

Learning game for teaching Devanagari Conjuncts to Children



Semester IV Project III

Kalyani S Dhone
136330008
Interaction Design, Master of Design

Guided by - Prof. Anirudha Joshi

Industrial Design Centre
Indian Institute of Technology, Bombay

Semester IV Project Report

Kalyani S Dhone

Guided By
Prof. Anirudha Joshi

Industrial Design Centre,
Indian Institute of Technology, Bombay

Declaration

I declare that this written document represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources.

I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission.

I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

A handwritten signature in black ink, appearing to read 'Kalyani Sanjay Dhone', with a stylized flourish at the end.

Kalyani Sanjay Dhone

136330008, Interaction Design
Industrial Design Centre,
Indian Institute of Technology, Bombay

Approval Sheet

The project titled 'Learning Game for teaching Devanagari Conjuncts to Children' by Kalyani Sanjay Dhone is approved for partial fulfilment of the requirement for the degree of 'Master of Design' in Interaction Design.

Guide :



Chairperson :



Internal Examiner :



External Examiner :



Date : 20th June, 2015

Acknowledgement

I would like to express my sincere gratitude to Prof. Anirudha Joshi for his support and guidance throughout.

Thanks to,
Faculty and Staff at Industrial Design Centre (IDC) for their support.

Teachers at 'Tirandaj Village School' for their valuable input in secondary and primary research.

Teachers at 'ASHA' for allowing me to do evaluation at their NGO

Colleagues at IDC for their suggestions and comments during various discussions. Maharaj Armugam helping me in visual design. Srikanth A for helping in developement of prototype.

The internet.

Family for their never-ending patience.

Kalyani Sanjay Dhone

Abstract

Lack of reading and writing is always a barrier in child's education and it also affects child progress. The idea behind this is to make an attempt to come up with a 'Learning Toy' which can help children in learning Marathi conjuncts. The main objective is to make a child understand the formation of the conjunct with engagement and fun.

User studies were conducted with teachers and children in BMC schools and it was found that conjuncts are mainly taught by rote learning where the basic concept of formation of conjuncts doesn't get clear in child's head. In addition to that, spoken language influences the child's reading habits. It gets more difficult when they come across the conjuncts having special form like विद्या, भक्त.

To solve this issue and understand the problem user studies were conducted in government schools where I tried to understand the current existing process of teaching and problems faced by children while reading and writing conjuncts. The studies were used to draw insights and observations, based on which different concepts were designed keeping the objectives and targeted user in mind.

As a final outcome, I came up with a game where child will be given a set of puzzles in which conjuncts will be given. In a game child plays with cards and learn formation of conjuncts. The game mainly provides the knowledge about sequence of letters combined in given conjunct. Making a two player game makes the game play interesting and challenging for each player. The game play is designed as an open card game. So while playing child tries to make his own pair of conjuncts but at the same time he tries to block the opponent. The game provides the learning as well as social dynamics among the players.

The game was mainly divided into 6 different levels, based on the complexity and frequency of the conjuncts. Simpler conjuncts were integrated in first levels and difficult conjuncts were integrated in later stages. Physical (tangible) board game was made to understand the game play and learning effectiveness of product.

Preliminary Evaluation was done on the board game with targeted users. Based on the user's feedback digital prototype was developed. Digital prototype was developed to add interactivity to the game with the help of sound and visuals. Three levels of digital prototype was evaluated with children to evaluate learning where it was mainly focused on sequencing of letters in conjuncts, pronunciation and engagement.

Content

Abstract	vii
Introduction	1
Conjuncts	3
Curriculum and Content	5
Overview of existing products	10
Literature Survey	12
User Studies	13
Redefined Goals	19
Initial Concepts	19
Finalizing the Concept	52
Digital Prototype	70
Evaluation Plan	82
Evaluation	83
Conclusion	87
References	88

Introduction

The aim of my project is to help children learn Devanagari conjuncts. Conjunct are the words where two letters combine together to form new letter. The pronunciation of the letter depends on the letters combined in it. Conjuncts are of different types and forms. Based on which they are easy and hard to read and write. It is difficult for the children to understand the logic behind the formation of conjuncts. Specially, when conjuncts take different form like **क्ष, क्त** or some of the conjuncts with **र्** and **र** are introduced to children. Pronunciation of the words plays very important role to understand which letter come first in given conjunct.

In any education system reading is the base of learning. ASER's 2014 reports that 71% of the children enrolled in schools attend the school. Out that, in Maharashtra 80-89% of children attend the school. Even though every year number of student enrolling in the schools are increasing, according to ASER latest report only 23.6% of 3rd grade children can read the text of 2nd grade. By the 5th grade, about 48% of children can read the text of 2nd grade and above. In rest of the students 20% of children can only read letters. 14% can read words but not sentences. 19% can read sentences but not longer ones. But without reading one cannot progress. As above number suggested very few children can read basic letters. [10][9]

Looking at the curriculum, in Maharashtra most of the government schools teach Marathi as a primary subject. Children get introduced to Marathi basic letters in 1st standard and basic conjuncts in 1st and 2nd standard.

By taking these issue into consideration, the objective of my project was to develop a 'Learning tool for teaching Marathi' where children

1. Can learn Marathi conjuncts with fun and engagement
2. Can understand the how conjuncts are formed

The target users are the students of 1st and 2nd grade, who are learning to read.

To achieve this goals following design process is followed

Data collection

Current existing data on conjuncts were studied throughly to understand its the complexity with respect to targeted users.

Literature review - Literature review was done to understand child's learning process and different stages involved in that.

User Studies - User studies were conducted in BMC schools to understand the current existing methods of teaching and issues faced by children while reading.

Insights and Findings - Insights and Findings were drawn based on the user studies and collected data to get to the design solution.

Ideation and concept - Based on the targeted users and findings, different ideas in context with the design goal were ideated. Selected concepts were prototyped and evaluated with children.

Final Concept - Based on the evaluation, pros and cons were listed down for each concept. Based on that final solution was finalised. The final output contains - Digital prototype of the card game designed for learning conjuncts.

Evaluation - The evaluation plan was drawn to evaluate engagement and learning effectiveness of the design solution. The prototype was evaluated with the targeted user to based on the parameters in the evaluation plan. Before starting the evaluation Pretest was given to children to understand their previous knowledge. Three levels of digital prototype were evaluated which includes simple conjuncts in first level conjuncts with different form and ₹ at start in next two levels. While doing the evaluation few things were noted -

Time to play the game (1 round)
Engagement of the user
Hints taken when he/she is stucked at one place
Time to make each move against opponent

Post test was given to children to evaluate the learning effectiveness.

Conjuncts

About Marathi Language

In India there are 22 official languages and 13 official scripts in which 9 are major scripts. Devanagari is one of the major scripts which is taught in India. Devanagari consists of vowels and consonants. Marathi language has 12 vowels and 36 consonants. Different consonants and vowels form different combinations. [3]

What are Conjuncts? जोडाक्षरे म्हणजे काय?

When two or more consonants come together they form a conjunct. Conjuncts can be formed with the different combinations of consonants. Although all consonants can form a combination but all are not used in daily life.

The pronunciation of a conjunct is a combination of the two consonants, where the first consonant is pronounced briefly and the second one is pronounced fully, followed by the vowel sound. For example, when म्ह is formed while pronouncing म is pronounced as half and ह is pronounced complete.
Conjuncts combination

Consonant + Consonant

ल् + ल = ल्ल - किल्ला

त् + व = त्व - सत्व

द् + या = द्या - विद्या

There are two methods of writing conjuncts

- Horizontal Conjuncts
- Vertical Conjuncts

Horizontal conjuncts – While writing the horizontal conjuncts the consonants are written in horizontal manner one after the other

For e.g. -

क् + क = क्क

Vertical conjuncts – While writing the vertical conjuncts the consonants are written in vertical manner one below other

For e.g. -

ठ् + ठ = ठ्ठ

Marathi conjuncts can be written in multiple ways, but some are written often than others.

For e.g. -

क् + त = क्त ऐवजी क्त

द् + य = द्य ऐवजी द्य

श् + र = श्र

क् + ष = क्ष

द् + व = द्व ऐवजी द्व

द् + ध = ध्

श् + च = श्च ऐवजी श्च

How to form conjuncts?

Type 1

Consonants with vertical line in it (अक्षरात उभी रेघ असते)

When a consonant has a vertical line (ख, ग, घ etc.) in it combines with another consonant, the vertical line gets eliminated and new conjunct is formed

For e.g. -

घ् + य = घ्य

Type 2

Consonant without vertical line in it (काना किंवा उभी रेघ नाही)

When a consonant not having vertical line (द, ट, ठ, ड etc.) in it combines with another consonant, the first consonant is written fully and next consonant is attached to it.

For e.g. -

ट् + य = ट्य

Type 3

Conjunct with र् halant at the start

When a consonant combines with र् halant, र् halant takes the form of an arc ॅ and sits on the top of the consonant letter.

For e.g. -

र् + द = र्द

Type 4

Conjunct with र consonant at the end

When any halant letter combines with र consonant, र consonant takes the form of an angular line ॠ and it gets attached with the halant letter it gets combined with.

For e.g. -

द् + र = द्र

Curriculum and Content

Before starting the user studies the curriculum of 1st and 2nd standard studied thoroughly.

Students are introduced to conjuncts in 1st standard in second half of the academic year. Before conjuncts, students are introduced to basic letters including vowels and consonants. After that how words and basic sentences formation is taught to them. The sequence of teaching Marathi is always sequential.

Letters..... Words..... Sentence

क म ल Matras शाळा Conjunct कमल शाळेत
का, कु, के क्य, क्र, कं

Before teaching conjuncts, they learn basic letters (मुळाक्षरे)

Basic letters are taught to children by rote learning, where children has to repeat the letter again and again with example and visuals
For e.g. क कमल चा , ब बदका चा

Once they know basic knowledge of all letters and they learn word formation. In word formation they first learn easier words without any matras like ा, े, ै etc. In next level matras are introduced to them. Once they learn formation of letters children get introduced to conjuncts. (जोडाक्षरे)

First they teach basic of conjuncts like halant letter and consonant formation. Children are also taught to read the conjuncts again and again to get familiar with its sound and form.

For e.g. - First children learn simple conjuncts like म्ह, क्क, च्य

After simple conjuncts they learn difficult conjuncts where form of the letter changes

For e.g. - विद्या, अश्व

All the books and worksheets contains pictures and illustrations related to conjuncts. Most of the objects and words used in books are from the surroundings which child see in his day to day life, so that child can associate words with them easily.

As shown in *Image 1*, children are asked to write word related to each object. Most of the objects are used in their day to day life, like दफ्तर, पेन्सिल

After every chapter exercise of difficult conjuncts will be given, so that children can practice them. Understanding the conjuncts with respect to context of story and word makes it easier for children to understand.
See *Image 2*

Conjuncts from the chapter are shown as half letters and full letters to make children understand the sequence of letters and their formation in that word.

See *Image 3 Image 4*

Different type of conjuncts and examples are given in the books to differentiate conjuncts with types

For e.g. -

Conjuncts with र, र् or conjuncts with vertical line consonants, without vertical line

See *Image 8 Image 9*

Different types conjuncts with र and र् are practiced to understand its different variation with different consonants and sequence.

See *Image 7*

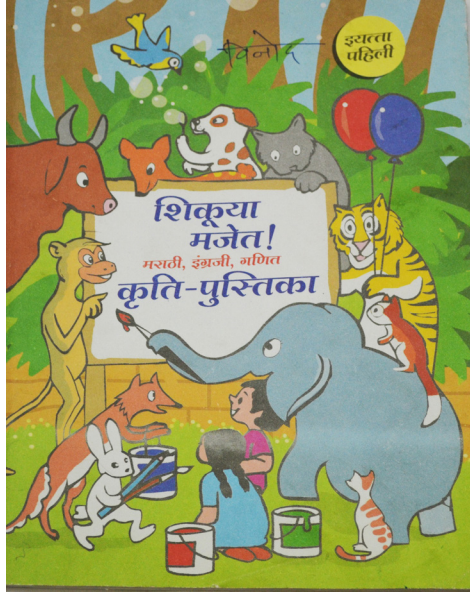


Image 5



Image 6

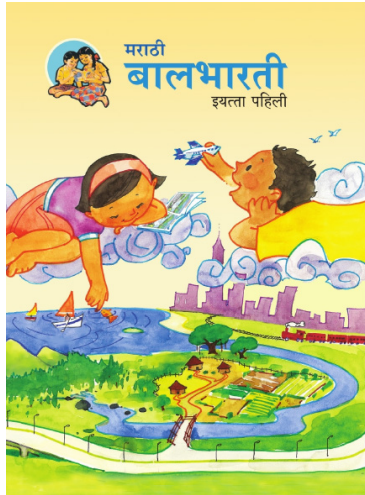


Image 7

Books used in curriculum for teaching basic letters and conjunct.

Worksheets are provided for practice to the children.

● ऐका. म्हणा. वाचा.

सर्व मित्र	सम्राट शेतकऱ्याला	पत्र वाऱ्यावर	वर्ग क्रमांक	ट्रक राष्ट्र
---------------	----------------------	------------------	-----------------	-----------------

'र' ची रूपे	'र' ची जोडाक्षरे	'र'च्या जोडाक्षरांचे शब्द
र		
र		
र		
र		

Image 7

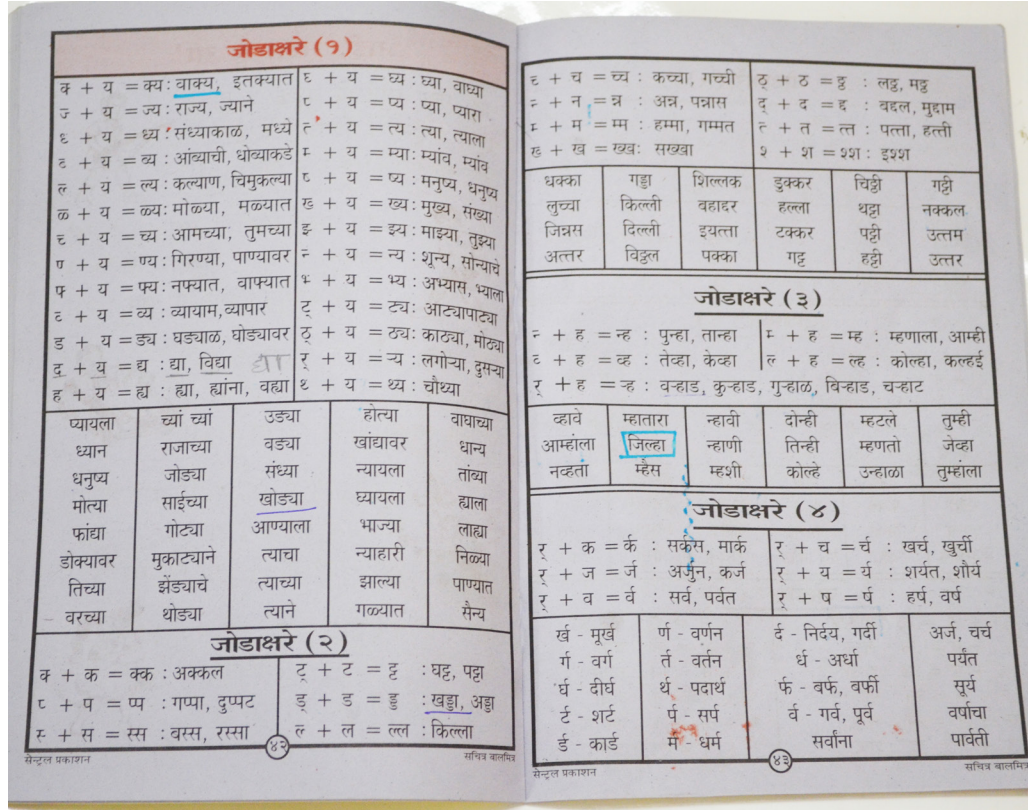


Image 8

Different types of conjuncts are explained.

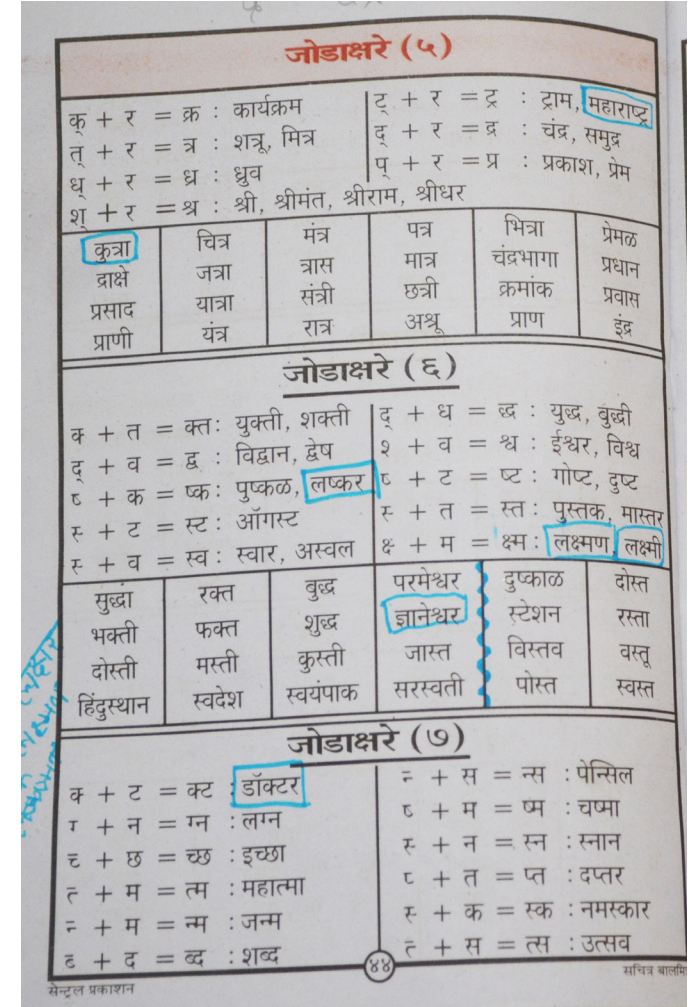


Image 9

Overview

Pros

- As different practice exercises are given after every chapter, child gets good practice of conjuncts.
- Word association with Illustration and pictures from their surroundings makes easy for children to remember it.
- Step by step explanation of how conjunct is formed makes children understand combination of different consonants combined together.

Cons

- Information about pronunciation of the letters while reading the conjuncts are not explained in the books. See *Image 8* *Image 9*
- Conjuncts which take different forms after joining are not explained in books. For e.g. – विद्या, विद्वान्
- There is no classification given for different combinations of conjuncts so that child can understand how different combinations of consonants combined together.
For e.g. -
Vertical arrangement
Horizontal arrangement
Conjuncts with र or र्
- Different types of conjuncts are given in the books but there is no explanation about how they are differentiated.
See *Image 8* *Image 9*

Overview of Existing Products

Existing learning application

Learn Marathi for Kids

This is an E-learning application for mobile and tablets available for the Android platform. In this application, children can learn Marathi vowels, alphabets, numbers, and colors.

Inside each section, a visual representation of the character is given with a sound. In addition to that, English letters associated with the Marathi sound for a particular letter are given so that children can map English with Marathi.



Learn Marathi

This is an application to learn Marathi vowels and consonants with phonetic sounds. Flash cards are given, where each flash card has a sound plus English mapping of the Marathi letter. In addition to that, you can see the picture associated with that word by flipping the flash card.



Marathi Mulakshare

In this application, vowels and consonants are explained according to their phonetic sounds. They have included a quiz in this application where children have to guess the letter or word associated with the picture given.



So the most important thing in a game or puzzle is engagement of the user for long time. Surprising elements, moving visuals, sound effects, animation helps in making game engaging. Also children always like to play against each other and win first. Strategies makes the game play more interesting and helps in learning from opponent.

In case of Devanagari conjuncts where there are different types of writing methods and types, We can introduce children to different conjuncts step by step based on their difficulty levels and forms.

Review

- Though all application gives visual representations and audio feedback of different letters, there no level of excitement or fun for child to get involved.
- No learning tutorial given for the learning conjuncts.
- Once you understand the application, its gets bored because same things (like sound visual of words) happens again and again. No game play or strategy is involved to engage children for long time.
- If children doesn't play the game for long time, it becomes static and doesn't encourage children to play more.

Literature Survey

A child begins the ability to read when he/she is infant. He/she develops this ability when they start attending the speech signals from their environment. A child starts recognizing the symbols and characters while listening to the stories from their parents or relatives. As they grow they start developing the understanding about letters, words and sentences. For literature review I have looked upon some Learning theories, specially how child develop their understanding from the age of 4-7. [11][5]

Preoperational Stages

Childs rapid development starts from the age of 2. Sensorimotor Stage starts when the child is infant where child has no understanding of the world except his own point. According to Piaget, the children in an age of 4-7 years are in their preoperational stage. From the start of this stage the child starts to learn to speak and last up until the age of seven. In preoperational stage child begins to develop the language skills and thinking process.

Piaget noticed that still children are unable to process the concrete logic and manipulate the information in his head. The child also start focusing on himself and how world relates to him. [6][4]

Child starts to learn to read at the age of 6-7. Children are taught basic words first and then conjuncts. At this stage the child is not able to process the logic behind the formation and different combination of conjuncts.

But same time child gets involved easily in dynamic activities like game play etc. At this age they want to play continuously. In a play if they play collaboratively they tend to motivate other players and learn effectively.

Any child develops learning capacity based on their interest, initiative, experimentation, discovery and imagination. [7][8]

Providing a fun and engaging experience while teaching is important in learning process.

User Studies

User studies with teachers

While doing the user study, I visited the Tirandaj Village School in Powai. It is a government school in Powai where Semi English and Marathi medium is available.

For my user study I talked to some of the teachers in the school who teaches Marathi to the children on 1st, 2nd, and 3rd standard. While doing the conversation with teachers I tried to understand the teaching methods they use for teaching the children for reading the Marathi. After the user studies with teachers it was found that they use rote learning while teaching to read Marathi. In rote learning information is memorized based on the repetition of the data. The method is used for teaching basic letters as well as teaching conjuncts.

While teaching teachers prefers to teach children from books and worksheets provided in the curriculum. First they read the words or sentences and then tell children to write it. Apart from this they use different charts and visuals for teaching. Students are provided with the worksheets where they have to solve the exercises based on the chapter they learned.

Activities given to children

First Activity

While doing the user studies some actives were given to children to know their knowledge about the formation of the conjuncts.

Students were given a worksheet where picture of objects were given and they have to write the name of the object below it.

Same worksheet were given to all students.

Total students – 20

Standard – 2nd Semi English medium

Age - 6 - 7 years

Simple visuals were used in the worksheet. Most of it were used from current curriculum books so that they can recognise them easily. Most of the objects used in worksheet are taken from children surrounding so that they can relate to them easily.

For e.g. पेन्सिल, सूर्य, चष्मा

Second Activity

Students were asked to read and write the conjuncts already given in books. Sentences were read loud from books and children were asked to write conjuncts given in the sentence.

दिलेल्या चित्रांची नावे लिहा



कु



स



च



कि



घ ळ



खु



पे ल



को



द र



सू



ल



झे

Worksheet given to children

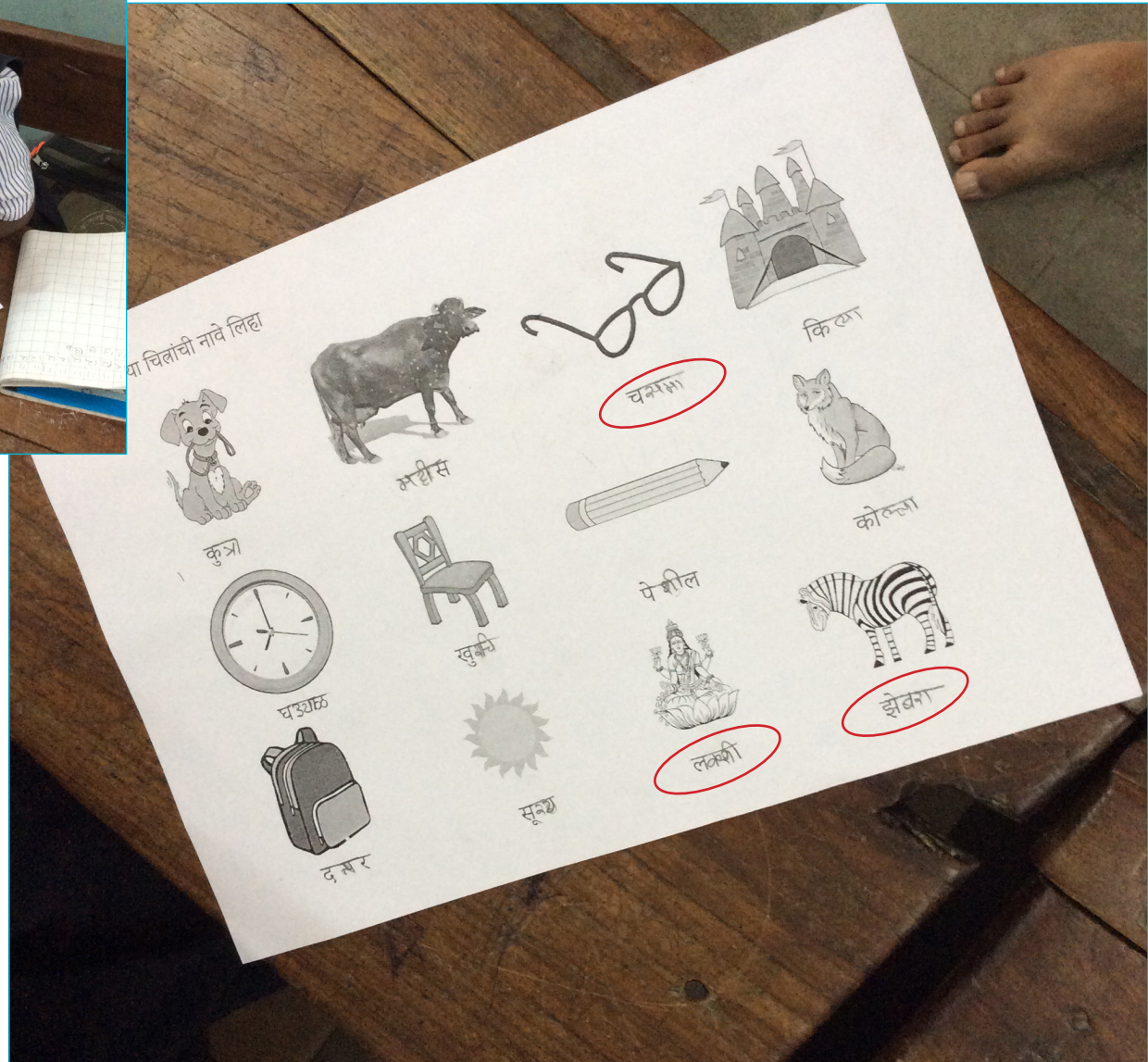
Observations from first activity

- Most of the children could write the conjuncts correctly which are familiar to them like - कुत्रा, किल्ला, सूर्य
- While writing children first pronounce the word and then try to write it.
- Most of the children fail to pronounce and write conjunct लक्ष्मी correctly. While writing लक्ष्मी they not able to understand difference between ष and क्ष.
- Children were facing the difficulty while writing झेब्रा where र combines with ब् and takes different form.



Image 10

Activity 2 : Children were asked to write name of the objects given on the worksheet



Mistakes done by children while writing the conjuncts

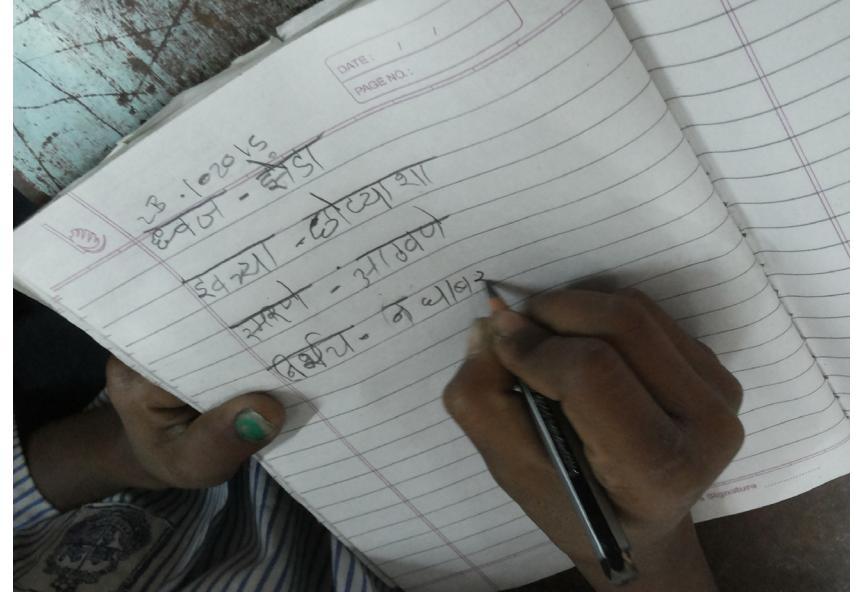
Observations second activity

- After listening to the sentences, children were trying to pronounce it again and then write it on paper.
- If the pronunciation of conjuncts read by teacher was not clear enough, children were facing difficulty while writing the conjuncts.
- Children were skipping the words which were difficult for them to listen and write.

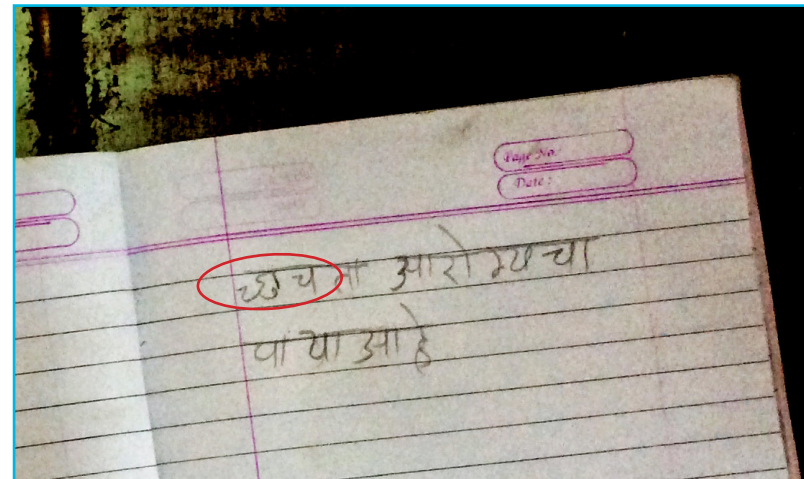


Image 11

Activity 2 : Children were asked to write conjuncts and words from the books



Mistakes done by children
while writing the conjuncts



User studies and activities given to children

Insights and observation got from the user studies

There is no introductory level or information taught in schools which will clear the idea about how conjuncts are formed and written based on their pronunciation (Sound). Because of that, when it take different form after combination child fails to read it properly.

While teaching, first teacher reads the chapter and tell students to read along with her. While reading if any conjuncts comes in between they repeat than conjunct again and again to memories it. If the meaning of that conjunct is given in the book teacher will explain it otherwise she will read the chapter ahead.

Pronunciation is very important while reading the conjuncts. While reading, teacher hardly gives emphasis on the pronunciation of the words. Hence, the mental model how to read conjuncts doesn't get clear in students head.

Conjuncts which are used in daily use get fixed in students head while on the other hand conjuncts which are rare and difficult doesn't get store in student's memory

For e.g. - Conjuncts like कुत्रा, मित्र gets stored in child's memory easily as they use this word in day to day life. But rare conjuncts like वह्नाड, विद्वान having different form are difficult to recall for children

While reading conjuncts students read the characters included in conjuncts separately instead of reading it as combined letter.

For e.g. -

Students read म्हैस as महिस which is wrong.

While teaching, teacher will sit with students and try to teach children from books itself by reading words loudly rather than teaching it on board. While doing this students who are sitting in the corner doesn't pay attention in reading with teacher and miss half of the chapter.

While teaching, teachers switches from one subject to another without completing the chapter completely. Many a times it happens that teacher switched from Marathi to English and it gets difficult for student to switch between languages while reading.

While reading the chapter teachers come across any difficult conjuncts like conjuncts formed with र or conjuncts, teachers doesn't explain how this conjuncts are formed based on their pronunciation. So student always get confused between the different forms of conjuncts with र

For e.g.- सूर्य, प्रकाश, समुद्र

It is also found that the spoken language of students is different than the formal textual language given in the books. So while reading student tends to read the words in their spoken language than the actual formal language given in book. In addition to that if they don't know how to pronounce the conjunct properly, they try to read that conjunct and pronounce the half words as full and skip the rest of the words

For e.g.-

They read लक्ष्मी as लशमी or स्वच्छता as स्वचता (They skip to pronounce छ as they cannot pronounce च्छ completely)

From the user studies it was even though kids try to restore the conjunct by reading and writing it again and again. But as conjuncts has different variations it gets difficult for them to store all of them in their memory. So it is very important to make them understand the basic knowledge behind the sequencing of letters, pronunciation and form of the conjunct.

Redefined Goal

After conducting data collection and user studies with children it was found that sequencing of letters in conjuncts and their formation is very important to understand the logic behind conjuncts.

So the design goal was stated as -

To design a learning game to help children understand sequencing of letters formation, recognition and pronunciation of Devanagari conjuncts.

"Making it fun and engaging to learn Devanagari Conjuncts"

Initial Concepts

Concept 1

The initial concept was to build conjuncts around the story. A child is given a story of their favorite character for e.g. Chota Bheem.

A player will be Chota Bheem and he has to save his friend Chutaki. To save his friend he has to solve the puzzles given to him. In puzzles a picture will be given on screen. Audio will be played in background so that child will know the exact pronunciation of the conjunct given. The word will disappear from the screen and gets hidden behind the object given. Child has to place letters one by one on table so that OCR will detect them.

Scenario 1 (Correct answer)

If a child puts all correct letters and forms a given word, the animation will pop up on the screen and audio feedback will be given to tell child that it's a correct answer

Scenario 2 (Wrong answer)

If the child puts wrong letter on table, the animation will popup on the screen giving feedback for wrong answer e.g. - Book will be sad and for hint correct letter will peek behind the book.

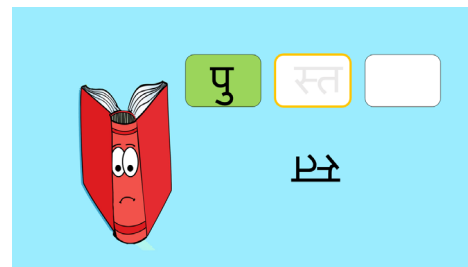
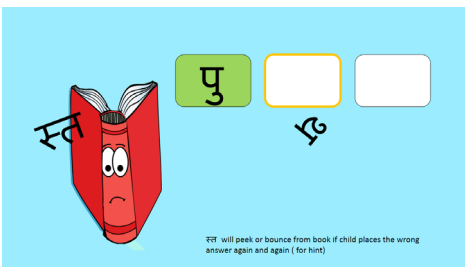
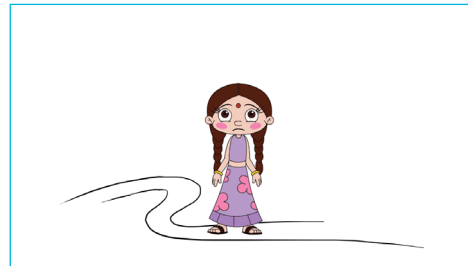
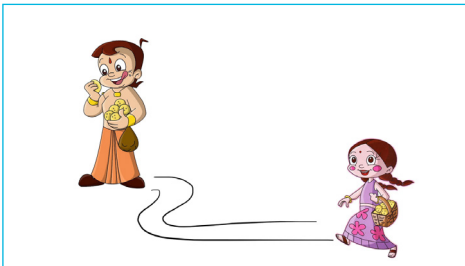
Scenario 3 (If child put letter in wrong orientation)

If a child puts letter in a wrong orientation, the box of that letter will start glowing and it will show how the orientation should be.

Scenario 4 (If child doesn't play for long time)

If a child doesn't put any letter on the table for long time, the letters hid behind the object given will start peeking and will make noise. Still child doesn't put any letter on table the picture of Chutaki will pop up on the screen to motivate child to continue the game for saving her

Whenever a conjunct is formed animation explaining how it is formed will be played on the screen, so that children will understand the half words combination visually.



Build conjuncts with a story

Advantages

- Easy to play and understand
- Different levels can be integrated in game play
- Sound and animation may interest the children and involved them for long time
- Storyline and their existing favourite character makes the game more interesting

Limitation

- Play area and seeing area is different which may confuse the children
- Sequencing and formation of conjuncts is missing.
- Difficult to implement in schools because of affecting factor like noise, light effects, technology etc
- Stereotype story might impose gender biasness on children.
- Not intrinsically motivating (Chota Bheem is extrinsic motivation)

Concept 2

Animating the characters

In the second concept the object will be given on the screen, for e.g. Scooter, the letter will be shown with the picture. As objects comes on the screen scooter will get crashed and letters will jump out of the screen and get crashed on the road

Scenario 1 (Correct answer)

If the child put all the correct letters in sequence, then the scooter will get repaired and will be new as it was. The letters will sit on scooter and goes with scooter happily from the screen

Scenario 2 (Wrong answer)

If the child puts wrong letter on the table, the scooter will go sad and start falling apart. If a child wants a hint he can touch the scooter and audio will be played to give audio feedback of the word.

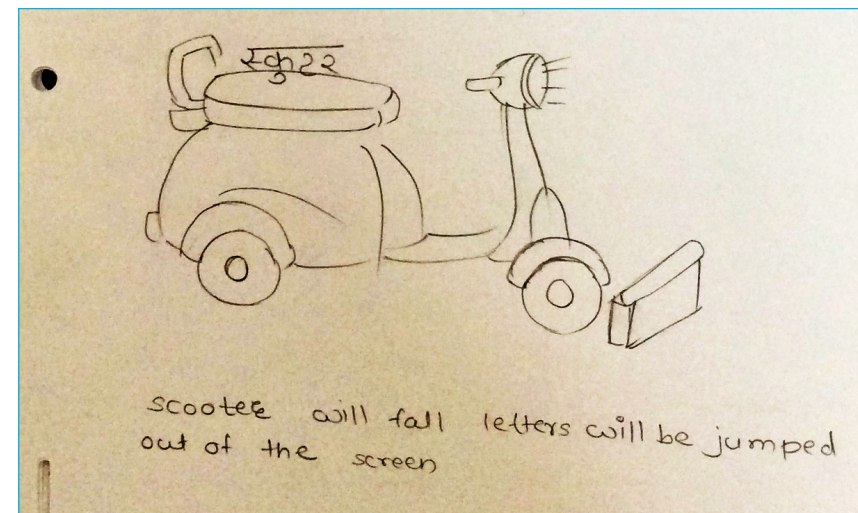
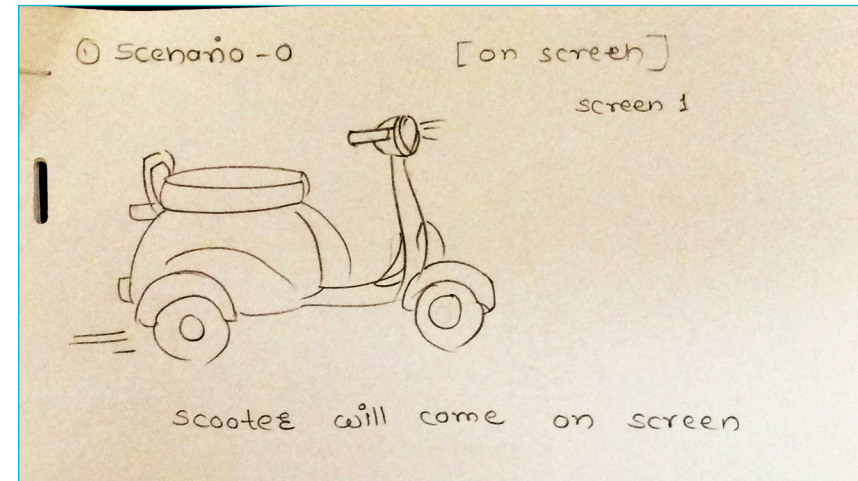
Scenario 3(If the child put the letter in wrong orientation)

If the child puts the letters in wrong orientation, the scooter will get positioned in the same position the child has put the letter. By the orientation of the scooter the child will understand the correct orientation of the scooter.

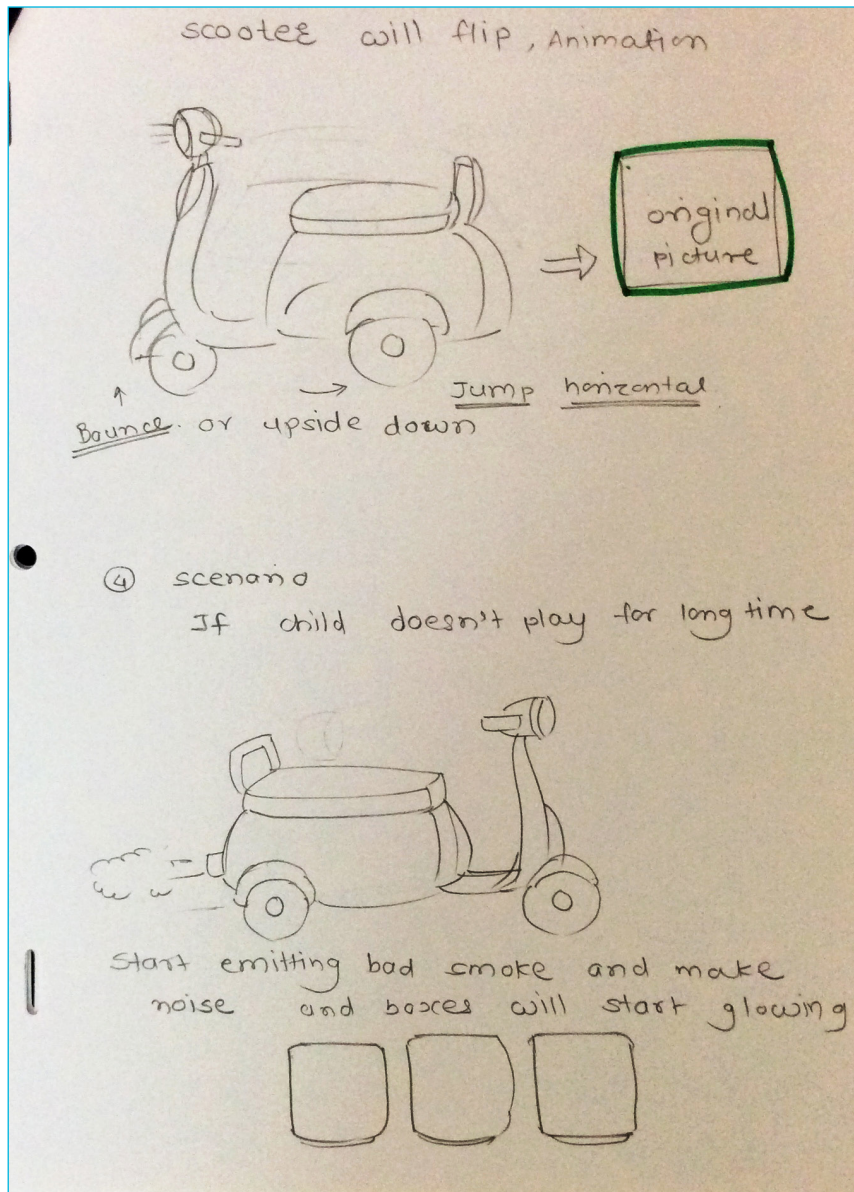
Scenario 4 (If the child doesn't play for long time)

If the child doesn't play for long time, the smoke start coming from the scooter and it will start making noise.

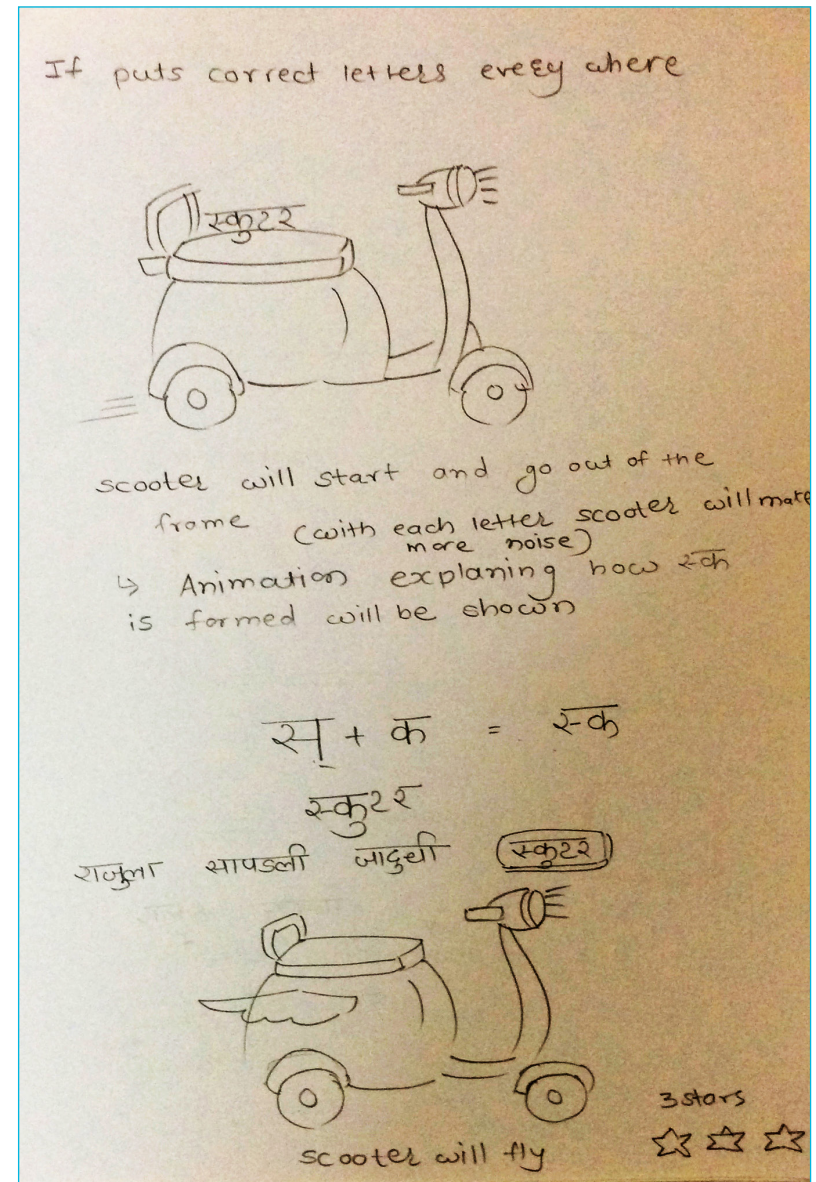
Whenever a conjunct is formed animation explaining how it is formed will be played on the screen, so that children will understand the half words combination visually.



Scenario 1



Scenario 3



Scenario 4

Advantages

- Easy to play and understand.
- Different levels can be integrated in game play.
- Sound and animation may interest the children and involved them for long time.
- Context of visual realated to given conjunct may add to learning.

Limitation

- Play area and seeing area is different which may confuse the children.
- Difficult to implement in schools because of affecting factor like noise,light effects, technology etc.
- It is difficult to integrate with all the conjuncts for example finding a contex for conjunct like **इय** etc.
- Not scalable
- Extrinsic motivation.

Concept 3

Game Design

Factors considered while designing the game
Engagement of the user

- Learning
- Theme and story line
- Strategies, risk, luck involved in game play
- Interaction between the players
- Complexity
- Players goal

Game Play should contain,

- Less strategies, more chance based
- Players moves should affect opponent
- Chance and luck should be involved for excitement and uncertainty
- Player will gain point in move for each correct answers
- Interaction of players – exchange of points
- Duration of the game – 3 – 4 min

Brick Man

No of players - 2 players

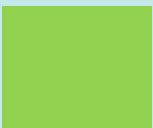
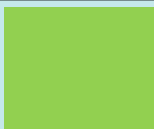
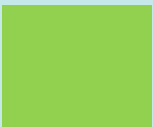
Goal of the player – To reach the end by solving the puzzles given on the matrix.

Goal of the game – To teach how conjuncts are formed

In this game the two player has to start their journey from one start point. On the maze each tile has particular number. In each turn player has to roll the dice and move from his position vertically or horizontally according to the dice number he/she got. There are different barriers and bonuses planted in between the maze. Tackling with barriers and grabbing more bonuses player has to reach the end. Player who reach the goal first wins the game.

Game Play

				End
	2			
1	3	6		
	4			

				End
	2			
1		6		
				
	 4			
Start				

Player should start the game from the start point. Player has to move to move to places as dice rolls. Each tile will have a number at the corner from 1-6. Based on the number on the tile and number on dice player has to move.

				End
	2			
1	3	6		
	4			

Player can move horizontal and vertical to adjacent places.

First the player has to roll the dice and if he gets any number on the dice which is adjacent to him/her horizontally or vertically, player can move to that place.

Suppose at start player gets 4 on a dice then player has to move to the tile having 4. So player will move horizontally. Now next player moves gets 1 on dice so player will move vertically to the tile having 1 at the corner. If the player gets the number which is not adjacent to them horizontally or vertically player has to skip the turn and pass it to next player. Players can not move diagonally.

				End
	2			
 1	3	6		
	 4			

Elements included to enhance the game play

				End
				
				
				
Start				

 Speed Boat

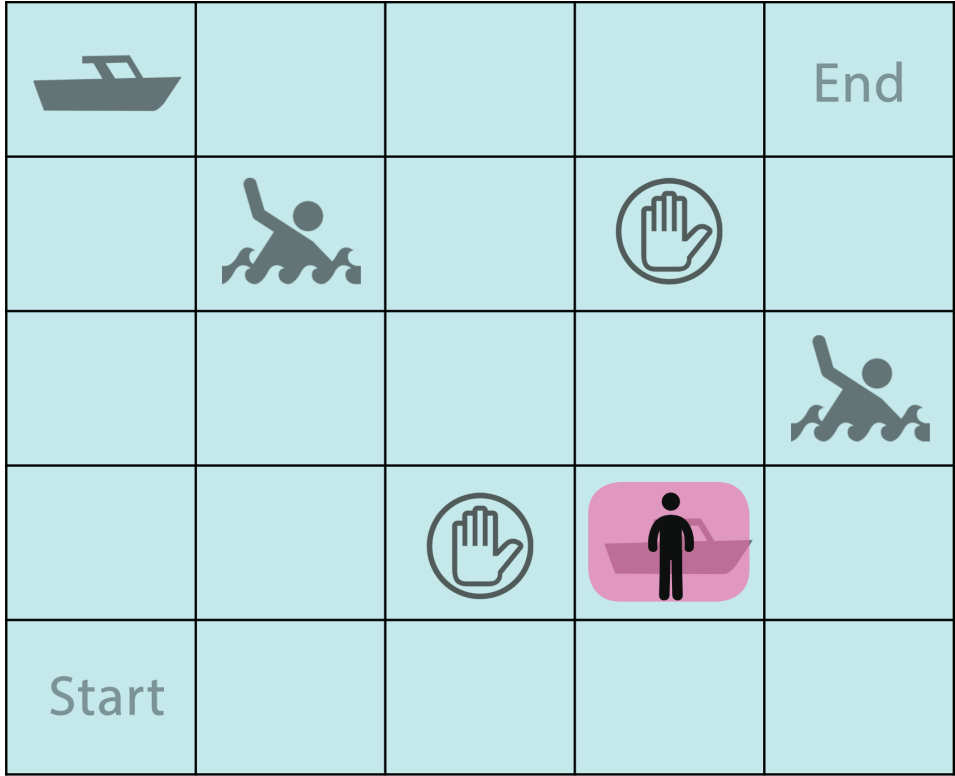
 Drown

 Block

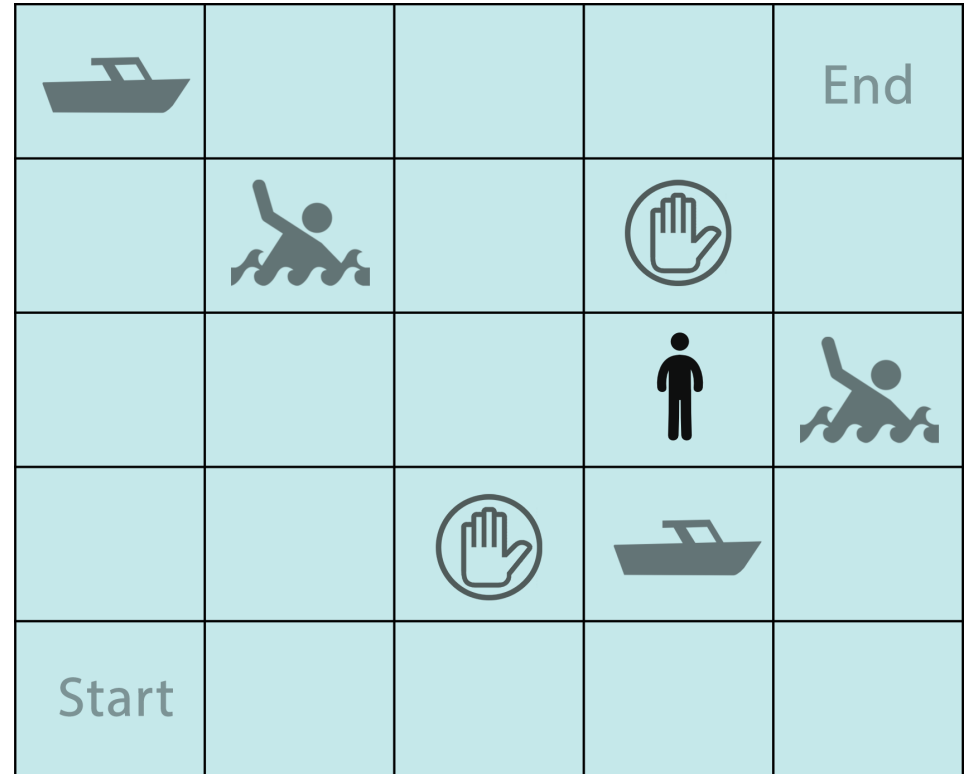
				End
				
				
				
Start				

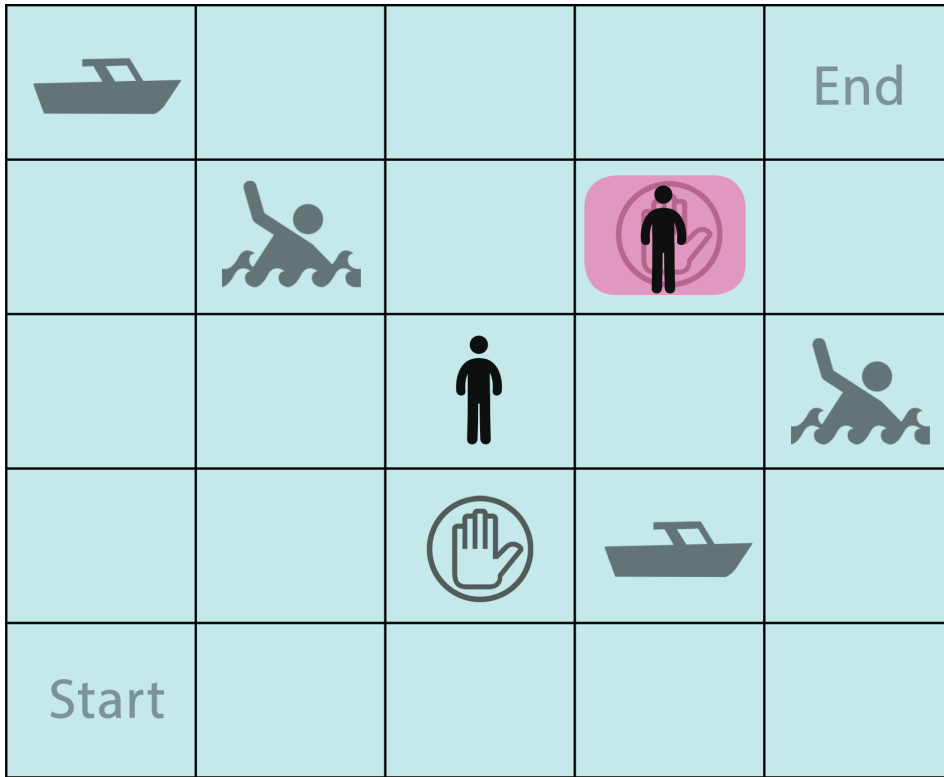
If player comes on drown tile,
player has to move down to
one line below as shown

				End
				
				
				
Start				

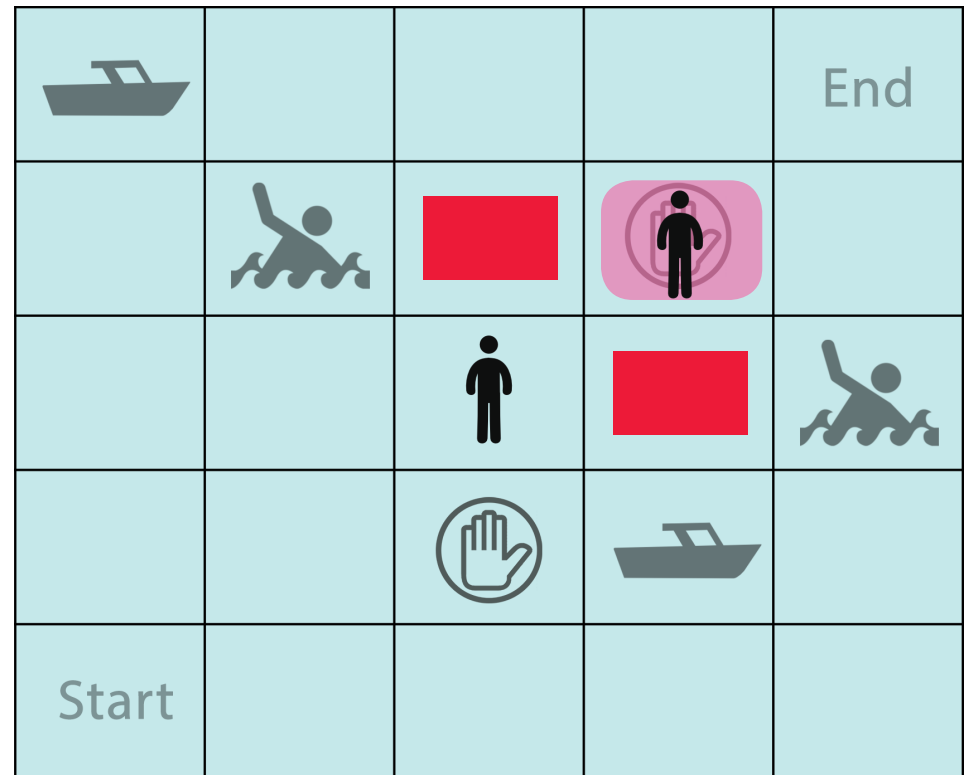


If player comes on Speed Boat tile, player has to move up to one line above as shown





If player comes on Block tile,
player can block any two of the
adjacent tiles of the opponent
player as shown



Puzzles given on the board

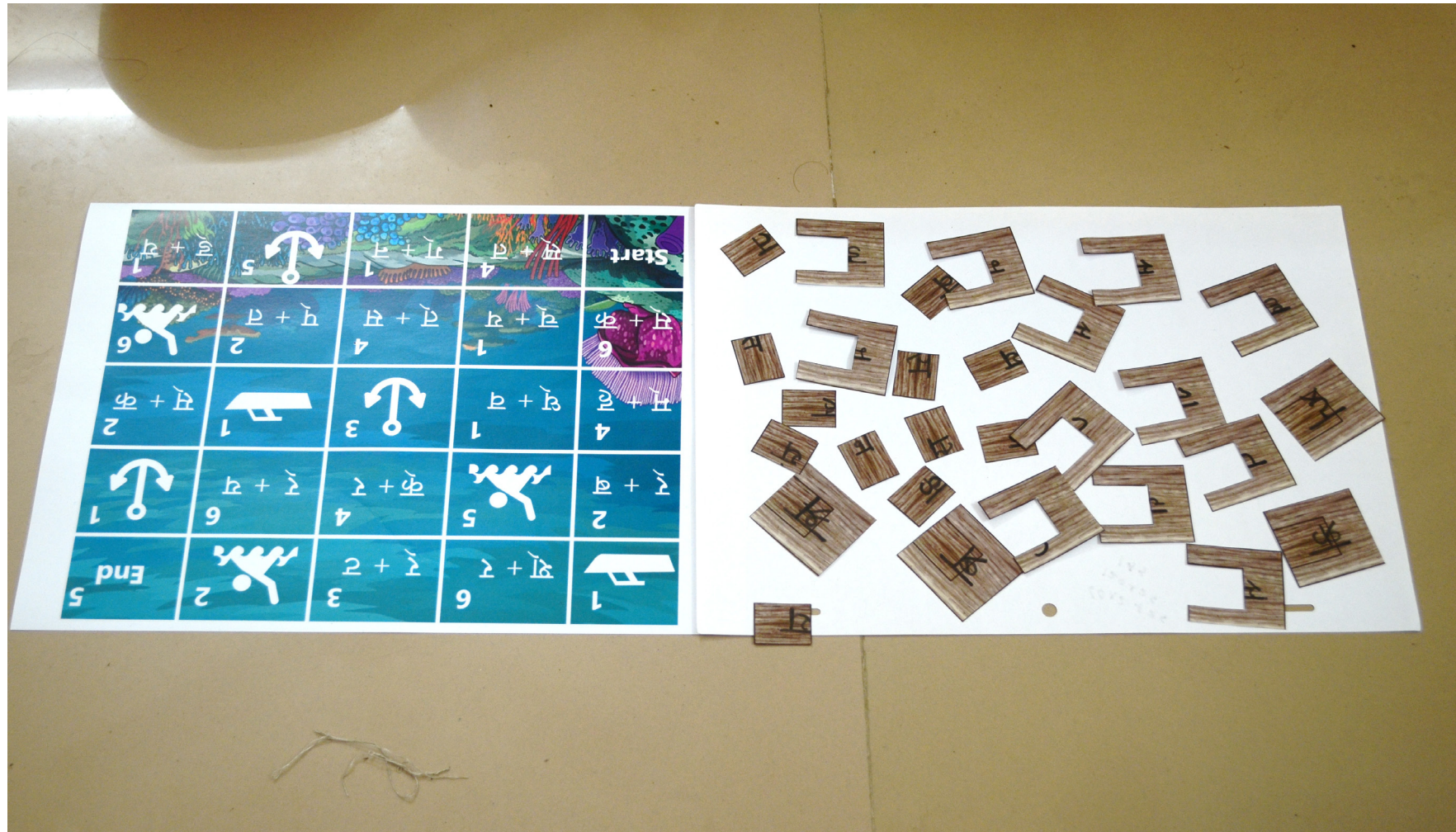


Variation in levels

Conjuncts which gets new form after combination are placed at the top for more difficulty

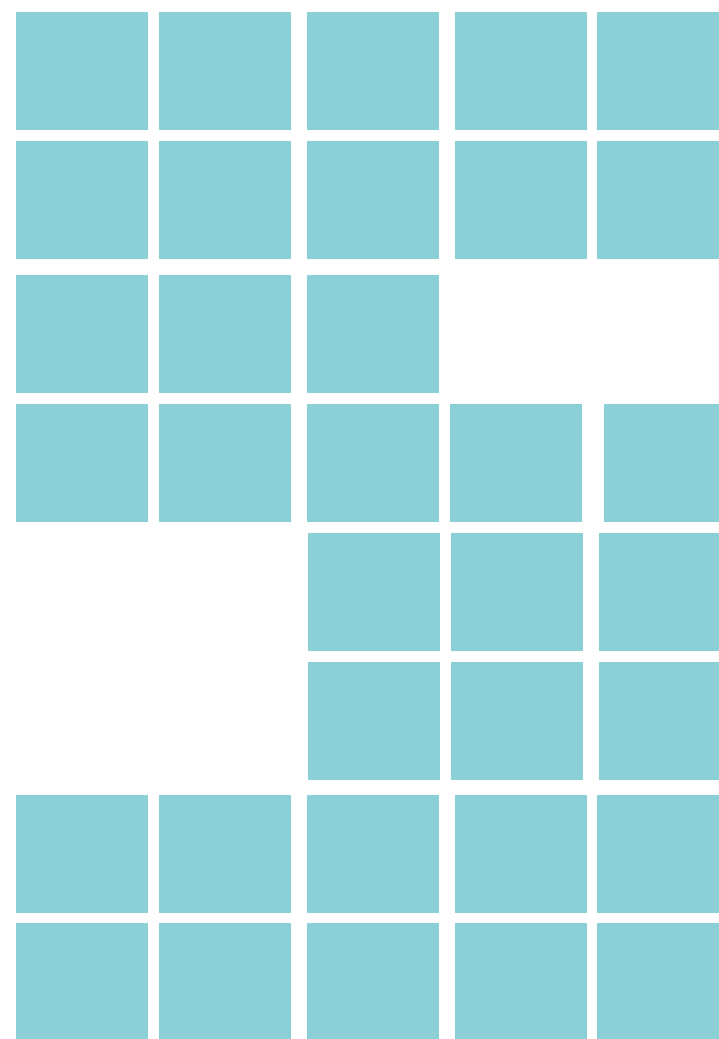
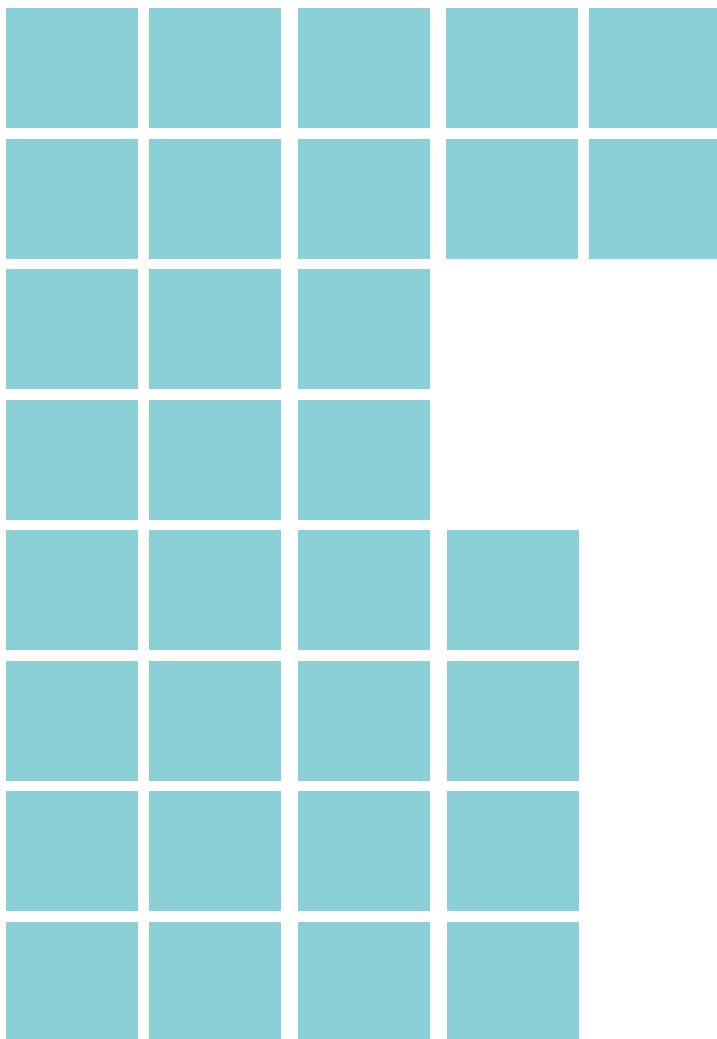
		ब्र		End
			र्य	
			ग्न	
Start	स्क			

Conjuncts which doesn't get new form after combination are placed at the bottom



Paper prototype of the game

Layout variations



Advantages

- Easy to play and understand
- Different levels can be integrated in game play
- Formation of conjunct gets clear while playing the game
- Storyline makes the game more interesting

Limitation

- In the game play, there was very less strategy involved in whole game play
- Winner or looser was mostly based on the luck of the player
- Less learning involved while game was played
- Less fun and repeat play was missing

Concept 4

Run the Wheel

No of player - 2 + player game

Objective of the Game:

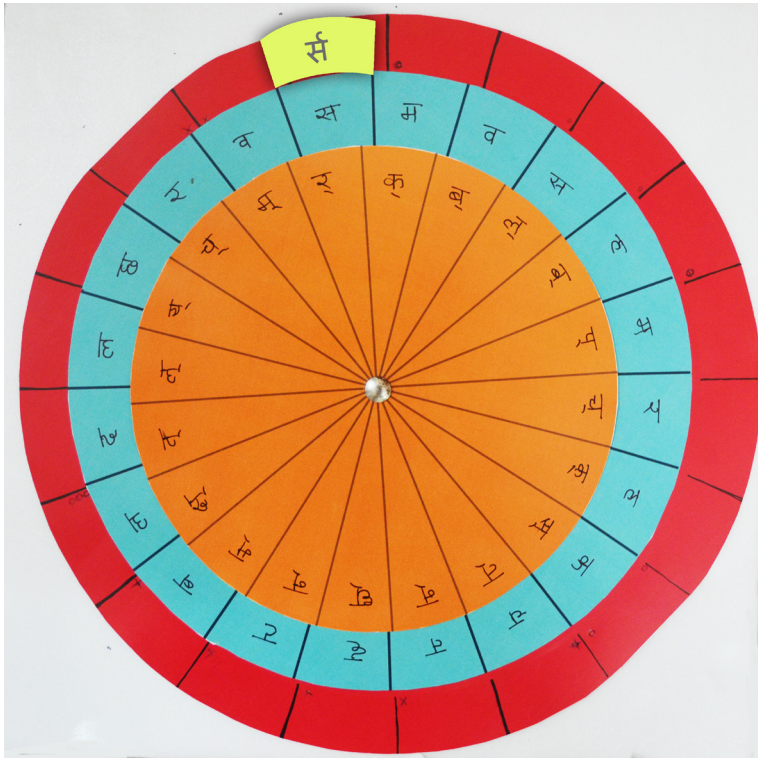
Find the combination on the wheel and answer the correct conjunct. Try to find the combination in consecutive places to block the opponent.

The game board was consists of three circles – Inner Circle with halant letters on it, Outer circle with consonants and outermost circle to grab the field by placing tiles after giving correct answer.

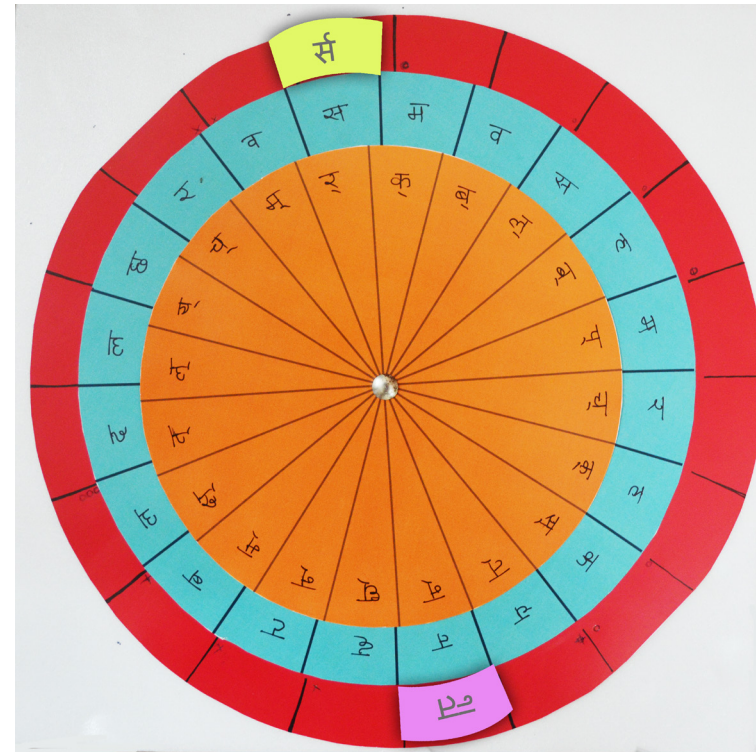
In this two player game player is supposed to run the outer wheel having consonant letters on it. As soon as the wheel is stopped child can search for combination of inner halant letter coinciding with outer consonant letters. If the player knows the answer of the combination of inner circle's halant letter with outer circle's consonant letter which is just in line with each other he/she can put the tile on it with of that particular combination(formed Conjunct). If the player gives correct answer he can put the conjunct tile on the outermost circle and grab that position. Now, next player comes and plays his game the same way.

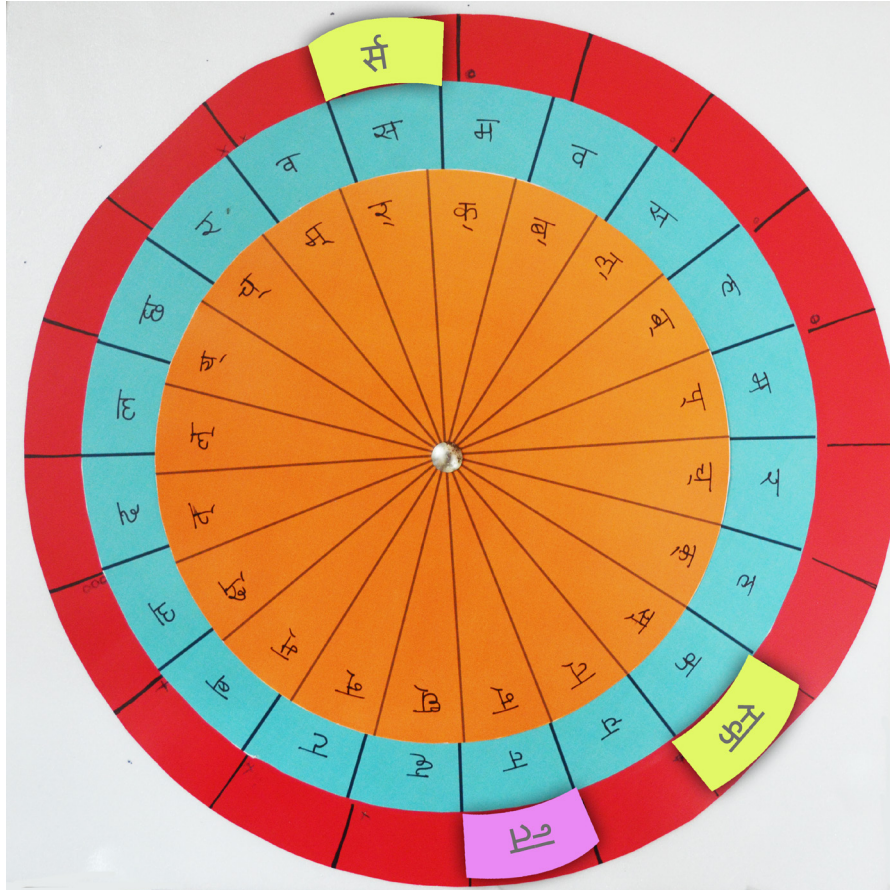
If the child gives three answers correctly for three conjuncts and if the position of those tiles are consecutive to each other, he/ she can block the opponent player to form consecutive fields.

The player who conquer more tiles at the end of the game wins the game.

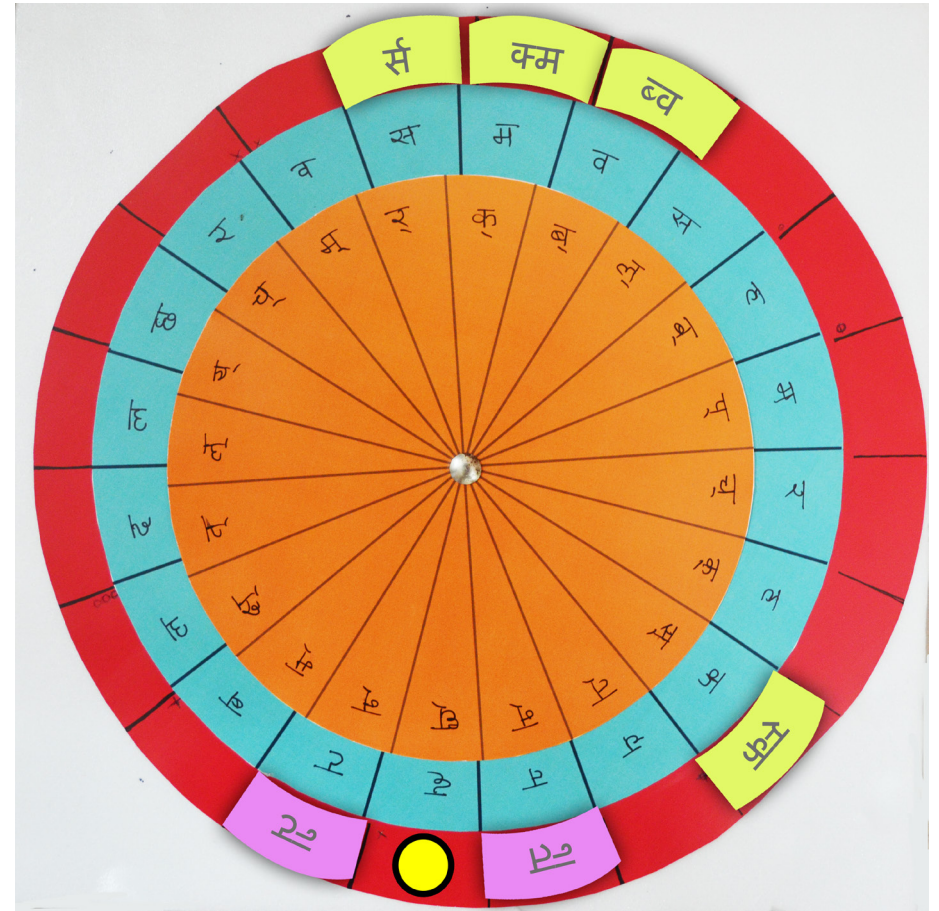


Now suppose player 1 runs the wheel. Once the wheel is stopped player will search for the combination of halant and consonant on the wheel coinciding with each other. Player 1 will answer the combination and put his tile on the combination containing that conjunct. For example if player knows the combination of र् + स = र्स he will put the tile of र्स on that position and conquer it. Now next player will run the wheel and search for the combination he/she can answer on the wheel. So if the next player knows the combination of न् + त = न्त he/she will put his tile containing the conjunct न्त. Player who conquer most number of tiles wins the game.



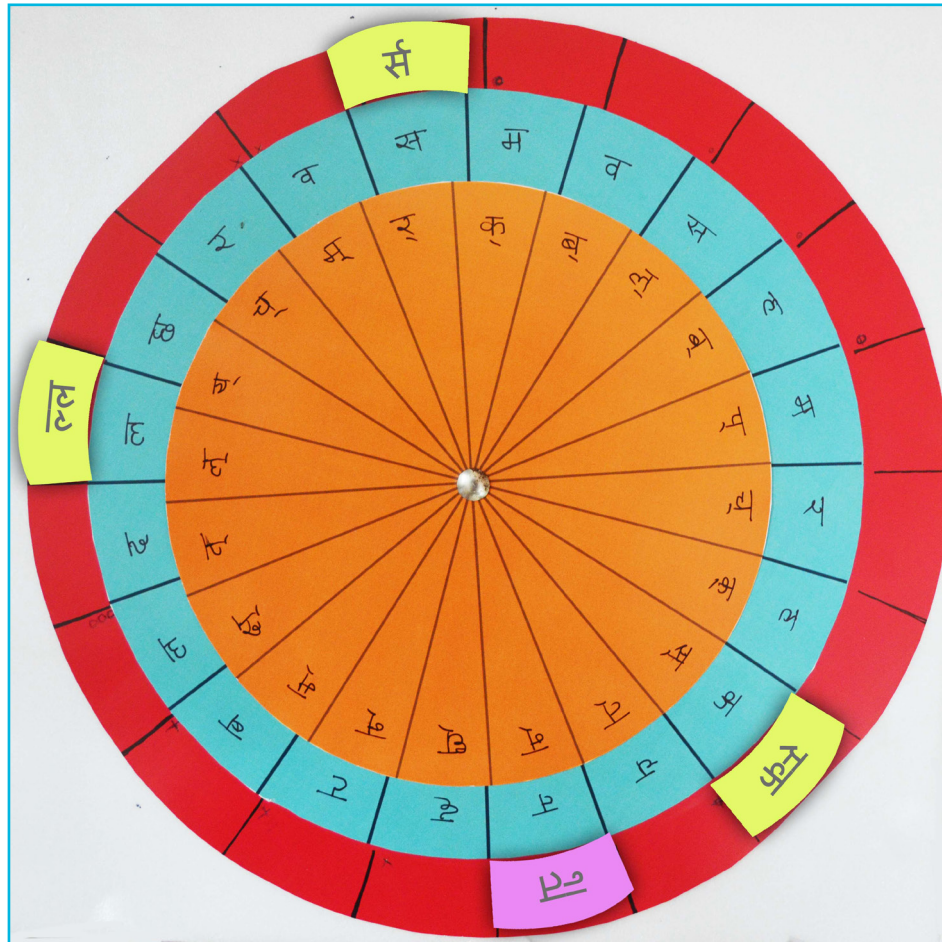


The player should try to conquer as more tiles as possible. Now if the player conquers three tiles in a row then he/she can get the chance to block other player to make three tiles in a row.



Player blocks the other player

Prototype and Testing



Paper prototype of the game



Evaluation with ASHA children

Advantages

- Can form as many combinations of the conjuncts as possible
- Can introduce different difficulty levels on different sets of wheels according to the user
- Tangible interaction makes the game more fun

Limitation

- It is difficult to get all valid conjunct combination on the wheel
- Strategy is involved based on the luck and knowledge of the user
- Less engagement and repeat play involved

Concept 5

Tic tac toe

No of player - 2 player

Objective of the Game

Solve the puzzle on the board by combining letters and form the conjuncts.

Try to make three conjuncts in a row, at the same time try to block the opponent.

The game was consists of 25 puzzles. The puzzles were arranged on the sheet of paper in 5 * 5 matrix.

The grid was provided on the sheet to form 3 * 3 matrix like jigsaw puzzle. The children were supposed to solve the puzzle like tic tac toe to form a three conjuncts in a row. But in tic tac toe the layout is fixed, but in this game the child can move the grid once he/she makes two conjuncts in a row.

Tic tac toe layout

क् + ट ●	ब् + ब ✕	ल् + ल	ब् + द	प् + ल
च् + छ ●	स् + व ✕	स् + ट ✕	त् + स	न् + म
ध् + य	द् + य	ध् + व	न् + स	फ् + र
न् + य	ष् + य	ज् + य	स् + त	म् + ह
त् + ह	क्ष् + म	ग् + न	ल् + ह	त् + त

Tic tac toe grid layout

Suppose, in first turn the player 1 gives correct answer for क् + ट = कट so he will put the his coin on the tile with puzzle क् + ट
Now, in second turn player 2 answers the puzzle ब् + ब = बब, so he will put his coin on that tile. In each turn player has to answer the puzzle and keep his/her coin on the tile to make three tiles (coins) in a row.

But in this game player can move the grid given for playing area. So suppose player 2 is about to make three coins in a row player 1 can move the grid wherever he/she wants and block the player 2. Same way player 1 can also block the player 1 any time in the game by moving the grid. So the rule is all time player should try to make three coins in a row in current grid area.

क् + ट ●	ब् + ब ✕	ल् + ल	ब् + द	प् + ल
च् + छ ●	स् + व ✕	स् + ट ✕	त् + स ●	न् + म
ध् + य	द् + य ●	ध् + व	न् + स ✕	फ् + र
न् + य	ष् + य	ज् + य	स् + त	म् + ह
त् + ह	क्ष् + म	ग् + न	ल् + ह	त् + त

Tic tac toe layout - after
changing the grid

Prototype and Testing



Paper prototype of the game



Testing with children

Advantages

- Strategizing is involved
- Can introduce difficulty levels according to users
- Cheap to produce and easy to carry
- Grid can be varied according to levels and number of conjuncts to be learnt

Limitation

- Less fun
- No luck factor
- Learning is limited
- Less chance of repeat play

Concept 6

Card Game

No of players - 2 players

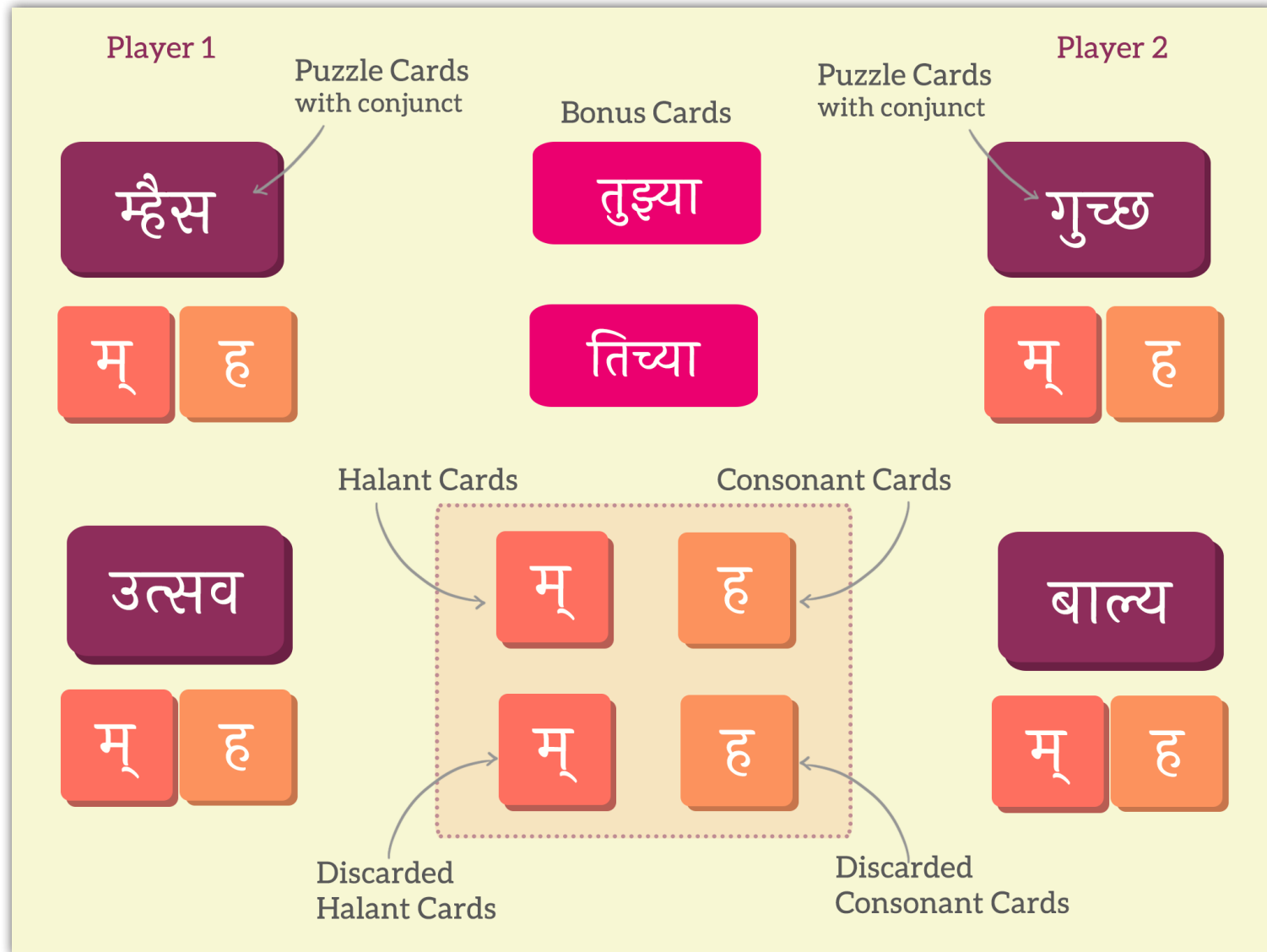
Objective of the Game

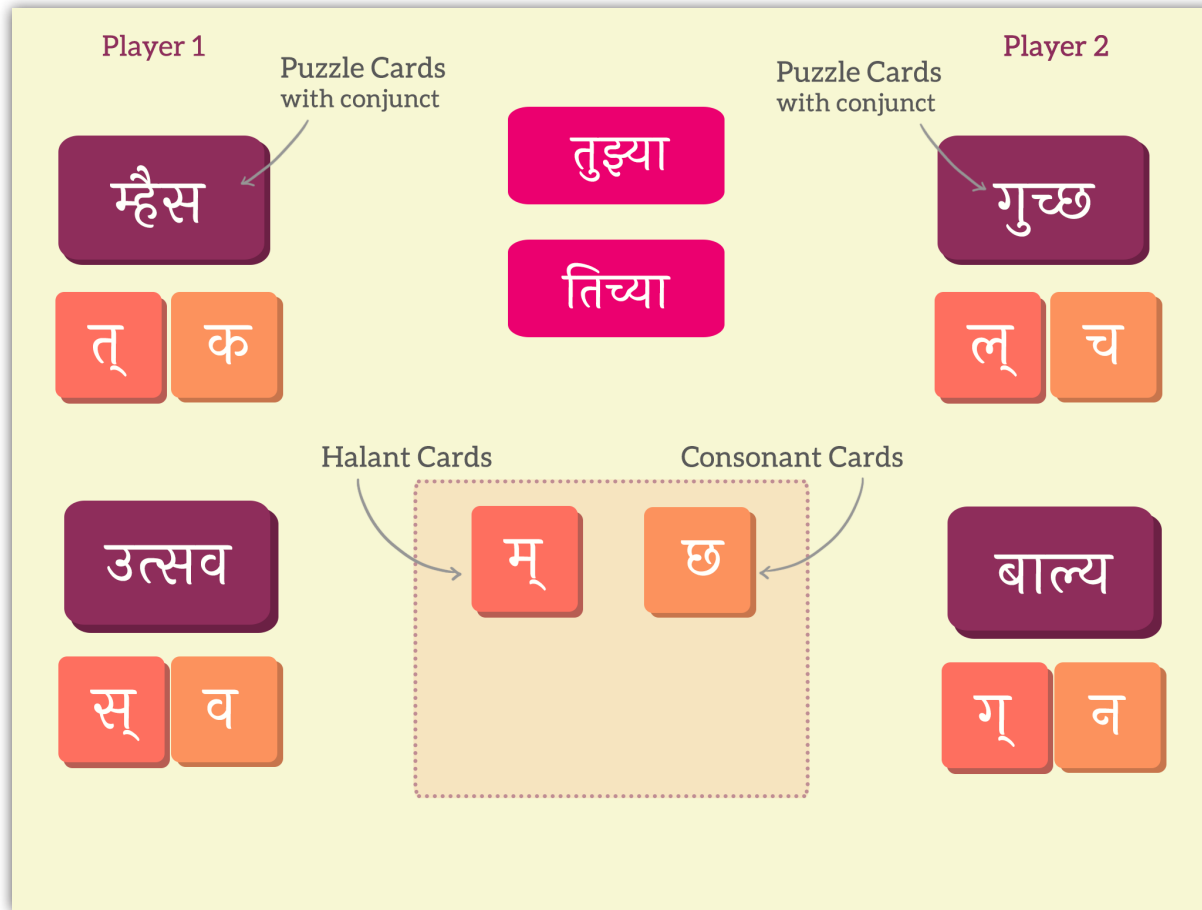
To make given pair of conjuncts from given set of cards.

Strategy - While playing the game children should try to build their own set of pairs of conjuncts; at the same time they should stop their opponent to form their pair.

The game consists of 4 puzzle, 2 puzzles are given to one player. The puzzle contains conjunct given on the card. Player will be given halant cards and consonant cards. Player has to take halant cards and consonant cards turn by turn to form a given conjunct. The player who finishes his/her pair first wins the game.

Game Board





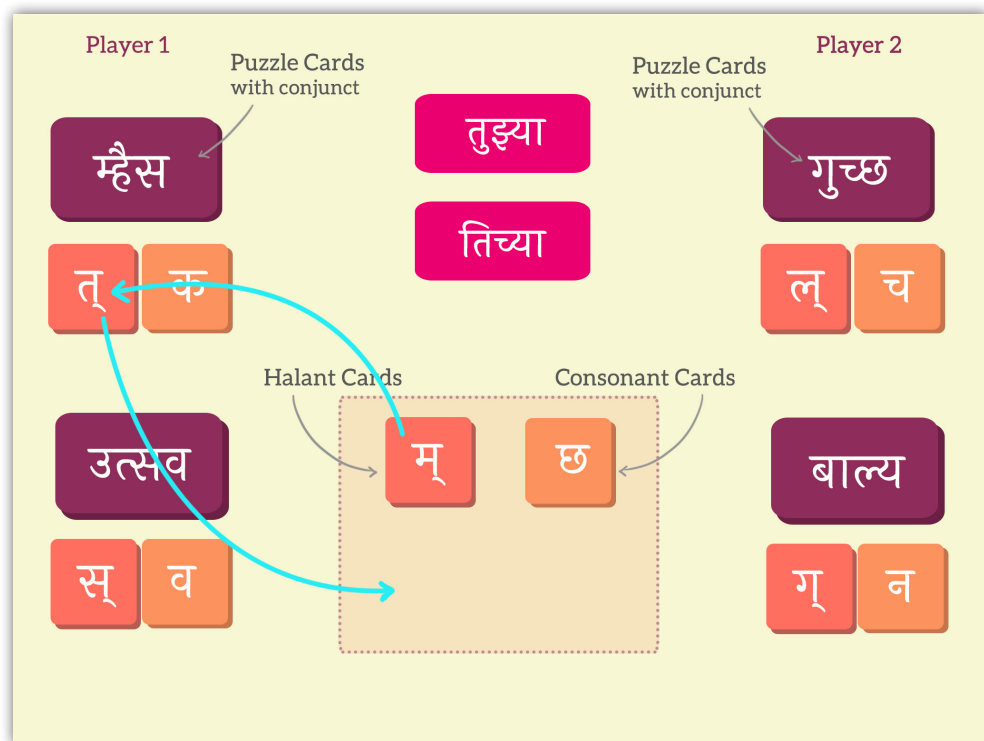
Initial arrangement of the game

Objective of the Game

Initially, two puzzle cards will be given to the each of the players. For e.g. - As shown in the Image Player 1 gets म्हैस, उत्सव and player 2 gets गुच्छ, बाल्य

Along with the puzzle cards each player will get two halant cards and two consonant card. Also, the pile of cards having halant and consonant will be provided on the board.

The objective of the game is to recognise the conjunct in the given pair of Puzzle of cards and make that conjunct with the help of halant and consonant cards given to players.



Player replaces halant card with another halant card from given pile of halant card

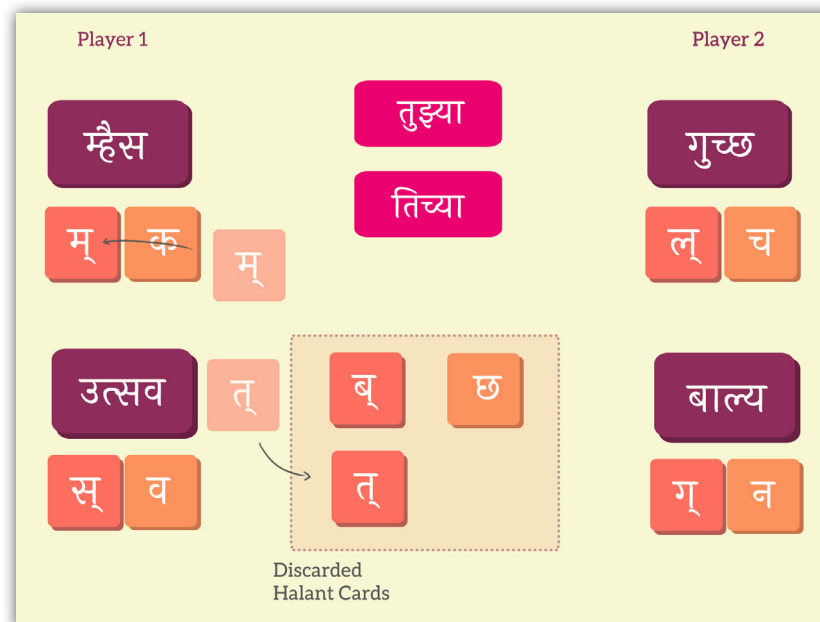
Step 1

Player1 turn

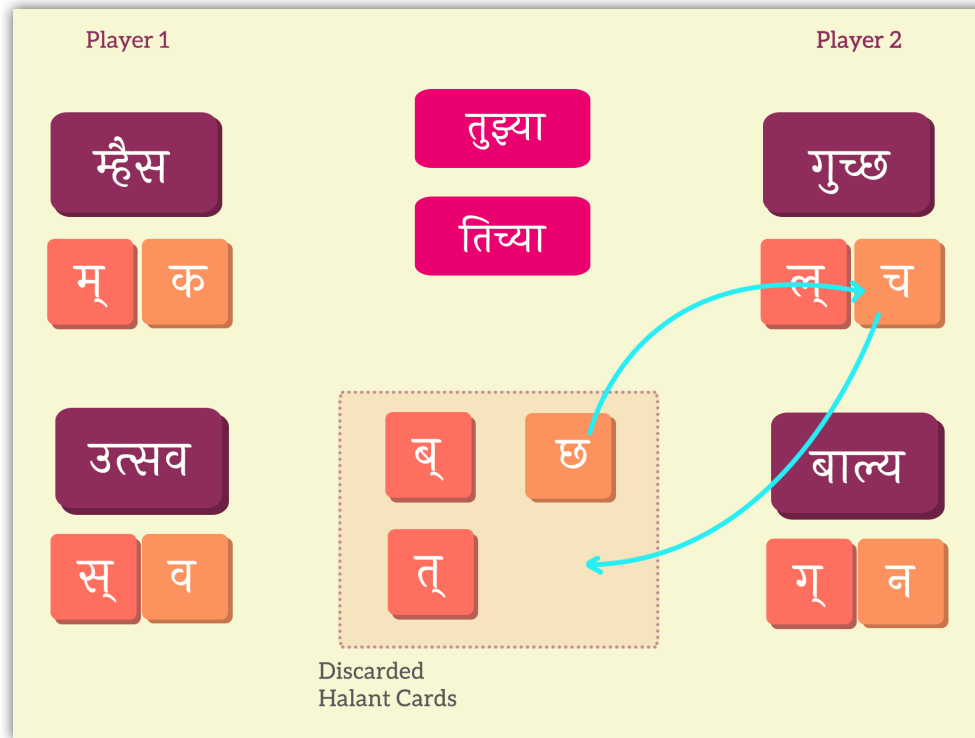
Suppose game starts with the player1's turn, so the objective of the player1 is to make his/her pair of conjuncts given in Puzzle Cards i.e म्हैस (म्ह), उत्सव (त्स)

Player 1 will try to make these conjuncts with the help of given halant and consonant cards. In each turn player can choose to make any word from the given puzzle which is easy to complete or has more chance of completion.

Suppose in his/her turn, player1 doesn't want त् card given to him/her. And to make म्हैस (म्ह) he/she wants म् and ह. So he/she will see the halant and consonant pile given. As he/she can take any of the the top most card from halant or consonant pile of card and he/she replaces त् card with म् card and keep त् card on the board as discarded card. He/she can do the same for consonant card in his/her next turn. Only rule player has to follow is - he/she can replaces same type of cards with each other - halant with halant and consonant with consonant.



Player puts the replaced card on the board as discarded card.



Player2 replaces consonant card with another consonant card from given pile of consonantcard

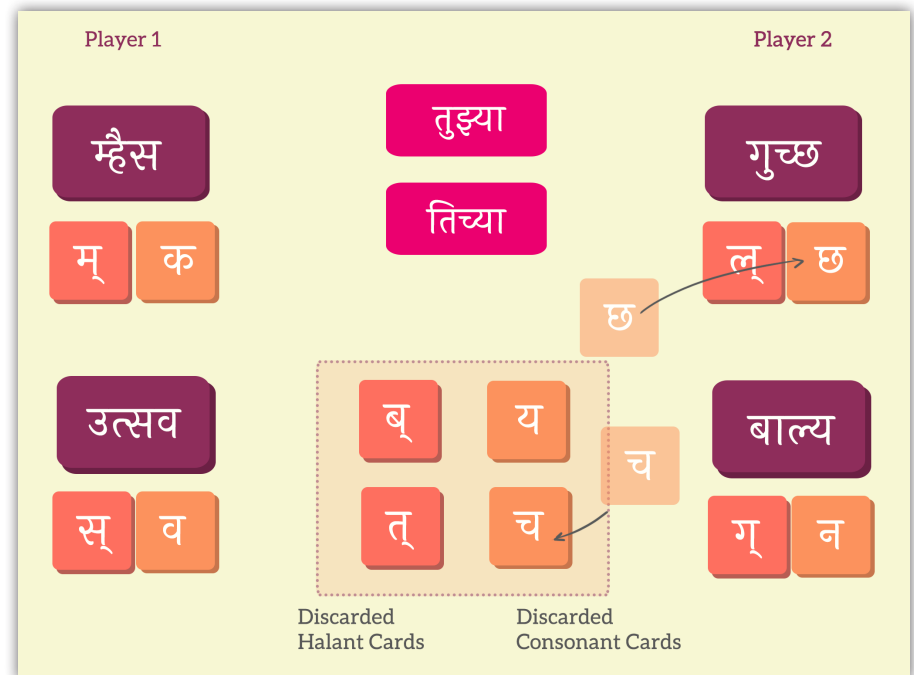
Step 2

Player2 turn

Now turn will be passed to Player2. The objective of the player2 is to make his/her pair of conjuncts given in Puzzle Cards i.e गुच्छ (छ), बाल्य (ल्य)

To make his pair player2 will look at halant card and consonant card pile and has to make decision which card he wants given set of halant or consonant piles. He/she can discard his card with halant or consonant card and replace it with given any of cards from pile.

To make his pairs गुच्छ, player needs च् and छ, so he will take छ the top most card from the consonant pile and replaces च with it. The player2 will put च as discarded card on the board.





Player can take cards from discarded pile, and replaces his card with that card.

As player can take cards from discarded pile in his turn both, original pile and discarded pile is kept in same area on board

Step 3

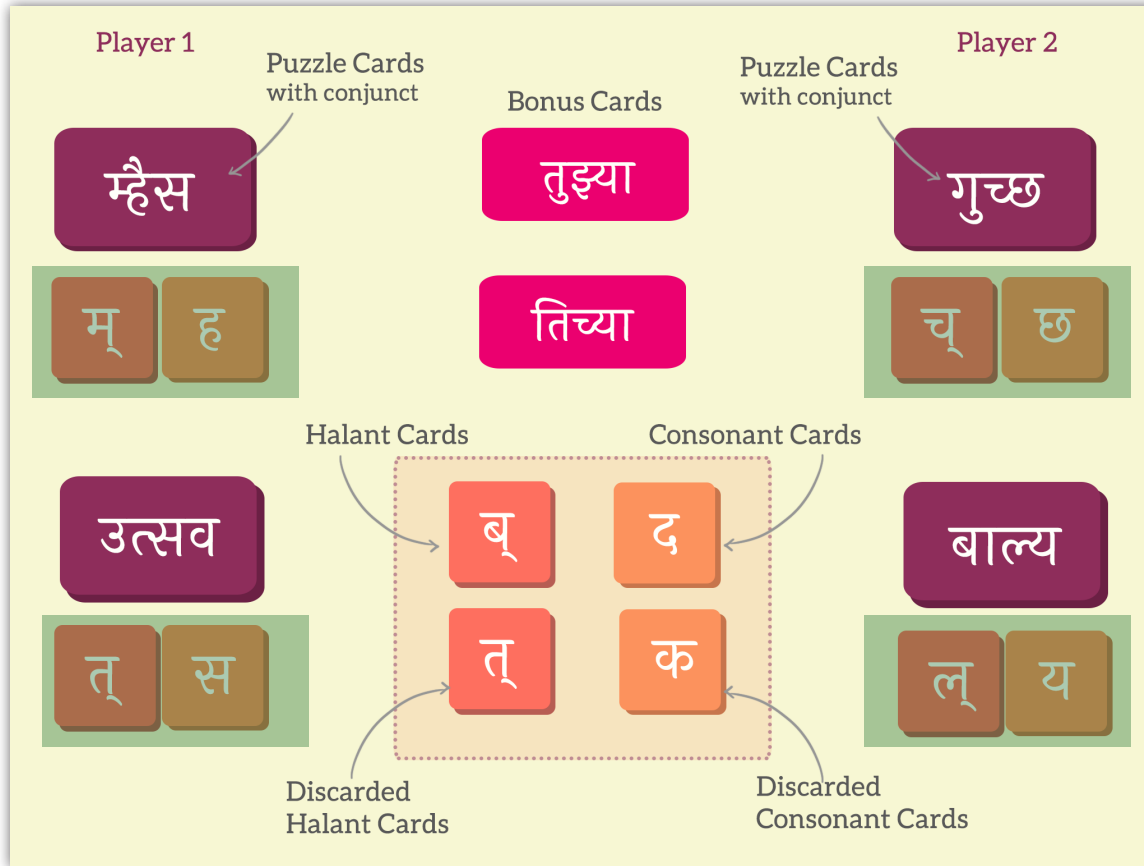
Player1 turn again

Now turn will be passed to Player1. If player 1 doesn't want any of his halant or consonant card he can replace his card with halant or consonant card from given pile of card. Now he can take card from discarded pile too.

Suppose, Player1 doesn't want स् halant card, he can take any of the top most halant card from the halant pile and discarded halant cards. Player 1 has two options ब् and त् to replace स्.

So Player1 takes त् from the discarde pile to make pair for उत्सव which includes त् and स. He puts स् on the board as discarded card.





Player who makes the pair of correct halant and consonant card for given puzzle of cards wins the game

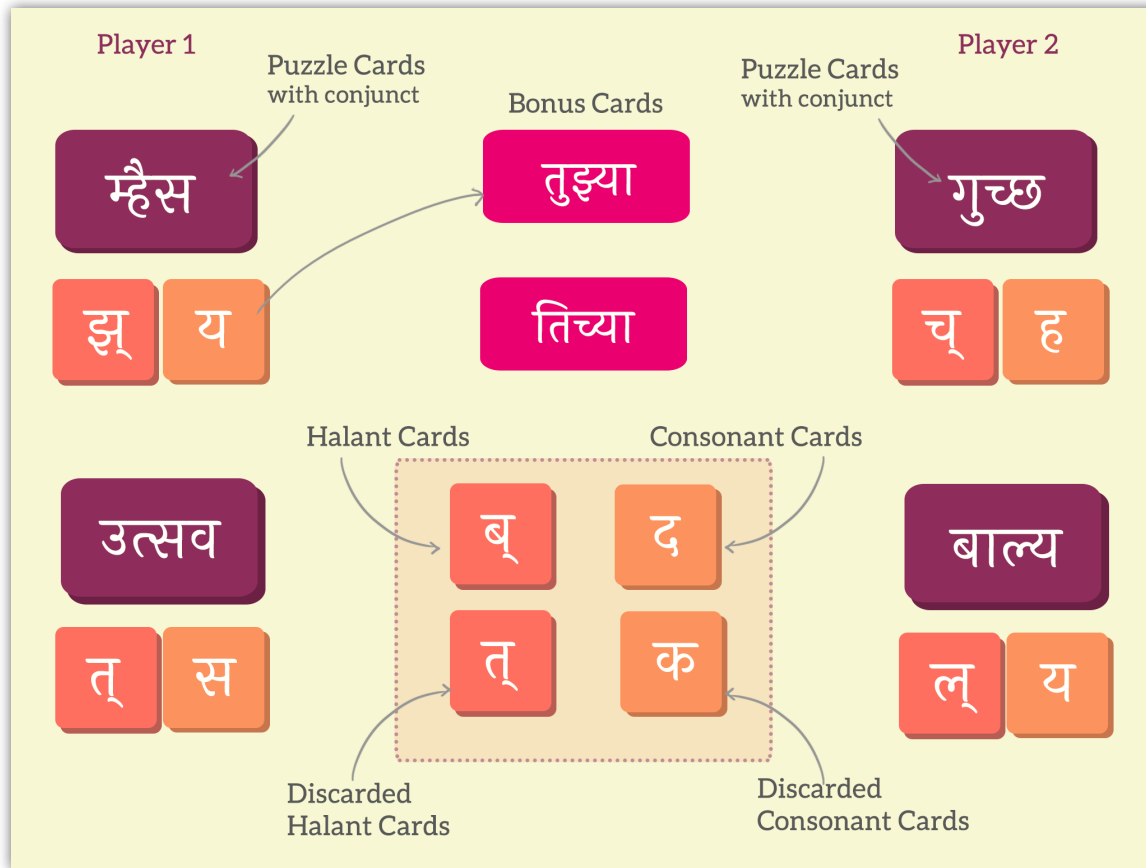
Step 4

Player2 turn again

Player2 can do same as player1. He can replaces any of his halant or consonant card from any of the topmost halant or consonant pile of card given the condition that same type of cards can be replaced. He can also take halant or consonant card from discarded pile of card.

Both the player will keep on taking and discarding the cards till they complete the correct pair of halant and consonant card for the given puzzle of cards.

Player who makes the pair first wins the game. As it is a open card game player can keep track of each others card and try to block opponent



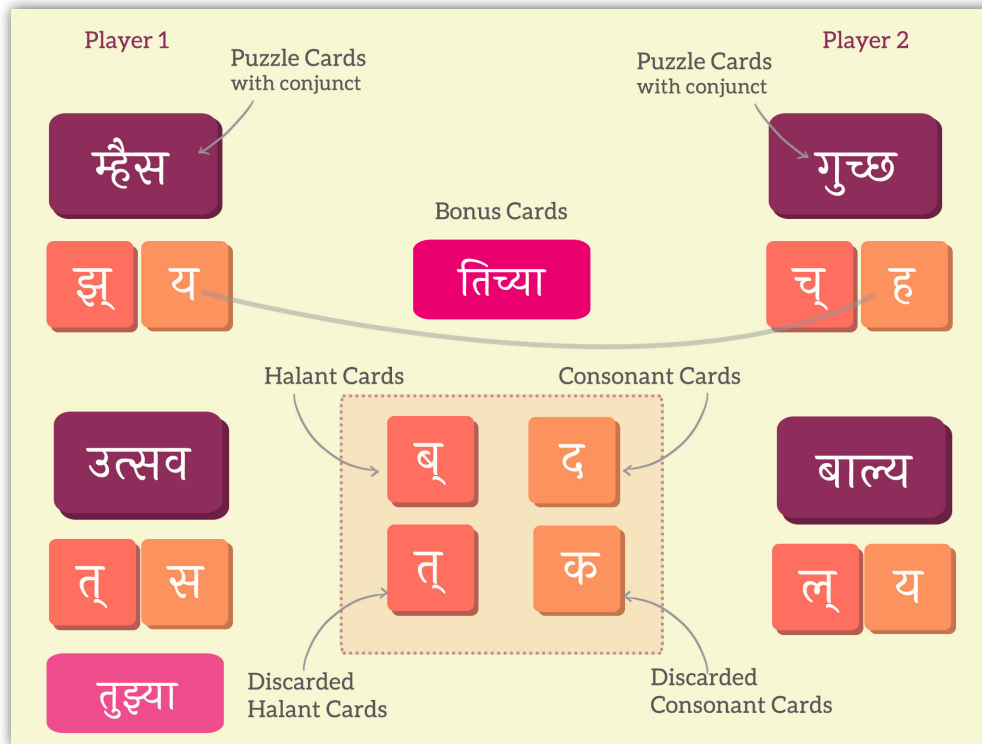
Player who wins the bonus card can keep the bonus card with him, and use it whenever he wants.

Role of Bonus card

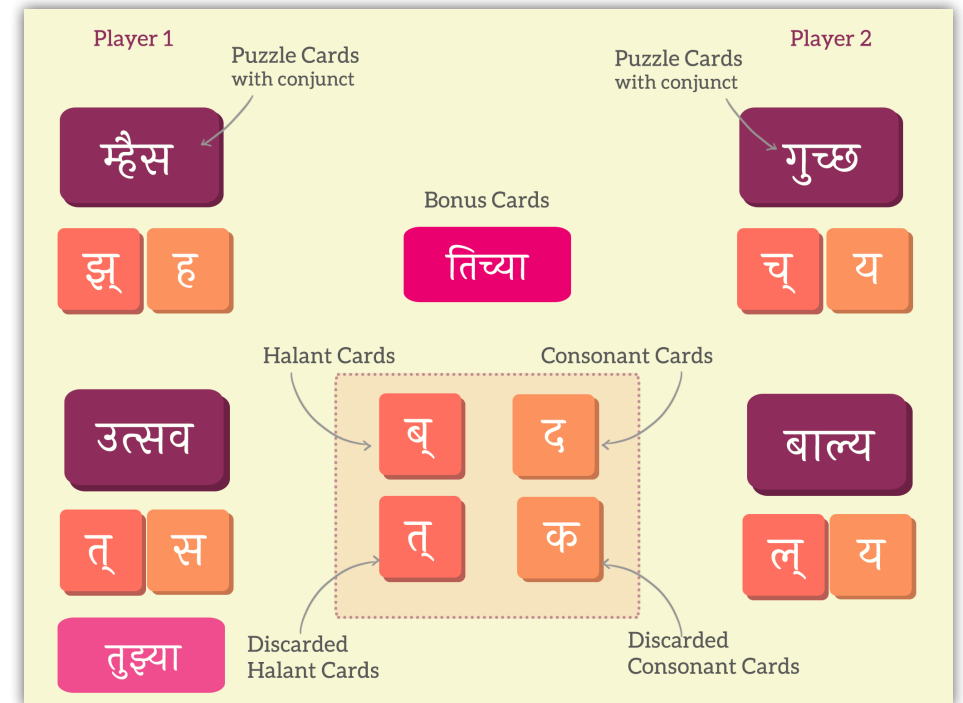
While playing the game, if player makes the halant and consonant card pair contained in Bonus card, he wins the bonus card.

For eg.- If player1 makes the pair of halant and consonant card झ् and य which is there in bonus card तुझ्या, he wins the bonus card. Now player1 can exchange any of the player2 card any time in the game given the condition that exchanged card should be of same type. Halant card can be exchange with halant card and consonant card can be exchange with consonant card.

For e.g. - Player 1 wins the bonus card and then he wants player2's ह card, he can exchange his झ् card with player2's ह card



With the help of Bonus card, player can exchange his card with opponent player anytime in the game



Preliminary testing

Paper prototype of the initial concept was tested with the user. The targeted users were 2nd std children of Marathi medium



Paper prototype of the game



Testing with ASHA children

Advantages

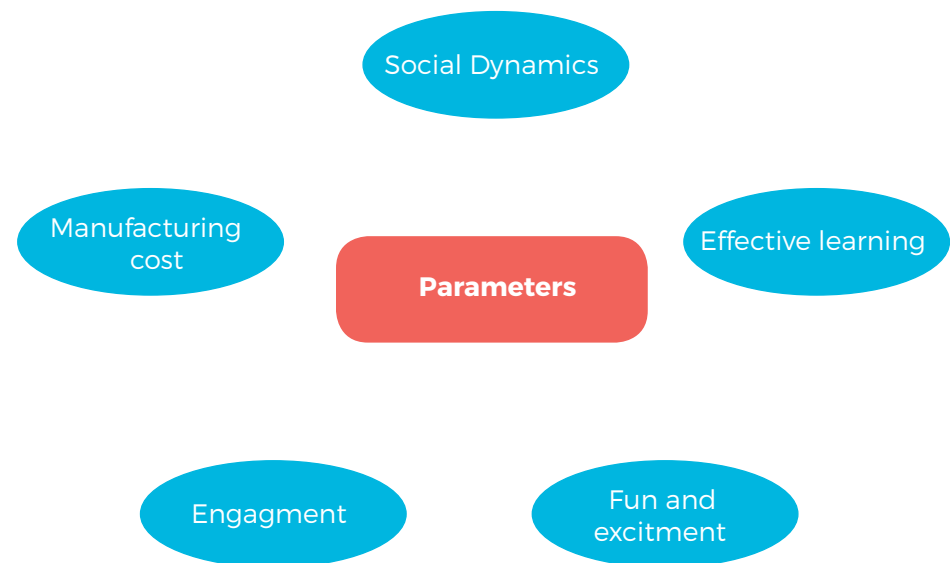
- While playing the game children were keeping track of opponents and try to understand their pair of conjuncts
- Exchanging of cards was making the game more interesting and fun
- Strategy was involved in game to block the opponent
- Luck involved in game was creating uncertainty in game play to keep the game play exciting
- Different levels can be introduced in the game play to increase difficulty level in the game

Limitation

- It was confusing for children to understand where to keep discarded card and which card to pick from four cards
- The horizontal arrangement of the cards were confusing for children to understand sequence of halant and consonant cards
- Children were taking too much of time while choosing or discarding the card which was making the game lengthy

Finalizing the Concept

Main parameters taken into consideration while deciding the final concept



Based on the pros and cons and time constrain, card game was finalised as final concept with few iterations

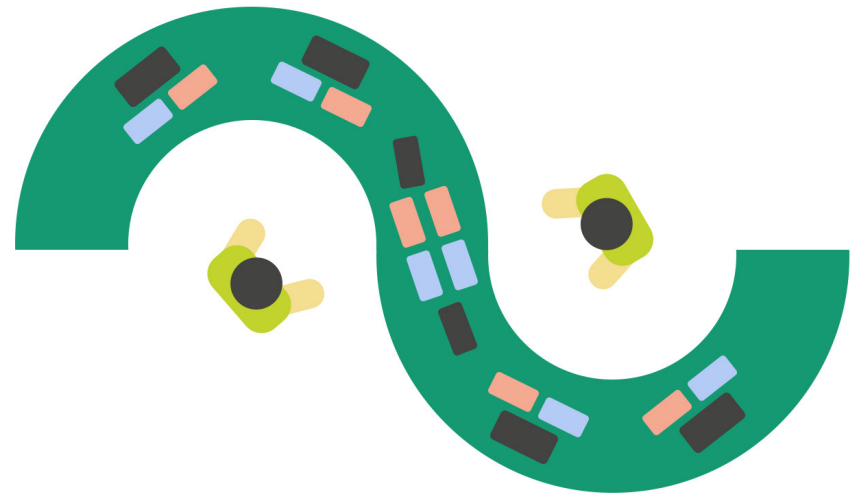
Layout of the Board Game

While designing the layout of the board game few factors were taken into consideration

1. Ergonomics
2. Area of reach
3. Visibility of the players and opponents play area
4. Arrangement of cards on game board
5. Area to move

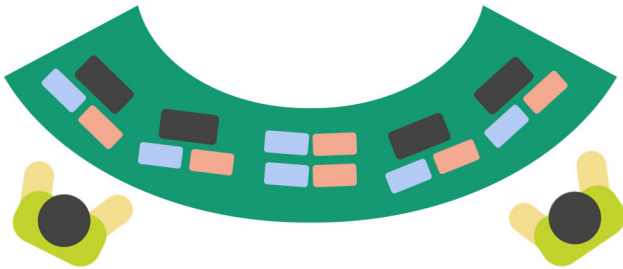
Variations in Layouts

S layout



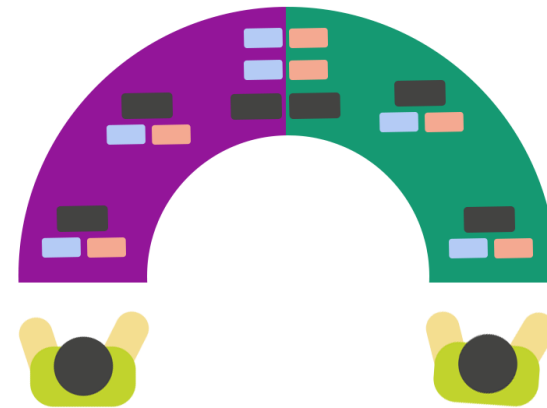
S shape layout - It provides the accessibility to the player to reach his own cards and see opponents cards at the same time.

Arc layout1



Arc shape layout - Same as S shape layout it provides the accessibility to the player to reach his own cards and see opponents cards at the same time. But the area of the player to move around is restricted

Arc layout2



In this layout player can play around the inside of the arc as shown above. In this layout, the position of the players will be fixed and they can play on one side of the the arc

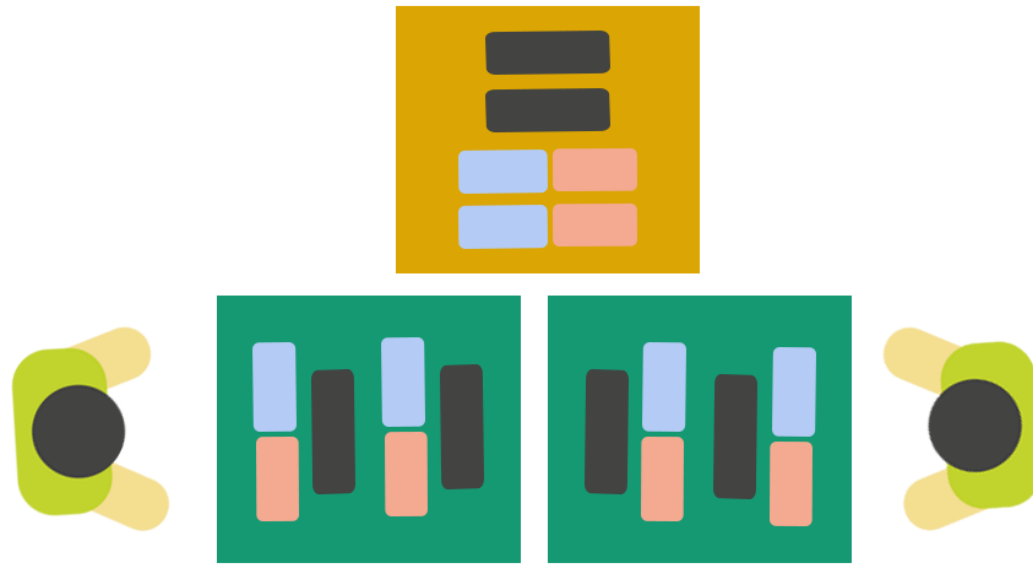
Final Layout -

Square Layout



In this layout player can have his/her own play area. The layout will be of the square shape so that it can fix and move around in any position easily. Player can have his own space plus he/she can easily see the opponents play area according to the given arrangement. User can customise their own game board according to the space provided.

Square Layout face to face arrangement



Player can keep the board according to the area plus they can move the arrangement face to face or on one side according to their comfort.

Levels of the game and frequency of conjunct

Different levels of the game were designed according to the complexity of the conjuncts. The word taken from the Swarchakra Corpuse based on the frequency of the conjuncts.

Top 100 words were selected from the list of the conjuncts

Conjuncts	Conjunct freq	Words				Complex Words
म्ह	6245	म्हणून	म्हैस	म्हणाले	म्हणजे	प्र
च्य	5825	तिच्या	तुमच्या			त्र
प्र	5485	प्रकाश	प्रगती	प्रभात		दं
त्य	4565	उत्सव	सत्य	नित्य		श्र
इय	3597	माझ्या	तुझ्या			र्व
छ	3458	गुच्छ	शुभेच्छा	इच्छा		क्त
त्र	3076	मित्र	कुत्रा	संत्र	रात्र	ग्र
ल्य	2967	कल्याण	बाल्य	सौल्युशन		र्य
दं	2845	मर्द	दर्द			च्य
श्र	2214	श्रवण	श्रमिक			घ
र्व	2010	सर्व	गर्व			र्ष
स्त	1863	दोस्त	मस्त	पुस्तक		र्थ
क्त	1656	फक्त	भक्त	वक्ता		क्र
व्ह	1642	नव्हे	मेव्हेणा	केव्हा		श्व
त्त	1488	दत्त	उत्तर	उत्तम		र्म
स्व	1374	स्वर	स्वभाव	रस्व		फ्र
न्य	1184	धान्य	वन्य	शून्य		र्च
ग्र	1183	ग्रहण	ग्रह	ग्रामीण	गुप	द्र
क्य	1165	वाक्य	शक्य	अशक्य		ट
ध्य	1086	ध्यास	मध्य	अध्यक्ष		द्व
र्य	988	सूर्य	आर्यन	कार्य		र्ग
च्य	988	गौऱ्या	वाऱ्यावर	कोऱ्या		डं
व्य	903	काव्य	भव्य	व्यथा	व्यवहार	ह्य
घ	895	उघा	विघा	येउघा		श्र
र्ष	879	वर्ष	हर्ष			र्श
ष्य	813	आयुष्य	मनुष्य			द्र
र्ण	688	वर्ण	पूर्ण	भावपूर्ण		म्र
ण्य	685	अरण्य	पुण्य			र्क
न्ह	656	उन्ह	पुन्ह	गुन्ह		भ्र
क्क	592	पक्क	चक्कर			र्प
र्थ	567	अर्थ	पार्थ			इ
स्क	560	नमस्कार	भास्कर	मस्करी		श्च

ज्य	554	राज्य	ज्यात		ब्र
क्र	549	क्रम	विक्रम	चक्र	
क्ट	517	डॉक्टर	विस्कटलेले		
श्व	516	विश्व	श्वास		
र्म	514	कर्म	धर्म		
द्ध	507	शुद्ध	वृद्ध	विरुद्ध	
फ्र	506	फ्रेश	फ्रीज		
प्प	503	बाप्पा	गप्प	शप्पथ	
क्षम	487	लक्ष्मण	लक्ष्मी		
घ्य	474	घ्यायला			
र्च	462	चर्च	खर्च		
ग्र	451	लग्न			
व्य	438	मोव्या	डोव्यात		
ष्ट	437	कष्ट	गोष्ट		
क्स	433	विक्स	सिक्स		
द्र	349	चंद्र	गर्द		
प्ल	304	रिप्लाय	प्लस		
र्ट	303	शर्ट	कोर्ट		
ग्य	275	योग्य	भाग्य	आरोग्य	
त्त	260	पत्नी			
ट्ट	258	कट्टा	घट्ट		
च्च	247	कच्च	बच्चन		
ल्ल	247	गल्ला	पल्लवी		
द्द	239	बद्दल	बहाद्दर		
ब्द	235	शब्द			
न्न	233	अन्न			
न्म	228	जन्म	सन्मान		
ख्य	225	मुख्य	संख्या		
र्ग	220	दुर्ग	मार्ग		
ई	210	काई	बोई		
ह्य	208	ह्याचा	ह्याला		
स्ट	191	पोस्ट	स्टेशन	ऑगस्ट	
स्थ	180	स्थळ	स्थान	अवस्था	

स्प	179	वनस्पती	स्पंदन		
प्त	173	प्राप्त	साप्ताहिक		
ल्प	165	कल्पना	कल्पेश		
भ्य	157	अभ्यास			
ल्ह	151	कोल्हा	मल्हार		
र्फ	138	बर्फ			
श्र	136	प्रश्र			
स्र	131	स्रान	स्रेह		
ड्य	129	वेड्या			
श्य	126	आवश्यक			
प्य	116	प्यायला			
ट्य	112	वाट्या	छोट्या		
र्श	105	दर्शन			
ठ्य	99	मोठ्या	कोठ्या		
ळ्य	96	मोळ्या	गोळ्या		
ट्र	96	ट्रक	ट्रेन		
त्व	89	तत्त्व	महत्त्व		
म्र	89	नम्र	विनम्र		
र्क	88	संपर्क	मार्क		
गण	83				
ष्ण	71	कृष्ण			
र्ज	67	कर्ज			
र्ध	66	अर्धा			
त्स	64	उत्सव			
श्म	63	काश्मीर			
गल	62	ग्लास			
त्क	61	सत्कार	उत्कर्ष		
ठ्ठ	59	विठ्ठल	गठ्ठा		
ज्ज	57	आज्जी	मज्जा		
ण्ण	56	आण्णा			
न्व	52	अन्वेषण			
न्द	52	सुन्दर	हिन्दू	धन्वंतरी	
ढ्य	47	एवढ्या	वेढ्यात		

स्य	47	रहस्य	हास्य
य्य	45	अय्या	आय्यंगार
स्म	44	स्मरण	स्मोक
न्ट	43	पिन्टु	
भ्र	42	भ्रमण	शुभ्र
फ्ट	38	गिफ्ट	
ष्ठ	35	विष्ठा	कनिष्ठा
त्व	34	सत्व	
र्ल	33	दुर्लक्ष	
र्प	31	सर्प	अर्पण
घ्न	31	विघ्न	
व्व	31	व्वाह	
ध्व	30	ध्वज	ध्वनी
क्ष्य	28	लक्ष्य	
थ्व	28	पृथ्वी	
ब्ब	26	तब्बल	
क्ल	25	क्लास	
खर्	25	मुखर्	
ड्र	24	ड्रेस	
स्ल	24	इस्लाम	
न्ड	23	एन्ड	
ब्य	23	तब्येत	
श्च	23	निश्चित	
म्म	23	मम्मी	
ल्ड	23	कोल्ड	
न्स	22	चान्स	
ड्ड	21	खड्डे	
ब्र	21	इब्राहम	ब्रेक

Levels of the game based on the frequency of conjunct and its difficulty.

Level 1

Simple conjuncts without any form change

म्हैस, तिच्या, उत्सव, तुझ्या, गुच्छ, बाल्य

In these words the halant and consonant comes together and form a conjunct which doesn't take any new form or arrangement. So just by looking at it user can understand which two letters are combined.

Level 2

Simple conjuncts with vertical and horizontal arrangements

पक्का, विठ्ठल, बदल, पन्नास, गड्डा, गप्प

In these words the halant and consonant comes together and form a conjunct which doesn't take any new form but there might be a change in the arrangement of the letters. For e.g.- **विठ्ठल, बदल, पन्नास** where the arrangement of the letters in the conjunct is either vertical or horizontal. Based on the arrangement the form of the conjunct also changes.

Level 3

Simple conjuncts with halant without any vertical line

मोळ्या, एवढ्या, पाट्या, वहा, घड्याळ, काठ्या

In these words the halant and consonant comes together and form a conjunct where form of the halant letter doesn't change and it gets attached with the consonant as complete letter.

Level 4

Conjuncts with form change

भक्त, विद्या, विश्व, पद्म, विरुद्ध

In these words the halant and consonant comes together and form a conjunct where form of letter changes and forms new conjunct.

Level 5

Conjuncts with र at end

प्रकाश, ग्रहण, ट्राम, ड्रम, कुत्रा, श्रवण

In these words the halant and consonant comes together and form a conjunct where halant letter combines with र and it takes the form of angular ˋ line and gets attached with the halant letter.

Level 6

Conjuncts having र at the start

मर्द, हर्ष, सूर्य, शर्यत, सर्कस, वहाड, दया

In these words the halant and consonant comes together and form a conjunct where halant letter that is र gets combined with consonant letter and it takes the form of the ॠ curve which sits on the top of the consonant letter as र्द

Designing the cards

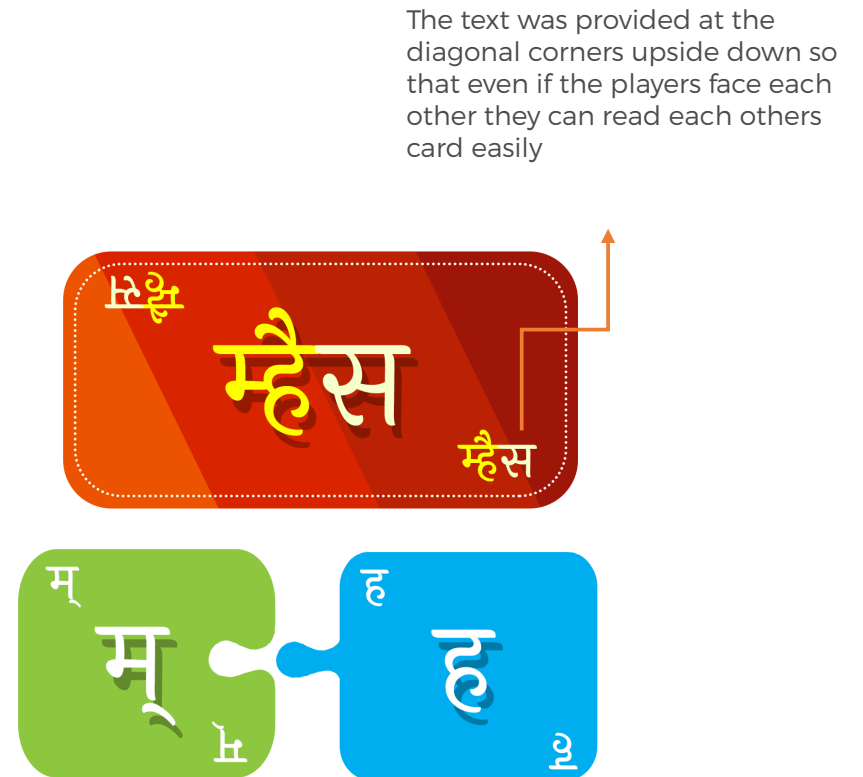
The cards were designed keeping the user in the mind.



Background colors were chosen in such a way that kids can see the text easily



Different background color was given to complex puzzles to recognise the complexity



The text was provided at the diagonal corners upside down so that even if the players face each other they can read each others card easily

Hints for puzzle

If child doesn't know the answer, he/she should be able to see the hints for correct answer. But hints should be provided in such a way that child can see the hint but at the same time it shouldn't be easy so that child won't do the cheating.

Hints can be provided on the back of the card as follows

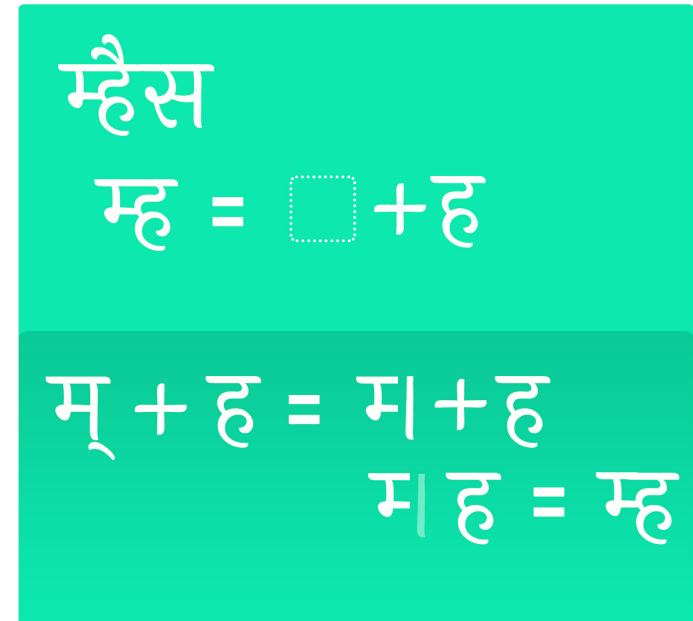
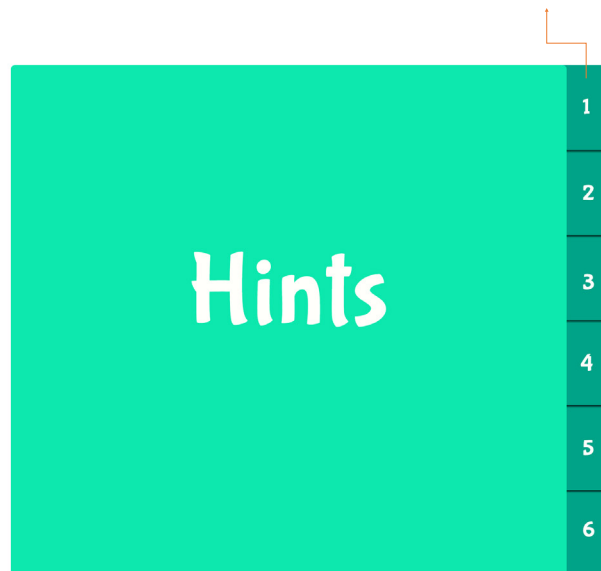
But there is a more chance of cheating in providing the hints on the back of the card. In addition to that, it is difficult to provide extra information behind the card



Key booklet

In this booklet, the hints will be provided according to the different levels of the cards and their complexity. In addition to hints, extra information like how conjunct is formed can be explained

With the numbers provided on book and card user can easily see which card hint to look at.



Information provided inside the booklet



Prototype for testing



Different arrangements in game layout

Pilot Evaluation

User – 2 std Marathi medium kids

Methods followed

Pre test

Evaluation of Game play with 3 levels

Post test

Pre test - In Pre test, children were asked to say the conjunct given on the card and they were asked which two letters are there in that conjunct.

Post test - In Post test, children were asked to say the conjunct from the given set which were there in game and they were asked to tell which two letters are included in that conjunct.

In pilot evaluation, it was found that-

Children were taking lot of time to take the card and discard the card which was making the game long.

Children were unable to recognise the conjuncts with र कार (where pronunciation is very important) and conjuncts with different form like भक्त, पद्म. But they were able to recognise conjuncts like हत्ती, हर्ष which are familiar to them.

In case of conjuncts like भक्त, पद्म children were expecting hints more than other conjuncts.

As there was no feedback for correct or wrong answer, sometimes children were unable to understand if they miss they have got one letter correct from given conjunct.

Sometimes, while picking up the card children were mixing up halant and consonant cards.

Eventhough children were able to make correct pair they were unable to understand how the exact formation of the conjunct happened.



Digital Prototype

After Pilot test few important things which were found are -

1. Children need feedback for there correct or wrong answer and time of play.
2. Hints are required in case of conjuncts which are difficult to recognise like भक्त, विरुद्ध, मर्द
3. It is important to show visually, how these conjuncts are formed to make them undersatnd the sequence and change in form in different types of conjuncts.
4. Sound is necessary to make children understand the pronunciation of the conjunct and its association with the combined letters in it.

To add interactivity in the game and based on the observations drawn from the pilot evaluation Digital prototype of the board game was designed.

The Digital prototype was mainly focused to solve the problems and restrictions in the board game.

The rules of the digital game kept same as board game to keep the game play simple and interesting. But in pilot test it was found that children were getting confused while picking up the card as they can choose from discarded pile and original card set. Hence in Digital game rule was kept like - Player can take cards only from original pile and not from discarded card set.

The strategy in the game was mainly focused on keeping the track of opponent player's moves. So, it was important to make the game play transparent for both the players. So keeping this in the mind the layout of the digital as well as board game was kept similar.

Digital prototype was designed keeping the different interaction in mind.

Key points in digital prototype were

1. Feedback for correct, wrong answer
2. Sound for hints, feedback
3. Hints for complex conjuncts
4. Formation of complex conjuncts by visuals or animation



Mockup screens for game



Player can choose between the different levels based on his knowledge .



Demo will be provided for each level to understand which level to choose and what is the content included in that level.

Active Player will be highlighted by green light

Deactivated Player will be fadedout



Initial setting of the cards.

As decided rules, player can discard any of his halant or consonant card and take same type of card from original pile of cards given to players.

Original pile of cards are kept on the upper plank while the discarded cards are put on the lower plank



1



2



3

Scenario -To select the card, First - user has to discard the card he wants by dragging it to the lower plank and drop it over there. Then he/she has to drag the card he/she wants from original pile of cards under the puzzle card given. The only rule is he/she has to drag the card from the top of the original pile of same type like halant can be replaced with halant and consonant can be replaced by consonant.

Drag and Drop interaction - While replacing the card the drag and drop interaction is used to simulate real interaction of playing the cards. Also the actions like click, choose might confuse the user which card is replaced by which card and where it is going. On other hand in drag and drop user will undersatnd which card he/she has discarded and which he/she has chosen.



Once the player makes the correct combination for the given pair of conjunct, the video will be played showing how the given conjunct is formed. For example for puzzle word **महैस** video will be played where formation of **म्ह** will be shown. In this video **म्** halant and **ह** consonant letter will come together and the vertical line of **म्** halant (part of the halant) will get dropped and it will get combined with **ह** consonant to form **म्ह**.

For the conjuncts like **भक्त, मर्द** different animation was used where form of the halant and consonant changes completely after combination. For example in **मर्द** the halant letter **र्** when mixes with **द** it takes form of arc curve which sits on the top of the **द** and forms **र्द**.



Formation of **म्ह** through *video*



Formation of रुद



If the user doesn't know the answer of given puzzle at all he/she can click on the puzzle card and see the hint given behind it. The hint will be given in stages, in first hint sound of the given word will be played so that child can understand the correct pronunciation of given word and understand the combined letter in that conjunct. In next hint only conjunct will get highlighted with sound. In third hint consonant will be displayed and user has to guess halant combined with it. User can see the hint again if they want by clicking on repeat button.



Hint for word



If the player makes the bonus card conjunct, he/she wins the bonus card. Once he wins the bonus card he/she can exchange his/her any halant or consonant card with other player at any time in the game.



If the active player does not play any card for 30 sec, the timer will popup on the screen. After that also within 30 sec, if player doesn't play any card, the chance will go to next player.





Player makes the both the pair of conjuncts wins the game.

Evaluation Plan

Based on the targeted users and design goals the evaluation plan was planned.

The product should be evaluated based on following parameters

1. Engagement of the user
2. Learning effectiveness

The engagement of the user will be evaluated based on the

1. Number of successful rounds one participant plays
2. Continuation desire - How long or how many number of times user wants to continue the game even if he is losing or winning
3. Time required to solve one round
4. Motivating other players to participate

The learning effectiveness of the user will be evaluated based on the

1. Number of words learned by user after all the rounds
2. Understanding the sequence of letters while forming the conjunct

Evaluation Plan

Target User – 1st to 3rd standard kids

Pre Test

To test users' previous knowledge

User will be asked to read 20 sample conjuncts

Post Test

To see users' understanding after using the product

User will be asked to say halant and consonant in the given conjunct

Evaluation

Total users – 6 (1st and 2nd standard)

2 levels of the game were evaluated consisting of simple conjuncts, conjuncts with different form and with र at start

Level 1 words

म्हैस, उत्सव, गुच्छ, बाल्य

Level2 words (conjuncts with different form and with र at start)

मर्द, हर्ष, भक्त, विश्व

In Pretest children were asked to pronounce the conjuncts given in the puzzle set. In first round children were asked simple conjuncts like म्हैस, तुमच्या. While in second round the children were asked to pronounce and tell the letters in the conjuncts like मर्द, विद्या.

The evaluation was done with 2 students at onetime. While doing the evaluation following points were noted

Time to play the game (1 round)

Engagement of the user

Hints taken when he/she is stucked at one place

Time to make each move against opponent

Once the evaluation was done Post test was conducted to understand the learning effectiveness of the game. In post test children were asked same conjuncts but in different word. For example for first round children were asked to tell halant and consonant letters in following words. All these conjuncts contains same word as given in puzzle set but words are different.

म्ह - म्हणाले

त्स - सत्य

च्छ - इच्छा

ल्य - कल्याण

For round two following words were asked in post test

र्द - दर्द

र्ष - वर्ष

क्त - फक्त

श्व - श्वास

Method

Before evaluating the Digital Prototype the Demo of Game was explained to children. In demo the instructions of the game was explained step by step with the help of simple instructions and visuals. As evaluation was done with BMC children, instructions were explained in simple Marathi to make them understand rules and strategy involved in the game.

While giving the demo important elements were highlighted in each step to make children understand easily. Different scenarios were explained to clear the different possibilities of game play and strategies.



Step by step explanation of game with the help of the Demo



Evaluation of Digital Prototype with the ASHA Children

Observations

Lengthy game play for first time -
For first time children were taking time to decide which word to form first and which card to remove.

One word at one time - Even though one player has a chance to remove any card from given two halant or two consonant card, children were replacing halant or consonant cards given under same puzzle word again and again. Once that puzzle word is solved, they were moving to second word.

Difficulty in conjuncts with different form - Children were facing difficulty while solving puzzle (Conjuncts) with different form like **मर्द, हर्ष, भक्त, विश्व**. Children were taking hint to understand which two letters are combined in the given conjunct.

Children were using the hints even if it is not necessary.

To get feedback of correct or wrong answer children were using check button again and again.

For the first time, some children were hesitated to use digital interface. They were scared to make mistake while moving the cards from one place to other.

Once they fail in first round, it was difficult to motivate them to play second round.

Evaluation Based on the parameters

Engagement - Initially, it was difficult to make children understand and play the game. Once they understands the game play, children were engaged in game play. Children liked the animation, sound and visual feedback for correct and wrong answers. Children were teaching other while playing. Also they were motivating each other to sit for second round and compete with each other.

Learning - Children were able to understand difficult conjuncts through animation and sounds. They were able to understand which two letters are combined in particular conjuncts and how they change form once they combined together.

While playing, children were trying to understand their own as well as opponents puzzles and their relative answers.

They were concentrating more on the sound feedback while taking the hints.

Conclusion

Reading a language is a basic step of any education. On the other hand the percentage of children who can read their language is very less. Meaningfull learning occurs when children are able to understand concrete logic and structure behind it. To read any language specially Devanagari children needs to learn basic letters and conjuncts. But traditional rote learning makes it difficult for children to understand the complexity and variations of conjuncts. So there is a great need of including design methodology in learning language.

It was found that children get easily involved in game play and learn faster through it. Animations, videos, sound plays important role in pronunciation and formation of conjuncts. It also reinforce children to understand the language easily. Combining these things together enhance the learning and its effectiveness.

Digital learning game can be used as learning tool to create effective learning environment. Also game play and strategies can engage the children for long time. Digital medium can reach out many people at a time and can serves the mass audiences.

References

1. Rote learning. (2014). Retrieved from Concordia online education: <http://education.cu-portland.edu/blog/curriculum-instruction/what-is-rote-learning/>
2. Language Reef marathi conjuncts. (2013). Retrieved from Language Reef: <http://www.languagereef.com/consonanttable.php?lang=MARATHI>
3. Omniglot Marathi. (2014). Retrieved from Omniglot.com: <http://www.omniglot.com/writing/marathi.htm>
4. Simply psychology Piaget . (2014). Retrieved from Simply psychology: <http://www.simplypsychology.org/piaget.html>
5. Wikipedia Jean Piaget. (2014). Retrieved from Wikipedia.
6. Teaching and Learning resorces, Cognitivism . (2010). Retrieved from Teaching and Learning resorces: <http://teachinglearningresources.pbworks.com/w/page/31012664/Cognitivism>
7. Weevers, R. S., schijnndel, C. v., & I.kolos. (2004). Read It
8. Chang, A., & Breazeal, C. (2011). ThinkBook: Shared Reading Interfaces for storytelling.
9. Learn to Read. (2014). Retrieved from Wikipedia: http://en.wikipedia.org/wiki/Learning_to_read
10. ASER report. (2014). Retrieved from ASER: <http://www.asercentre.org/>
11. Wikipedia Jean Piaget. (2014). Retrieved from Wikipedia.