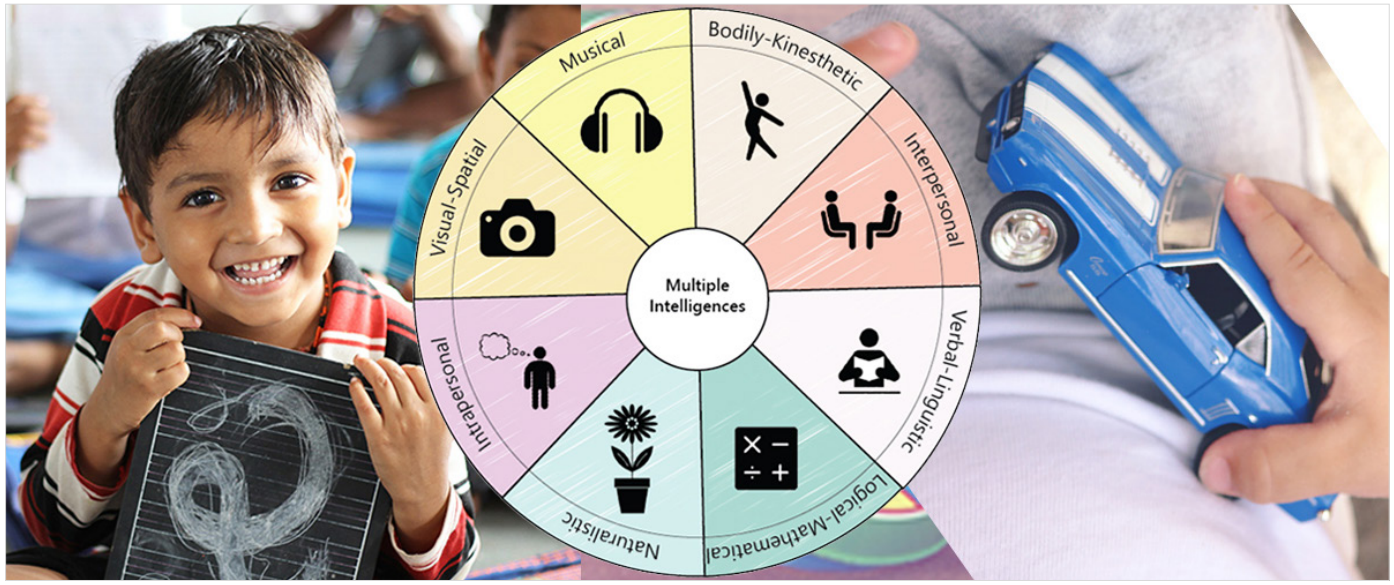
Design Course

# Designing for Children - Play and Learn

Play and Learn

by
Aakash Johry
IDC, IIT Bombay

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## Play Theories and Design

Play has been recognised as one of the most significant activities in childhood, playing a critical role in the development of children. While play manifests in different forms as the child grows, its definition remains elusive, often being seen as a uni-dimensional concept in the past. A contemporary definition of play does not simply look at the absence or presence of play but rather looks at a continuum or gradability using the handle of 'playfulness', such that an ***activity could be more or less playful depending on a set of dispositional characteristics*** which are present like intrinsic motivation, non-literality, means v/s ends, active engagement, positive affect, etc. Moreover, recent definitions have conceptualized ***playfulness as a dynamic entity which is dependent on the context***. Thus, understanding playfulness as context-dependent and multi-dimensional, allows for the possibility

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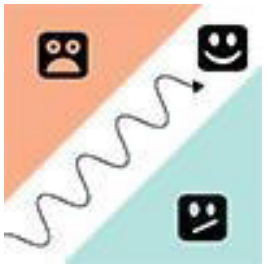
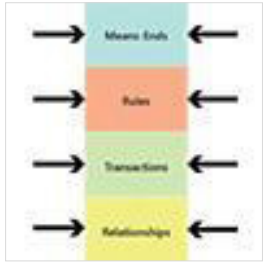
of design interventions to increase the playfulness in an activity/artefact.

Having been extensively studied from a long time, there are a plethora of play theories and classifications. Some of these selected theories and classifications are briefly discussed below, which are interesting from the point of view of using them in design applications.

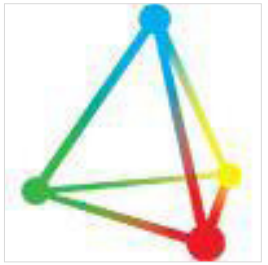
Caillois's Attitudes in Play Experience



Csikszentmihalyi's Flow Theory



Apter's Reversal Theory



Play Pyramid by Kudrowitz and Wallace

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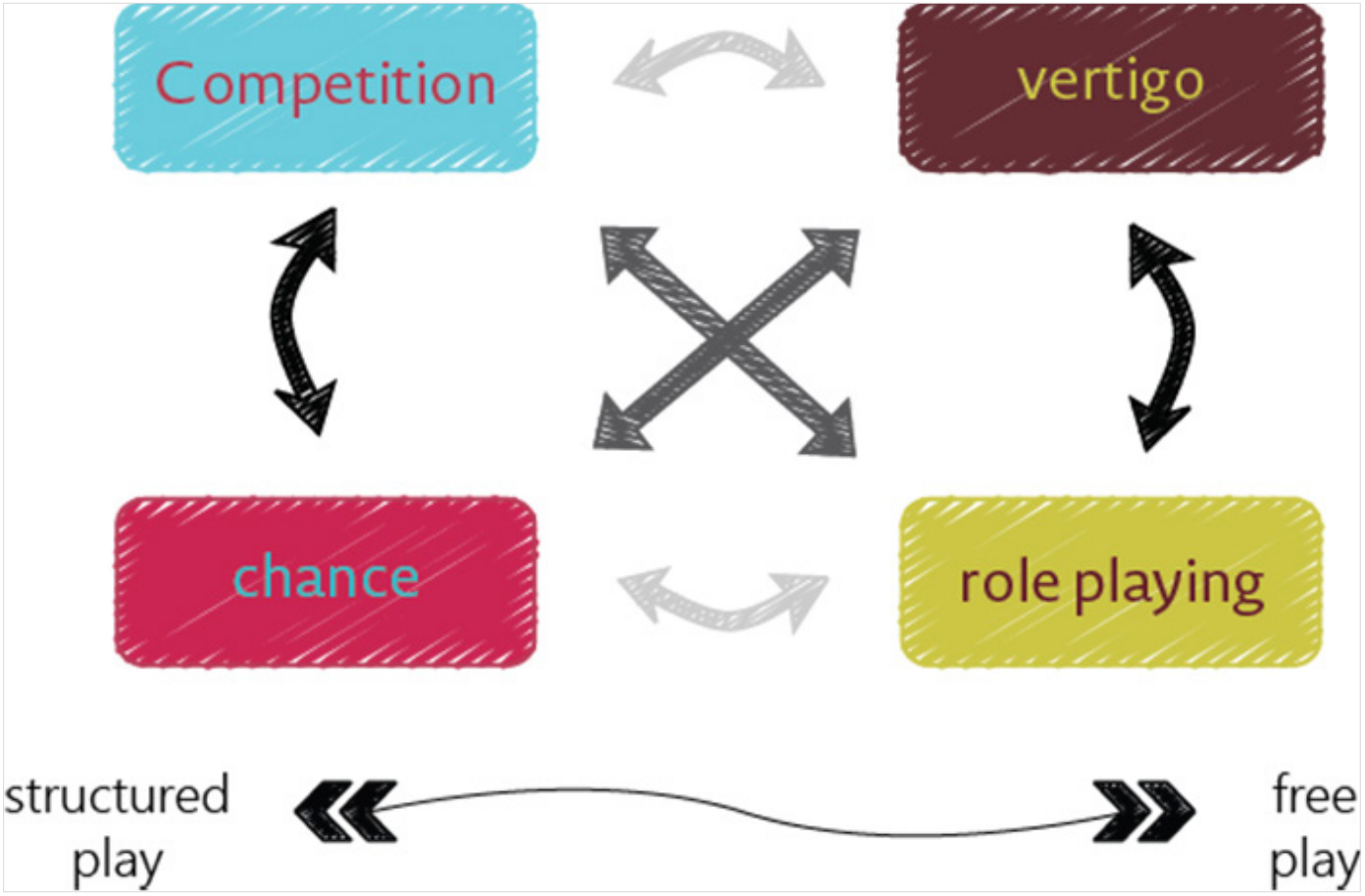
## Caillois's Attitudes in Play Experience

Roger Caillois studied play and culture in his famous book Man, Play and Games, describing play by six characteristics: free-not obligatory, limited in time and space, uncertain, unproductive, governed by intrinsic rules and allows makes-believe. Caillois also identified four broad attitudes in play experiences, which lead to four play forms, on a continuum from completely unstructured, free play to structured, rule-based play:



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• **Agon or Competition:** Based on the idea of winning by mastering a single quality/skill against opponents, within defined limits and without outside assistance such that there is an equal chance of winning e.g. chess.

• **Alea or Chance:** Based on the idea of winning by favor/luck, rather than skill and experiencing pleasure in the lack of control and anticipation. Agon and Alea both involve creating conditions of equality. E.g. slot machine.

• **Mimicry or Role Playing:** Based on pretending to be another to convince others (audience) such that imaginative reality is maintained. Unlike Agon and Alea, mimicry does not have explicit rules or conditions but relies on improvisations. E.g. playing doctor-patient.

• **Ilinx or Vertigo:** Based on the pleasure from altering perception and shocking self through bodily movement. It may also involve pleasure in destruction/disruption of moral order. E.g. roller-coaster ride.

It is common to use these categories in combination. Some of these categories are traditionally seen as more compatible e.g. Agon and Alea (both being rule based) could be seen together in poker and similar card games. Similarly, mimicry and ilinx being unstructured are compatible together. This makes the classification a useful framework for design applications by exploring one or more of these categories to create playfulness.

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## Csikszentmihalyi's Flow Theory

Mihaly Csikszentmihalyi is most renowned for his theory on flow or optimal experience representing a mental state while performing an activity when a person is fully immersed. While not specifically written for play context, most of the dimensions of flow experience are also found in an engaging and enjoyable structured play activity. These dimensions are:

- Clear goals and immediate feedback
- Equilibrium between the level of challenge and personal skill
- Merging of action and awareness
- Focussed concentration
- Sense of potential control
- Loss of self-consciousness
- Time distortion

**Autotelic or self-rewarding experience:**
However over a period of time, among these dimensions, the central precondition which is responsible for flow experiences has been recognized as a **perceived balance between challenges and skills**. Later researchers have expanded the flow theory and represented it using the experience fluctuation model as shown below.

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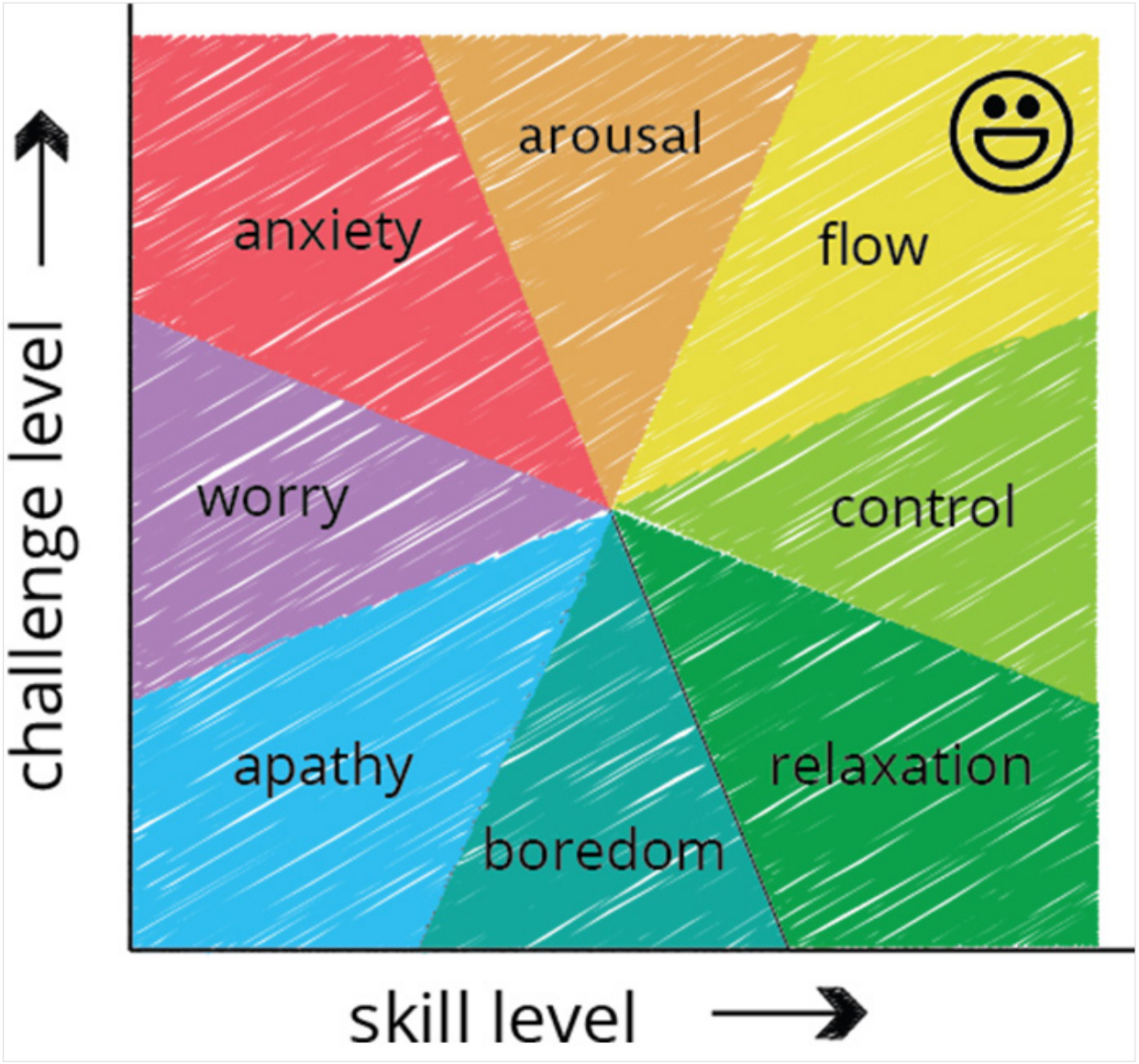


From the perspective of design practice, this model can be very useful in evaluating an existing play and learn activity and adjusting the level of challenge with respect to the skill or ability of children to achieve a specific mental state including flow. Other aspects of flow theory including establishing clear goals and providing immediate feedback have been recognized as significant components of engaging games and learning applications.

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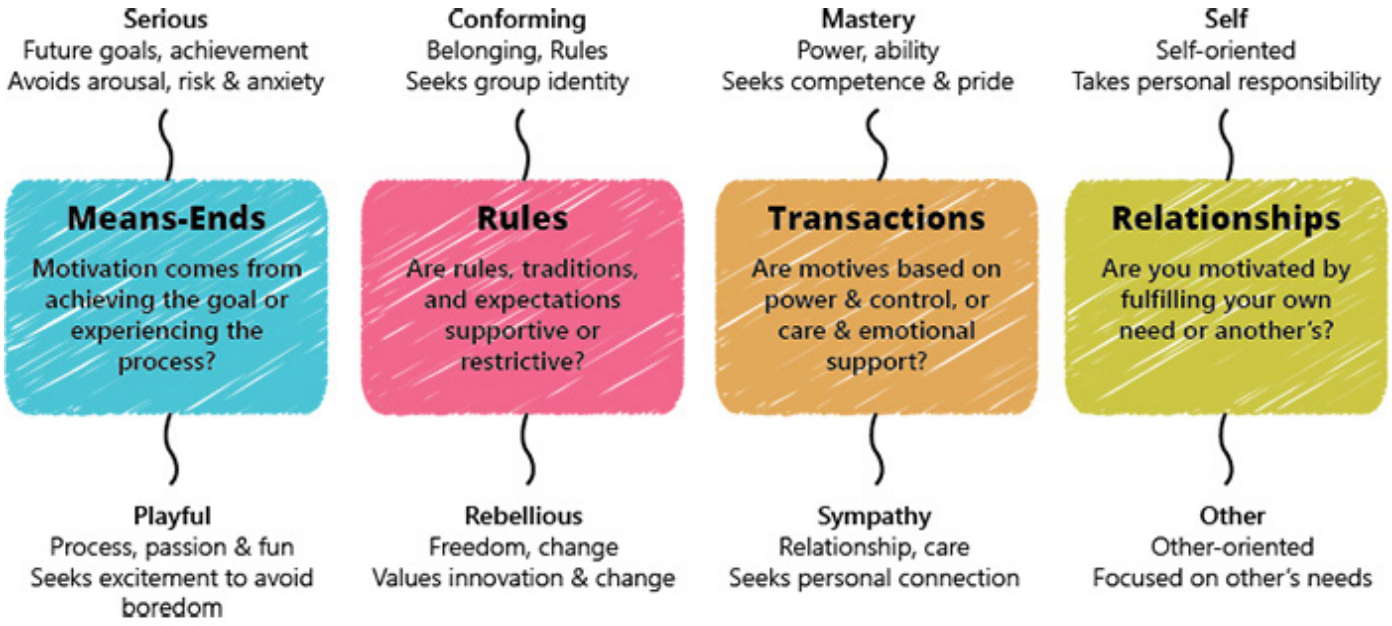
## Apter's Reversal Theory

Apter's reversal theory proposes using design to induce changes (reversal) in motivational states and/or emotional arousal, to guide the user in a desired experience. According to Apter, any action is a result of an interplay between four pairs (dimensions) of alternative motivational states (refer figure below). Each of these dimensions can be 'reversed' leading to change in hedonic tone (emotions) which further affects the action.




In the context of designing for play, the aim of the designer should be to reverse serious state to playful, process oriented state in the 'means-ends' dimension. However, the other motivation dimensions can be used as a framework to generate design ideas for play activity, by selecting their different combinations. e.g. allowing players to bend or set rules (i.e. rebellious) in 2nd dimension, designing for sympathy in 3rd dimension and focusing on social aspect of fulfilling other's needs in 4th dimension would result in the popular multiplayer Role-playing board games like Dungeons and Dragons, which are more suited to older children and adults. Similarly selecting rebellious, mastery and self in the respective dimensions could lead to Lego brick games, suited for middle school children. Exploring other combinations may lead to design possibilities which have not been explored much.

Having talked about the different motivational dimensions and their possible effect on activity, Apter further

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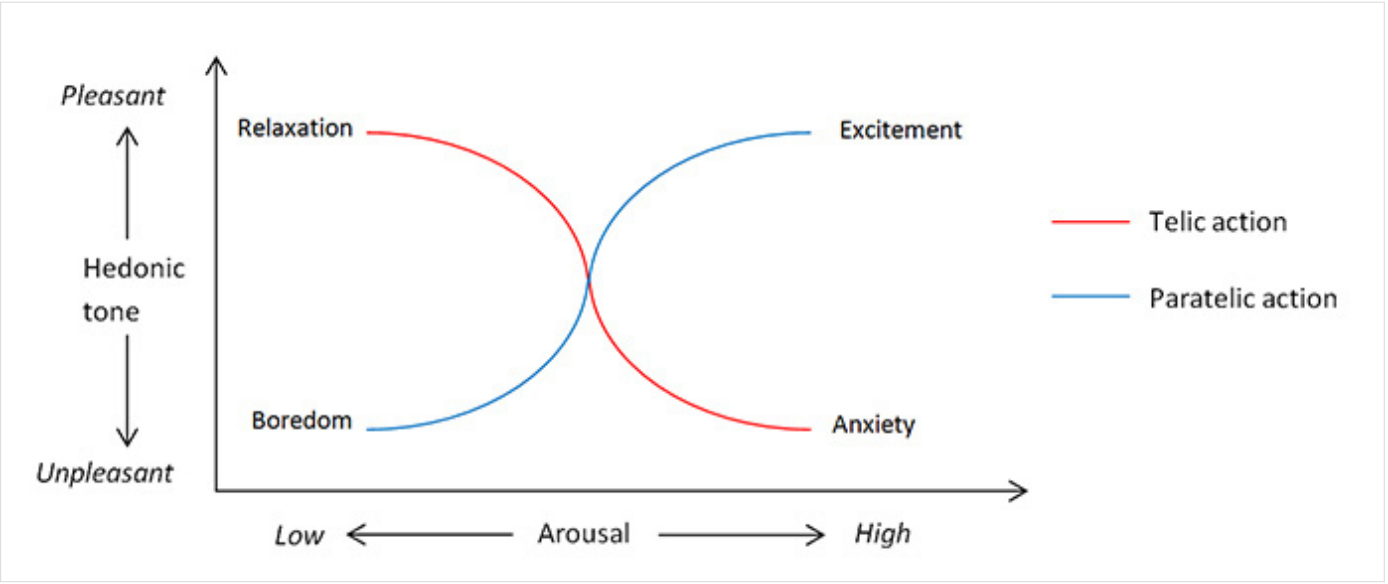
expands the idea of telic v/s paratelic states, by relating it to the level of arousal in an activity.




A high arousal situation would lead to anxiety in telic mode, but high arousal would be perceived as exciting in the paratelic mode. Similarly, low arousal situation in paratelic mode is boring but it may be preferred in telic mode leading to relaxation. The designer can explore two kinds of possibilities while designing for play:

a) Reversing a telic activity into paratelic activity.

b) Increasing/decreasing arousal levels within paratelic state to create pleasant experiences.

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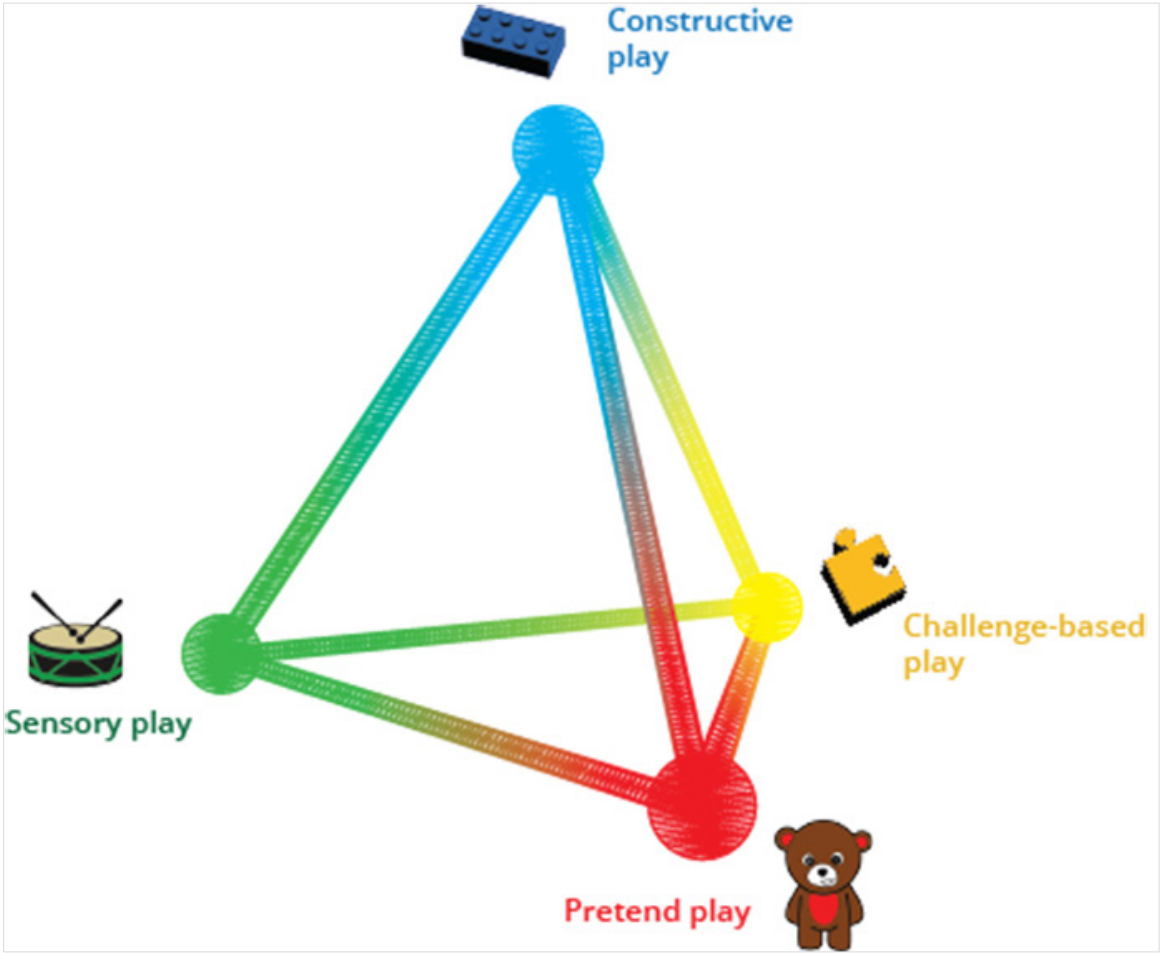
## Play Pyramid by Kudrowitz and Wallace

The play pyramid is a three-dimensional map that allows designers to classify a toy concept by placing it in a space between four independent axes representing four types of play i.e. sensory, fantasy, construction and challenge-based play, applicable to all ages.




Play pyramid is a very resourceful tool for toy and play designers as they generate different configurations by moving around on the pyramid (combining characteristics of multiple play types in different extents). A designed concept can also be explored for modification by moving it.

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## Learning Theories and Design

Children undergo rapid changes in their cognitive and motor development as they age. It is important to understand the basic theories of their development to understand the capabilities of children as a function of their age, which also limits the possibilities in which different tools and technology are experienced, needed to guide design. Some of the important classical & contemporary theories of cognitive development are discussed below, with a focus on how they may guide design process and output for children.

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Piaget's Theory of Cognitive Development

Vygotsky's Socio-cultural Theory of Development

Gardner's Theory of Multiple Intelligences

Developmental Milestones for Design

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## Piaget's Theory of Cognitive Development

Jean Piaget has been one of the most popular and influential experts in the field of developmental psychology and education. He stated that learning occurs in children through the process of adaptation, an active process where children construct knowledge structures through experience and interaction with their environment. Adaptation could be further divided into two processes – ***assimilation*** (fitting new information into pre-existing cognitive schemas or knowledge) and ***accommodation*** (altering pre-existing schemas in order to fit in the new information). This discourse of actively creating knowledge by building upon previous experiences through interaction with environment is known as ***constructivism***, which is very popular among a lot of other researchers and actively used in the field of interaction design. Seymour Papert expanded this discourse into ***constructionism*** stating that Piaget's active learning process works best when children are consciously engaged in constructing public entities. This has been widely adopted in the design of toys, games, and learning technologies that allow the child to author the experiences, rather than passively following a script.

Piaget further identifies four major factors that affect the development process. The design implications of these factors are briefly discussed below:

• **Maturation:** Artefacts & technology need to adapt to the limited physical and cognitive capabilities of children at a specific age.

• **Experience:** Enabling environment such that children can naturally learn by experiencing different artefacts to form their knowledge (schemas).

• **Social Interaction:** Enabling social interactions through technology such that knowledge in the form of information and strategies can be passed from one generation to the next.

• **Emotions and Motivation:** Learning and developmental activities need to be made relevant to children's lives and interests.

Apart from the above theory, one of the most significant contributions from Piaget's theory is the identification of developmental stages. He stated that all children go through a series of stages in their intellectual development, each related to certain typical behaviours and abilities. These stages are:

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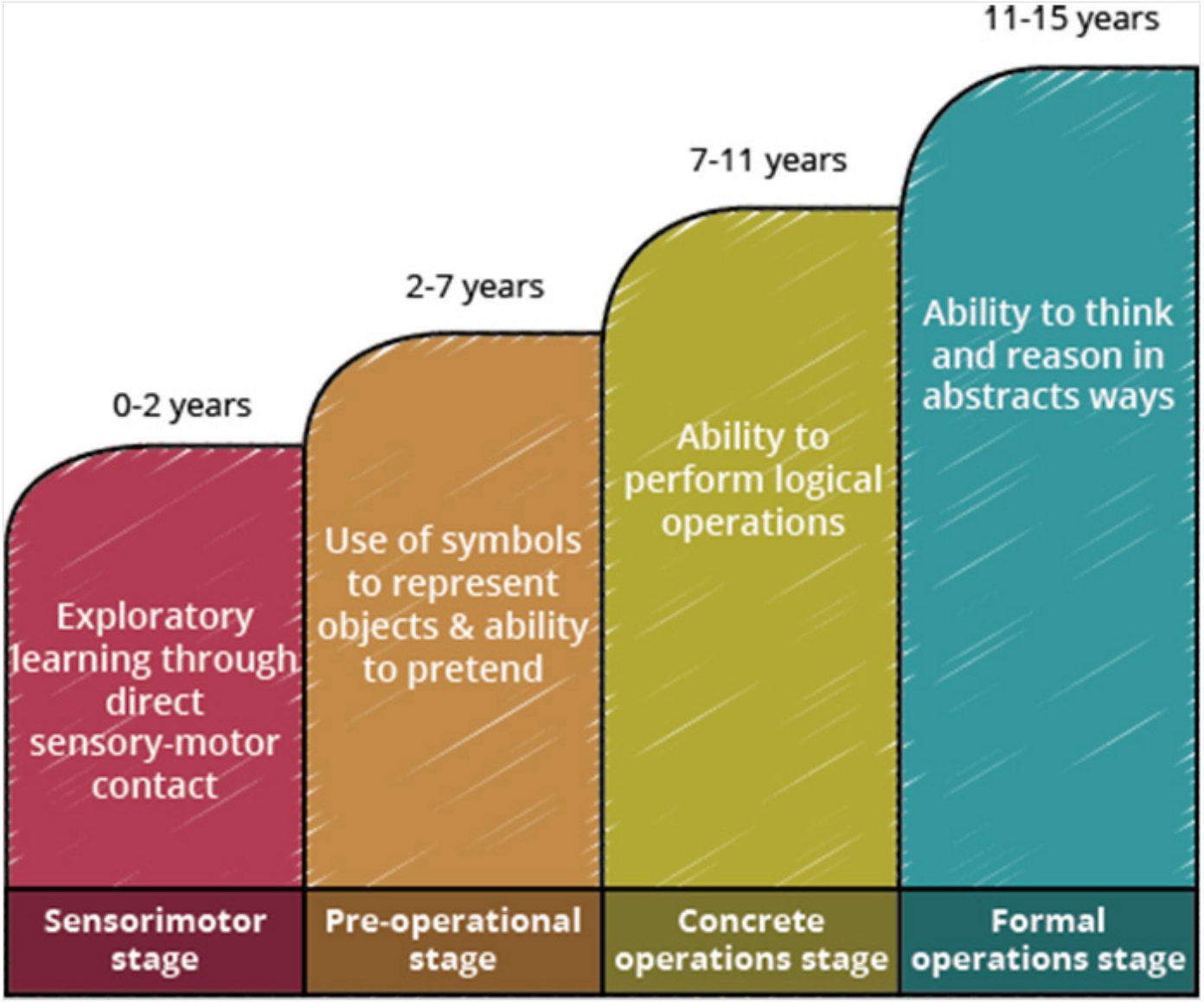

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**Design Recommendations Based on Piaget's Theory:**

**1)** Children at pre-operational stage cannot concentrate on more than one characteristic of an object at a time, thus they have trouble in interacting with hierarchical elements in an interface. Providing alternative options together instead of a hierarchy is a better option in the design of interfaces. Hierarchies are useful for children from the concrete operations stage.

**2)** Learning applications which involve abstract concepts like deductive reasoning and logically analysing options are understood for children only in the formal operations stage, and are not ideal for younger children.

**3)** Children at pre-operational stage are ego-centric and can't be partnered in participatory design processes and methods. This could be better achieved in children from concrete operations stage and later.

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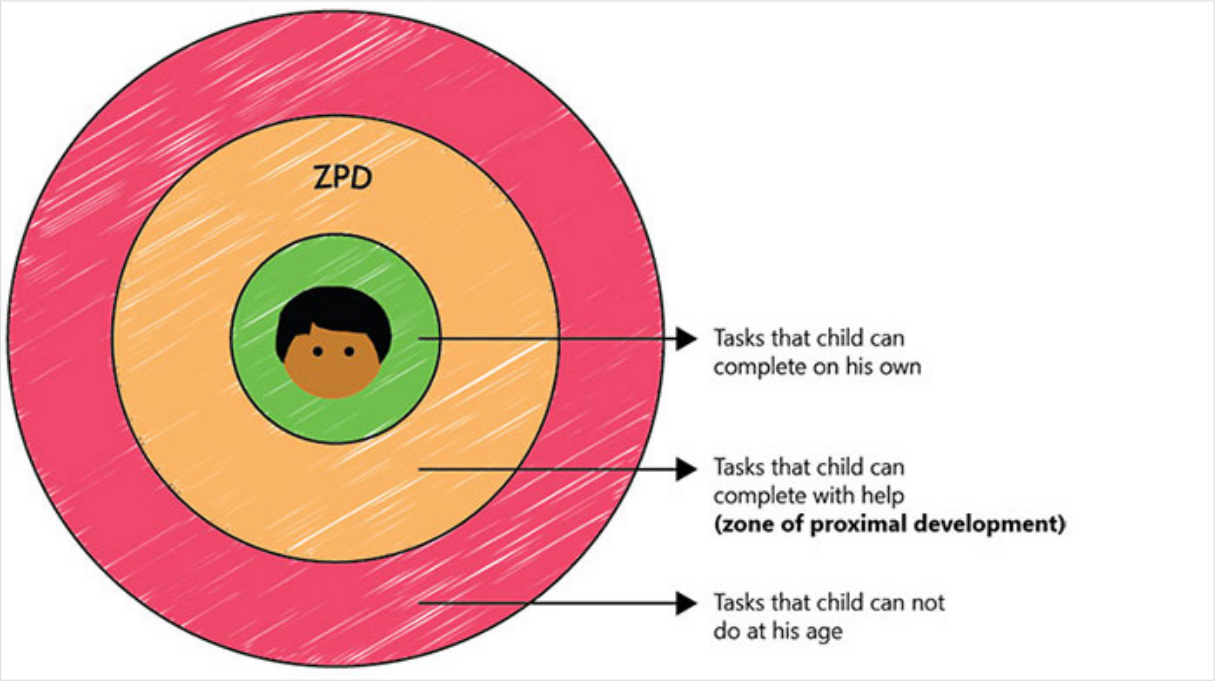
## Vygotsky's Socio-cultural Theory of Development

Lev Vygotsky was among the pioneers to highlight the effect of society and culture on the development of children, and gave a complementary view to Piaget's framework, becoming a basis for much of the later work in education. Some important aspects of Vygotsky's theory are briefly described below along with some design recommendations.

• Social artefacts like language and signs play an important role in the cognitive development, and it is through speech, that children learn to plan actions.

• Appropriate social supports and external tools can have a significant effect on aiding learning and augmenting cognition in children. Also, context is an important part of learning so ***learning applications need to ensure that knowledge is situated in a context*** for easier understanding and retention.

When children can complete a task with help (scaffolding) but cannot complete it on their own, they are in the ***zone of proximal development***. Focus of design should be on keeping the learning goal in this zone, to maximize gains.



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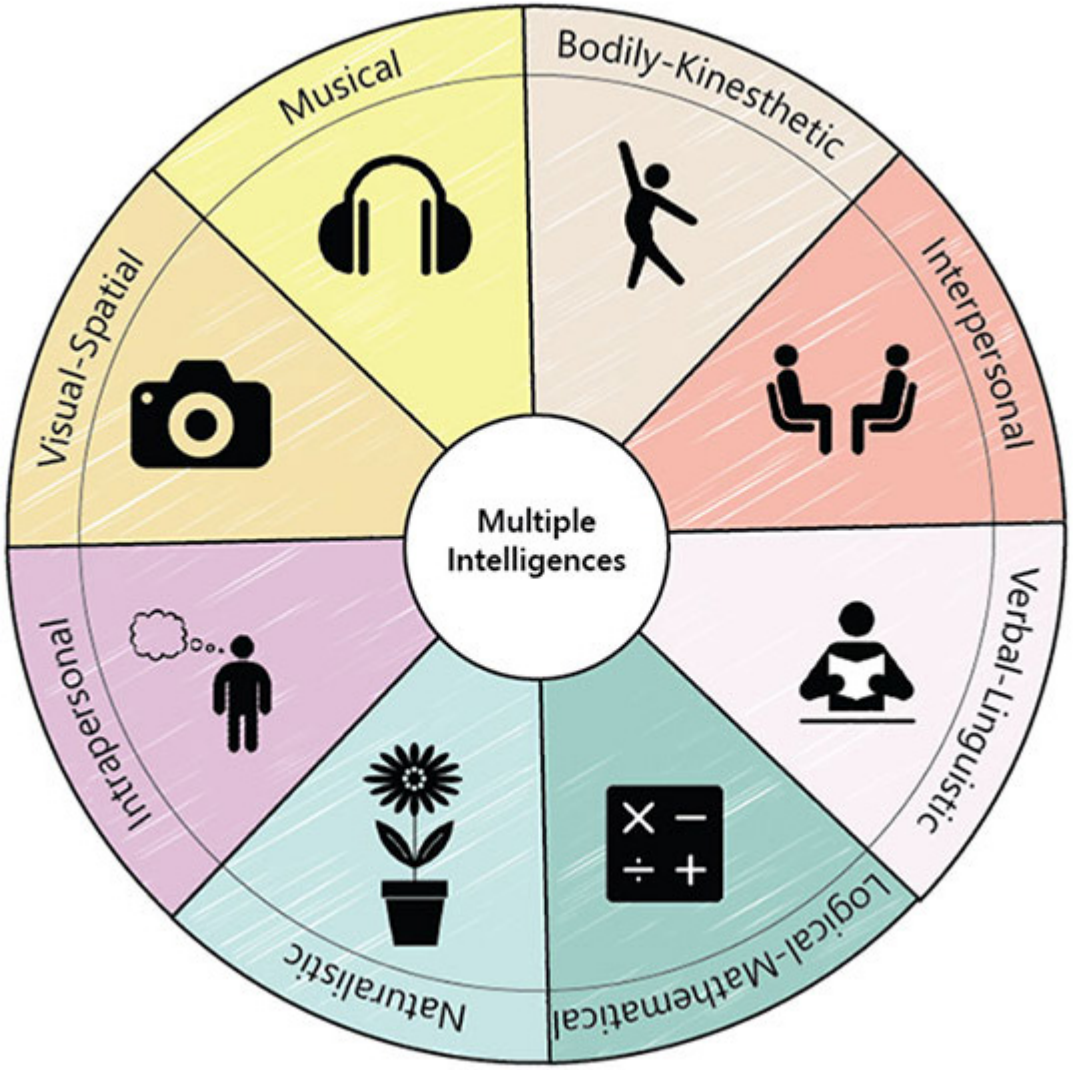
## Gardner's Theory of Multiple Intelligences

Gardner rejected the concept of intelligence as a single general ability, often measured as IQ in various psychometric tests, and proposed that there are multiple, interacting intelligences (modalities) which better represent the spectrum of human cognitive abilities. These intelligences are eight in number, namely:



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While the focus of most traditional educational and pedagogy practices is on verbal-linguistic and logical-mathematical intelligences, other intelligences are often much less explored as a medium of learning. ***Design of artefacts, applications and activities for learning should use all of these modalities as multiple entry points to introduce concepts***. Increasing the ways that work for different children based on their unique profiles of multiple intelligences would allow better understanding as well as higher number of children who would understand these concepts. There are useful free online tools which assess an individual's strengths and weaknesses for each of the intelligences, such as:
http://www.literacynet.org/mi/assessment/findyourstrengths.html

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## Developmental Milestones for Design

• Working memory is limited in terms of how much information can be processed at a time. While adults can hold 7 chunks of information on average in working memory, five-year old children can hold 4 or 5, and nine-year old children can hold 6 chunks of information at a time. Design of artefacts and applications needs to account this in determining the complexity of tasks for children.

• A number of strategies are used by children to store information in long-term memory which become more prominent as their age increases. Some strategies which could be used include – clustering information, linking concepts with visuals, selecting most relevant part of information to store, rehearsal, etc. Design could be informed to use some of these strategies in learning applications.

• Understanding symbols emerges in around 3 years. While pre-schoolers can understand simple maps, they have difficulty in understanding the representational nature of maps e.g. the colour of an object in reality and its representation in map could be different which would be confusing for children. These representational characteristics would be more comprehensible by maintaining uniformity as much as possible in the design applications.

• Pre-schoolers generally concentrate on only one aspect of a task and neglect others. Furthermore, pre-schoolers generally focus on the current status of the task, overlooking the past and future possibilities. However, older children in elementary schools can perceive an array of information aspects of a task as well as information about previous events or states, in a problem-solving task. Thus, design applications need to present information accordingly to children, based on their age-group when problem-solving is involved.

While pre-schoolers are more likely to make qualitative assessments to solve problems or make decisions, elementary school children would more likely be making quantitative assessments, which is important to consider in designing feedback for applications.

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## Contact Details

This documentation for the course was done by Aakash Johry, faculty at IDC, IIT Bombay.

You can get in touch with him at aakashj[at]iitb.ac.in

You can write to the following address regarding suggestions and clarifications:

**Helpdesk Details:**
Co-ordinator
Project e-kalpa
Industrial Design Centre
IIT Bombay
Powai
Mumbai 4000 076
India.

Phone: 091-22-2159 6805/ 091-22-2576 7802
Email: dsource.in[at]gmail.com