may be done at the risk of defying powerful states of mind inbuilt into our cognitive systems. In other words, it may well turn out that story telling is not an indulgence or option, it may have to be considered as an imperative not only for localized cultures such as those of India's but universally, since children are a universal feature of our existence.

But, significantly from the view of new media's ability to render itself as a particularly media-rich environment, we have now the opportunity to leverage this absorption of a plethora of sensory modes (visual via text, graphics, caricature, animated graphics, moving images as video clips, etc; aural via voice, music, special effect sounds, etc.,; gestural, via tapping, drop and drag, etc.,) into the given media platform. Naturally, this increases for us the likelihood of attaining, as close a match as has been possible so far in the history of the medias, of the sensory-rich environment associated with its original and the most satisfying mode of story-telling – viz, that of oral tradition.

It would seem that we have at last reached a reasonable and achievable platform that has the capacity to unfold information in layers, the capacity to absorb metaphors as a ruse for making information exciting, the capacity to carry out a narrative not in a linear, chapter-by-chapter story telling, but more as a zoom-in zoom-out manner of presenting, retaining and withdrawing information, depending on the interest levels of the audiences. Next to oral traditions and big screen cinema today, new media augurs the most promise of conveying a thought process to a young audience without invoking boredom or indifference.

(5.5) The Role of Cultural Contextualization in Gaming:
The role of cultural context to game has become evident to scholars as well as to the industry, especially in the recent years with the shift of the markets form the West to the emerging markets located in highly culturally-driven countries such as India, China and Brasil.

Games are an intrinsic part of our culture (in India). For various reasons, game play has become an intrinsic part of our rituals in the social domain – especially within the ceremonial, but sometimes in every day life as well.
This is attested by the every day rituals of bathing and entertaining the statuettes/dolls that go to represent the physical form of our gods. It is believed that the gods need to be indulged in, in the way that we conduct our own rites of passages across the day.
No wonder then, that a major object of worship, viz., Krishna from our pantheon of god, has a strong childhood and playful representation, where the young Krishna ('Balakrishnan: 'bala'- child; 'krishnan' god) is worshipped especially or inspite of his childhood pranks and intransigencies. And endears in the collective psyche for stealing butter and sweets from his mother Yashoda's pantry and even gets caught, much in the way a human child flicks cookies from the cookie jar and gets caught as well.
Paradoxically, it is the same Krishna who is represented as a think tank/philosopher-strategist on the battlefield, prevailing upon Arjuna - the warrior par excellence - in his moments of doubt to not lose heart over having to battle his own kith and kin. Krishna's counseling to Arjuna about the the world as a gaming area, and the need to use the right strategies to help eliminate the accumulated evil from time to time, is what goes to form the Bhagavad Gita.

The larger explanation for such mental models of childhood, gameplay and gaming strategies, lies in our 'folk society' mindset with a great propensity to drive our contexts around the notion of the 'sacred'. The 'sacred' is taken to explain what is not always obvious to the naked eye. Driven by the need to narrate our experiences through metaphors and symbols, games are used to play out some of these mental representations of tasks, events, anecdotes, historical and ecological references, that are not possible to explain in clinical, logical terms.

But a major thrust for games comes from the reasons that have also gone to build game theory. 'Game theory', which is the 'mathematical analysis of competitive strategies where choice depends on the action of others, e.g. in war, economics, game of skill etc.' (Oxford Dictionary) or 'a hybrid branch of applied mathematics and economics that studies strategic situations where players choose different actions in an attempt to maximize their returns' (Wikipedia) outlines situations – both competitive and cooperative - for playing and winning a game.

In India, an example of a fertile ground for game play, perhaps meant

to prepare a nubile, unsuspecting couple to the vagaries of social play, are the games played as part of the wedding rituals at wedding ceremonies. Played as simple games (in the modes of treasure hunt and board games), are meant to afford a glimpse into the realities of life – the strategies, the moves by people, the subterfuges, the joys of winning, etc., that are to be expected when a couple sets up home.
Traditionally built around several days of celebration, perhaps because people traveled from distant villages to attend the ceremony and necessarily had to stay back, games at weddings were devised to engage guests parked at the wedding venues after their long travels. Games were also intended as ice-breakers between the families of the couple, usually unknown to each other on account of the practice of arranged marriage – a match negotiated between two families. The guests themselves are usually made up mostly of relations and members from one's clans and hence, culturally, game languages remain familiar.

The way social games such as the one at weddings are played out is as follows: typically built around strategies to test the preparedness of the young bride and the groom to the travails of everyday life, the relations gather together, grouped as teams belonging to either the bride's or the groom's side, and help the couple play the games either through back-seat driving or through active playing. One game in particular, played with rice and 'kouri' (shells that served as amongst the first known currency in human history) – required the bride and the groom to take turns to hunt down 'kouris' hidden amongst a small heap of rice kept before the seated couple. Members from the opposite sides would make sure to hide the kouris as cleverly as possible to make their discoveries slightly difficult (if not insurmountable), with the bride's side hiding them if it was the groom's turn to play, and all kinds of machinations being employed to make it difficult for the player to find the 'kouris'. The subterfuges of the game would also provide an opportunity for the newly wedded couple to play around, injecting their body language into the game to fish around and to communicate signs of early intimacy.

Needless to say, the games that have endured on and attract the most fun and mirth are those that use local artifacts and local customs. And for that very reason, it becomes necessary for games to become culturally situated.
It scarcely needs mentioning that the properties of values such as machinations, 'entendres', etc., related to strategizing, while being universal in their use in humans, require the use of language for their actualization on the ground. Hence, a game to be truly coherent and fruitful would necessarily entail plugging into a local language with localized idioms, since the articulation of these take place through speech and gestures, which, in turn, are a highly localized affair.

(6.0) What a game must not have:

A game, in order to be motivational and to be an effective learning tool, must avoid the following features **(Kirriemur, and McFarlane, 2003):**

(i) the game must not be too simplistic in comparison to competing games. Even in absolute terms, given the child's layered ability to view and uncover facts from his environment, a game must contain unfolding levels of information and strategy
(ii) the tasks must not be repetitive, such as continually doing sums, making it boring and like a chore
(iii) the tasks must be well designed to support progressive understanding
(iv) the range of activities must be wide and variegated, rather than being homogenous in content and use of skills
(v) the target audience must not be warned of being embarked on 'learning' something, and get the feeling of being patronized.

Further on, one must bear in mind that a game must include (**Sandford and Williamson, 2005)**:
(i) task that one can complete
(ii) ability to concentrate on one's task
(iii) task has clear goals
(iv) tasks provide immediate feedback
(v) deep but effortless involvement
(vi) exercising a sense of control over actions
(vii) sense of duration of time altered

(7.0) In conclusion - inputs on game as variegated and complex as game itself

The need to dip into multiple strands of thoughts related to the axis of our problem – *'children-gaming-learning'* - arises from the complex nature of the problem itself.

The drawing of our references from varied disciplines and sources says that the problem of children, game and learning is not only highly inter-disciplinary, it is also highly complex.
Some of the areas which have contributed to our understanding of the given problem in a combination of theoretical and empirical inputs are:
cognitive and behavioral psychology, gaming studies, anthropology, sociology, urban studies, media studies, cultural studies, educational technology, interaction design studies, structuralism and semiotics, and visual studies related to perception, aesthetics and caricature.

The single definitive assertion or thought with which we might conclude this paper would be that the non-linearity of the computing medium and its synergies with the non-linear nature of children's thought processes is a helpful condition against which we need to evaluate the very important assertion by pedagogy from the sixties and earlier, that the cognitive structure of the child is driven by the fundamental process of make-belief and fantasy right into adulthood. As mentioned already, this involves a continuum of activity across the stages of mental development to accrue intelligence, starting with the child using three modes of mental representations – sensory-motor as an infant, iconic as a child and symbolic as an adolescent. And mapping onto these modes are the external articulations – where the sensory-motor child uses **motor expressions as representations of experience** to play with objects, the older child employs **perceptual representations** to pretend, and the adolescent child manipulates **symbols** to fantasize.
In a combination of assimilation and accommodation, children thereby adapt their cognitive structures to expand their learning faculties. But significantly for us, this involves the use of multiple media, multiple learning modes – formal and informal, and results in a multiplicity of artifacts, from pictorial representations of the child's world to models representing this in miniature, to theatre and plays and other forms of enactment articulating the child's essential condition of being.
And most importantly, a crucial instrumentality across the stages of development right into adulthood, remains the element of 'play' through which the child apprehends the nuances of his environment and engages his mind to *construct* his own notions of the world around him.

It is this critical element of 'play' as a running thread of the narrative across the development trajectory of the child's intelligence and cognitive abilities, is what we have sought to leverage as an idiom for learning. While the industry surrounding the activity of gaming, especially in its electronic form, offers important benchmarks for potential learning systems, it is also necessary to remember that these come from the industry's own learning curve being predicated on research carried out by an entire spectrum of work drawn from the fields/disciplines stated above. And hence, the complexity of understanding the world of the child is reinforced by the complexity of being able to comprehend material from so many divergent disciplines. Any attempt to narrow it down to longitudinal studies in limited directions has its pitfalls in a distorted appropriation of concepts and ideas being applied to our problem area.

It has been our modest endeavor here, therefore, to reference thoughts from divergent areas to enrich our understanding of the complex problem underlying *children-gaming-learning*. And it needs no saying that any reference outside of the preferred compendium may not only be valuable, it could even suggest an unavoidable, if inadvertent, omission.

But, as long as we are confident that we have tried to move our solution away from the overly-emphasized use of the linearly driven left side of the brain so common to our formal, instructional systems, to shift gear and pay attention to the otherwise "murderously shortchanged right-brained population of the world", to quote Nicholas Negroponte (Brand, 1987), we have probably apprehended the complex problem of children-gaming-learning to some reasonable extent.

Perhaps, at the end of the day, underscoring all of the research perspectives referenced above, remains the single claim by Stewart Brand (1987), who quotes Einstein to say in the context of computing and learning for children: "Love is a better teacher than duty."

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