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Gamification of Word List Cleaning

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Approval Sheet

The B.Des Project II entitled “Gamification of Word List Cleaning” by Tarun Mugunthan, Roll Number 16U130001 is approved, in fulfillment of the Bachelor’s in Design Degree at IDC School of Design, Indian Institute of Technology Bombay.

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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 'Tarun', written in a cursive style.

Tarun Mugunthan, 16U130001

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1. Introduction

Swarachakra Hindi is an Hindi text input keyboard developed by IDC, IIT Bombay for touch input mobile devices. It has over 60,00,000 downloads on the play store as of now. The words typed by users through this keyboard are recorded in the form of a word list. The word list contains two data points, the word that was typed and the number of times(frequency) it was typed. The copy of the word list I was working with is from 2015 and contains 329,525 unique words with their frequencies. The premise of this project is a need to clean the wordlist(remove/correct errors and tag problem words) to get a usable database of conversational Hindi words.

1.1 Hindi Words

Hindi is the dominant language of the Hindi Belt region in India. Around 422 million speakers [1] exist who favour different dialects across the region. Hindi has an abundance of loan words from different languages like Persian, Arabic, English and Portuguese[2]. Hindi also has a lot of words which are used colloquially as slang and are not present in standard Hindi dictionaries. Words like झकास (jhakaas), फट्टू (fattu), जुगाड़ (jugaad), ढिंचक (dhinchak) are commonly used as seen through personal experiences. There are also regional words like लफुसड़ा (lafusada, meaning: a scrap piece of cloth) which are used only in specific regions of Uttar Pradesh. Such words are also found to be absent in dictionaries[3]. An analysis of the

Swarachakra word list shows presence of these words which is to be expected as it is a 'natural language corpus'[4]. The list contains substantial amount of transliterated words, not formally considered to be Hindi words, showing up with frequencies on par with common Hindi words: स्मार्ट (smart), स्पेशल (special), लाइक (like), वाट्सप (what's up? Or WhatsApp), प्लीज (please). These words often occur with more than one spelling since people transliterate these words on their own discretion. For example the transliterated form of 'video' occurs in the list as विडियो , वीडियो, वीडियो and clearly mis-transliterated forms like विडियों.

1.2 The Approach

A variety conversational words which are present in the Swarachakra word list, lie outside the bounds of formal Hindi language. The value judgement with which I approach this project is one of inclusion. Many of these words, often not considered as even valid in Hindi, make up part of how people communicate in real life as proven by their existence in the word list. Language is an evolving entity and it evolves through usage by people. I therefore take the stand that including these words in a cleaned up database is representative of living language and acknowledges the richness seen in the usage of words by the masses.

From this point of view, challenges in cleaning the database are extensive. Algorithmically correcting words as is done by

spell-checkers relies on a reference dictionary of words[5]. Words which do not occur in this dictionary cannot be corrected by spell-checkers. In my research, I could not find any spell-checker which uses a dictionary containing conversational words like the ones present in the Swarachakra word list. I did a comparative analysis of spell-checkers to understand the shortcomings of existing spell-checks. Google spell-check could effectively detect and correct some(not all) colloquial words not present in formal Hindi while Hunspell, MS Word and Google Docs spell-checkers as well as online spell-checkers like awgp.in, dict.hindkhoj.com and stars21.com fail to detect and correct these words (see appendix). This means that relying on algorithms using existing dictionaries to clean the corpus would leave out a lot of slang, regional, colloquial and transliterated words. Furthermore, a lack of an agreed upon spelling for a lot of these words(specifically transliterated words) makes the task even more challenging.

In this scenario crowdsourcing the task of correcting and cleaning the wordlist is a possible path that I wish to explore in this project. This approach is consistent with the values I have stated for this project since it includes and preserves the diversity of usage of words by the masses. Crowdsourcing spellings of certain words may generate conflicts between two or more competing spellings as used by different sections of the population. This is something I wish to capture and encourage through design as it adds to the discussion on language and usage of words. Crowdsourcing also is a feasible approach given the sheer amount of words in the Swarachakra word list(The data I was working with was from 2015 and had

329,525 unique words. This number is sure to be higher in today's date). It would take a single person or a small group a lot of time to clean the list.

Specifically in the case of this project, since it was inspired from the work of a previous IDC project done by Vivek Paul(M.Des, IxD batch of 2017 who designed a crowd based gamified application for Malayalam word corpus cleaning, the broader direction I would take was already set. While I had the option to explore other solution spaces apart from just crowdsourcing, the justification given for it was strong and it aligned with my own learning objectives. I took up this project with the intention to learn about crowdsourcing systems and crowd based games.

2. Working with the Data

The first step in my primary research was understanding the data. The Swarachakra word frequency list has two kinds of data - the word and the frequency at which it has been typed by users (Fig 1). The working data for me was a 2015 copy of the word list and it contained 5,161,455 words(adding all the frequencies) and 329, 525 unique words(the list of words).

2.1 Studying the Frequency Distribution

To figure what would constitute cleaning the list I had to identify the different kinds of errors/issues which were present. I sampled words from different parts of the list. The distribution of the word frequencies is logarithmic with the highest frequency being 135,943(है) and quickly dropping such that the bottom half of the words only have a frequency of 1. This meant random sampling would pick up unusually large number of low frequency words. To circumvent this problem and get samples that appropriately represented different categories of words I took samples of 50 words each from frequency intervals of 1 to 10, 10 to 100, 100 to 1000 and above thousand. This gave me equal representations of the kind of words which are in each category. The words which occur more than 100 times are generally shorter with a lower error rate and the words at the bottom of the list, with frequency less than 10, had much higher error rates and longer word lengths.

Word	Frequency
है	135943
के	95308
की	76134
से	63449
का	62875
को	56484
में	51119
तो	49341
हो	47721
भी	40579
और	39171
मे	34343
पर	34017
नहीं	30368
कर	30077
ही	27393
जी	25258
क्या	25214
एक	23761
आप	23157

Fig 1- Swarachakra Hindi word frequency list

2.2 Word Tagging Activity

I took the four samples of 50 words and put them together to form a set(of 200 words each). I made three such sets. I then conducted a pilot test where I gave each set to a native Hindi speaker and asked them to tag words as 'correct', 'incorrect' and 'unsure'. The 'correct' tag was only to be given to words that were valid, recognised Hindi words. Wherever they tagged words as 'incorrect' or 'unsure' I asked them to write their comments about why the word was incorrect or what were they unsure about. They were free to add any other comments according to their discretion. The idea behind doing this was understanding the types of errors and issues in words in the word list and the comments were an open ended way of figuring out different types of errors the users perceived while

they dealt with the words. The objective of this exercise was to club similar comments and generate categories of errors/issues in the word list.

2.3 Results

After the tagging, I went through the words and the associated comments and identified the dominant error types/issues. The errors/issues fell into one of 4 different types. These are shown in Fig 3. The types were:

Misspelt Hindi words: These are valid Hindi words which had spelling mistakes. These words were not so badly misspelt that the intended word was unrecognisable. The users were able to tell what the word was intended to be typed.



Fig 2- Sampling Process

Misspelt Hindi Words	Words in other languages	Missing Spaces	Non words/gibberish
बंदि	स्पेशल	हैकहीं	शतायुषीभव्
इकठ्ठा	कोट	बडेबड़े	ढढडँँःःःशत्रुमाधदधःअृऔरऔ
ठिक	प्लीज	मांगलगा	पटाटोड
आयेगी	लाइक	उछलरहा	रहेत्र
ढूँढता	मीडिया	आएगीमेहनत	ज़ः
निवासा	वाट्सप	सडकबना	लललललल

Fig 3- Types of errors and issues in the wordlist with examples

Words in other languages: This category contains words which are from languages other than Hindi but written in Devanagari script. These include both transliterated words as well as words in languages like marathi which share the script. There is ambiguity in this category as some words which may be derived from other languages may be considered valid Hindi words now (loan words), like बस (bus), फोन (phone). Moreover, these words may also have spelling mistakes within them and correct versions these spellings are some of the major debates which will need to be dealt with in the solution.

Missing Spaces: These words are born of silly typing errors where Swarachakra users probably missed spaces between words. Because of this, two or more words were recorded as

being one long string which was registered by the algorithm that fetched the data. These, within them may contain words in other languages and misspelt words mixed with correctly spelt words. First step to correcting these would be adding the space in the appropriate spot.

Non words/Gibberish: As is characteristic of typing on keyboards people often type gibberish words. There are also cases when words are so badly typed that the intended word becomes unknowable. These words fall in the category of gibberish and non words. These need to be removed from the data.

Doing this classification exercise yielded some results which helped me understand what kind of actions would be required to clean the list. Misspelt words need to be corrected, words from other languages would be needed to be tagged as such and their spellings decided, spaces would need to be added in appropriate places and the resulting words would further need to be cleaned and finally, non words will have to be removed.

धोते	सही (✓)	
नंदन	अनिश्चित (?)	definitely a word, don't know if hindi or not
नमो	अनिश्चित (?)	sanskrit, don't know if hindi also
नहींक्या	गलत (X)	two separate words, नहीं क्या
नहींबाँट	गलत (X)	two separate words नहीं and बाँट
नालेसारखे	गलत (X)	sounds like a marathi word
नि	गलत (X)	not hindi
नेट्	गलत (X)	either incomplete word or meant to be नेट - assuming it to be hindi transliteration of english word "net"
नैऋत्य	गलत (X)	marathi word
पकीतानी	अनिश्चित (?)	not familiar with this word
पंडित	गलत (X)	पंडित
पण	गलत (X)	Marathi word
पय्यात	गलत (X)	not familiar with the word but could be urdu
पातरा	अनिश्चित (?)	not familiar with this word
पार्टी	सही (✓)	
पावे	सही (✓)	
पास	सही (✓)	

Fig 4- Screenshot of word tagging activity

3. Background Reading

Given the decision to pursue crowdsourcing as the solution to this problem I started by looking at where crowdsourcing is used in similar contexts related to correcting and tagging words.

3.1 Crowdsourcing in NLP Applications

Natural Language Processing(NLP)[6] is a subfield of computer science and linguistics which deals with how computers process and analyse large amounts of human language(natural language) data. Statistical NLP is a branch of NLP that relies on machine learning techniques to do this. This is done by training ML models on natural language text corpora. Text corpora(*singular: corpus*) are large bodies of structured text which are compiled for NLP purposes[7]. In order to use text corpora, they often need to be tagged. Tagging is the process of adding linguistic information to the text corpora[8]. An example of tagging a corpus of words would be deciding which class of words(noun, verb, adjective...) does each word of the corpus belongs to. This is called Parts of Speech(POS) tagging. There exist other forms of tagging as well. Tagging a corpus often requires human intelligence and needs to be done manually. Tagging new and larger corpora requires a huge amount of human labour. Due to the labour intensive nature of this process paired with

relatively less skill requirements, these tasks can be crowdsourced.

There are three main platforms used for tagging/annotating text corpora through crowdsourcing[9]:

1. **Paid for marketplaces:** Here participants are paid small sums of money to do small Human Intelligence Tasks(HITs). Humans are analogous to processing units. Established marketplaces like Amazon Mechanical Turk and CrowdFlower provide a reliable source of cheap human labour. The outputs of marketplaces are of comparatively lower quality as the motivation of participants is purely financial.



Fig 5- Amazon Mechanical Turk and CrowdFlower are popular marketplaces for crowdsourced labour

2. **Games with a Purpose:** Contributors carry out annotation tasks as the result of playing a game. This method of crowdsourcing can have some advantages over paid marketplaces. It is cheaper in the long run as participants don't need to be paid. It also generates higher quality data with less cheating as participants are intrinsically motivated. This,



Fig 6- A screenshot from the wardrobe game series which makes players bet on the contextual meaning

however, is subject to making appealing games which attract a critical mass of participants. An example is Wordrobe[10] which is a set of language related games where people can generate linguistic data while playing games.

3. Altruistic Crowdsourcing: Here, contributors participate in doing tasks because of altruistic motivations and a desire to add value, for example Wikipedia.

For the purpose of this project, using a paid for market place was out of the scope. As you will see later in the report, the final solution emerged as a combination of a Game with a Purpose and an Altruistic crowdsourcing platform.

3.2 Games with a Purpose(GWAPs)

I pursued the idea of gamifying the process of cleaning the word list. I did so as I found this strategy to be the most interesting out of the three.

Games have been used for data correction/validation and tagging as in the cases of ESP Game[11], Waze[12] and



Fig 7- The ESP Game by Luis Von Ahn and Laura Dabbish

Peekaboom[13]. For my starting point I chose the ESP Game designed by Luis Von Ahn and Laura Dabbish in 2004 at Carnegie Mellon University. The objective of the game was to crowdsource labels for images on the internet. It paired up two strangers online and gave them both the same image. Both players were directed to write labels for the image such that their labels matched. They In doing so they would type in labels which they thought showed the most significant, recognisable and commonly identifiable attributes of that image; things that the other player would also guess. When their labels matched they would be rewarded with points. The game gained significant traction and was online till 2011. A notable attribute of the game which I took away as learning was the simple but effective mechanism with which quality data was being generated. The process of creating agreement between strangers so as to generate the most appropriate labels through the game mechanics, was innovative. They were building consensus without forcing it by incentivising it through the game itself. This set my trajectory for the initial part of my ideation where I was trying to achieve similar simple yet effective ways of getting players to clean words and get quality data. Luis Von Ahn said about games with a purpose that:

“People play not because they are personally interested in solving an instance of a computational problem but because they wish to be entertained.”[14]

This sort of defined the player-side outcome of the game I would try and create. The philosophy propagated by the ESP

Game was that of turning boring tasks into interesting ones through gamification to get people to willingly offer their labour in return for entertainment. Thus, the game would need to be ‘fun’ enough to get players to correct words.

Users in crowdsourcing platforms tend to be anyone they attract. For example the ESP game did not have a specific target group because the skill that the game demanded was basic common knowledge. It was played by anyone who came across it and found it to be fun. In the case of my game the possible user base is equally wide. Anyone who knows Hindi and has access to a computer or mobile device could potentially play the game. The user facing insights I use in my project are from my readings about crowd based games and the general testing of games I did to get a feedback from potential players.

4. Game Design

4.1 Deciding Microtasks

The first step to designing crowdsourced tasks is to break down the large task into smaller microtasks (Here the large task is the complete cleaning/tagging/correction of a word from the word list). Microtasks are small manageable pieces of

the larger computational problem which needs to be solved. The larger problem can be solved by accomplishing all the individual microtasks separately. Microtasks are distributed amongst users and their output is aggregated to form the final required output.

This meant defining the kind of output I want from a word and the laying out the process of how a user could reach that output. While doing this I decided not to limit the scope of the output that could be produced i.e the kind of data points about

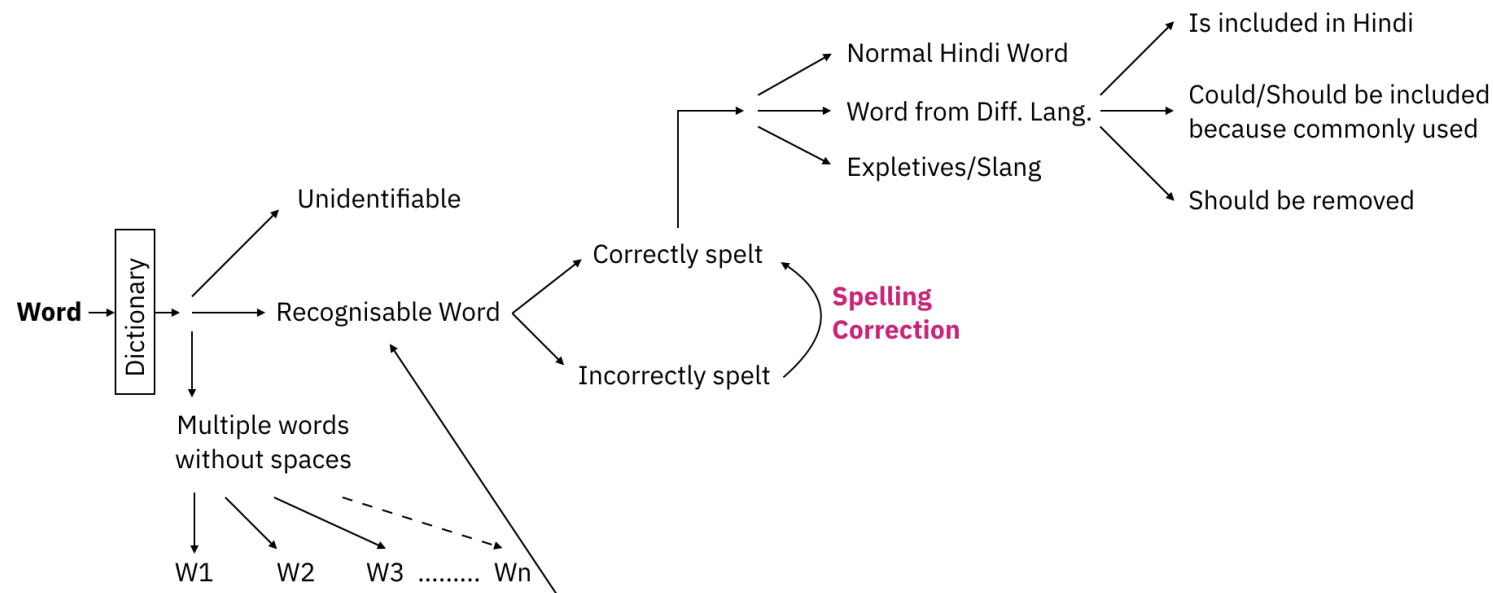


Fig 8- The data generation process

the word that could be gained from users. The data that the game would finally give could be limited based on player expertise, game design considerations and viability. The process of data generation to the maximum extent, as aligns with the objectives of the project, is shown in Fig 8.

The process then was broken into 4 microtasks which are as follows:

1. Word, Words or Not a Word?

Words from the wordlist are passed through a dictionary to filter out the obviously correct words. Falling back on the categories of words that had emerged from the Word Tagging activity in my primary research, I knew that the remaining words were of the types:

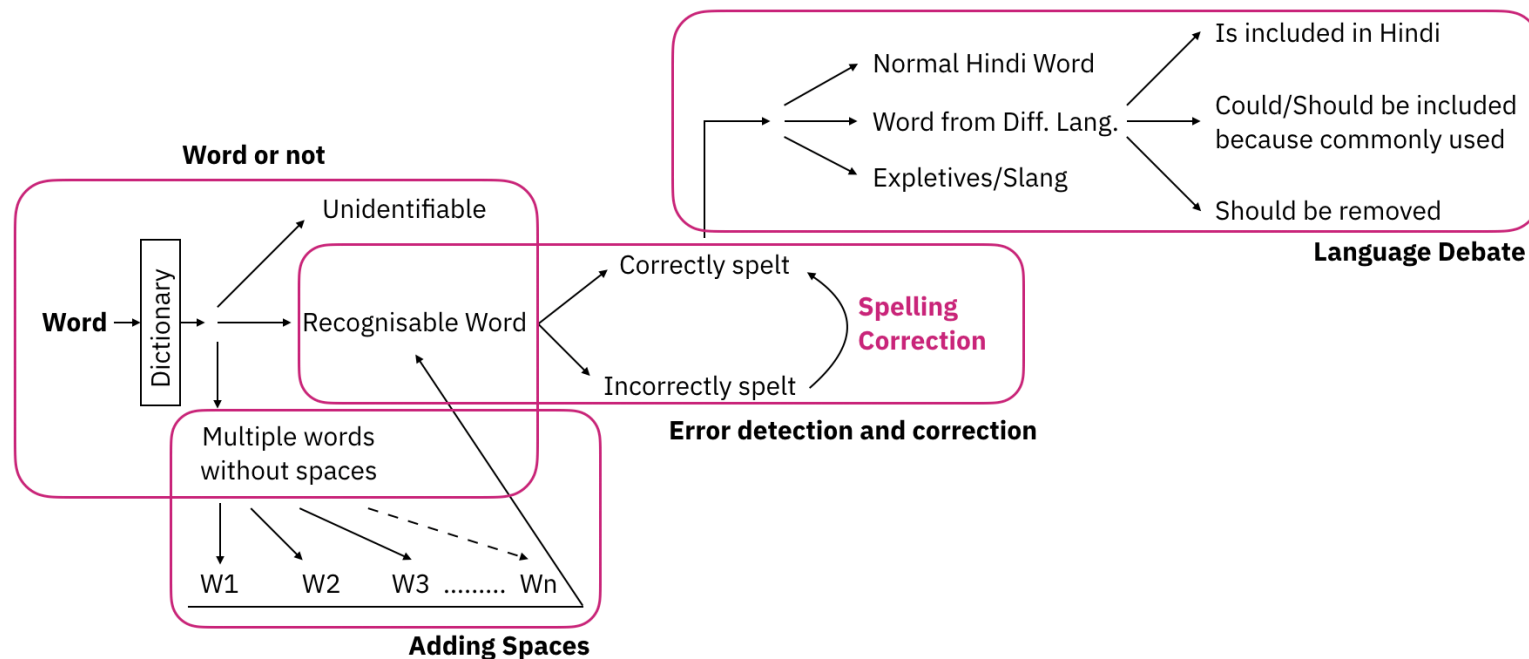


Fig 9- Microtasks

1. Words that were slang or expletives that were not in dictionaries. (झकास, घोंचू)

(+ the previous categories)

2. Misspelt words of any category(संगित, गिला)
3. Words from other languages(स्मार्ट, फोन)
4. Words with missing spaces(हैउसे, दिखरहा)
5. Non words/Gibberish(गगगगग, कसदज)

Keeping in mind the next step of the process, which was the correction, this microtask was focussed on bringing the words into a form that could be corrected. Words from the above categories would be classified based on whether they could be recognised as one word, several words or not be recognised. This was done without judgement about any other factor like whether the word was valid in Hindi or not. It was just about capturing the intended words from the list. It is also established that this kind of tasks can be done by users as the Word Tagging activity showed participants extracting the intended word/words from given strings of letters regardless of type or language the word was in. The output of this task would be to simply classify if a string can be understood as a word, multiple words or gibberish. Single words are kept, gibberish words are removed and strings with multiple words are passed into the second microtask.

2. Adding Spaces

In the case of strings comprising of multiple words, which happens because of Swarachakra users missing spaces, there is one more step to be done before moving to the error detection and correction stage. This is adding spaces to the string to break it into individual words. If there is a string W , it is broken up by adding spaces into $W_1, W_2, W_3 \dots W_n$. After the first microtask and this, we end up with a list of single words to be checked for errors and corrected.

3. Error Detection and Correction

Each single word would be checked if its spelt correctly or not and if spelt incorrectly then it would be corrected. This step is the most important as its the bare minimum requirement of the solution.

4. Language Debate

The next part of the process is what I am calling the Language Debate for lack of a better name. This is the part which goes beyond the minimum and questions how much information can users possibly contribute to the system. It would entail two levels: one where users classify the words into types and the other where users take judgements on the position of some of these word in the Hindi language.

The input to this microtask would be the corrected words from the previous one. These words would first be classified as being normal Hindi words, slang/expletives and words from

different languages. I am aware that there is some ambiguity in the classification with each category overlapping with each other but users would classify these words according to their preference and that will serve as that user's perspective on that word which could be an interesting data point to collect. Further, words that are from different languages could be classified into whether they are accepted as words in Hindi, could be accepted in Hindi or should not be acceptable in Hindi, based on personal opinion. This level would have a high degree of subjectivity but that is something that would add to the richness of the data which is collected. The possibilities which this offers is to some degree wishful thinking on my part but as I had stated before, I decided not to limit myself in the extent of data that could be generated in this activity.

4.2 Scope of game ideas

For the first stage of my ideation I decided to focus on the first three microtasks since these were the essential requirements from the game. After considering turning each individual microtask into a game I decided against it because the leap from seeing a word in its raw form from the list to the correct version of it, encompassing all the intermediate steps was made in one action organically by users. This insight came from the Tagging activity I had done in my primary research. People looked at a word and directly wrote comments containing the corrected word. When asked, they did not go through a step wise process but could tell immediately what the 'right answer' would be. Designing different games would

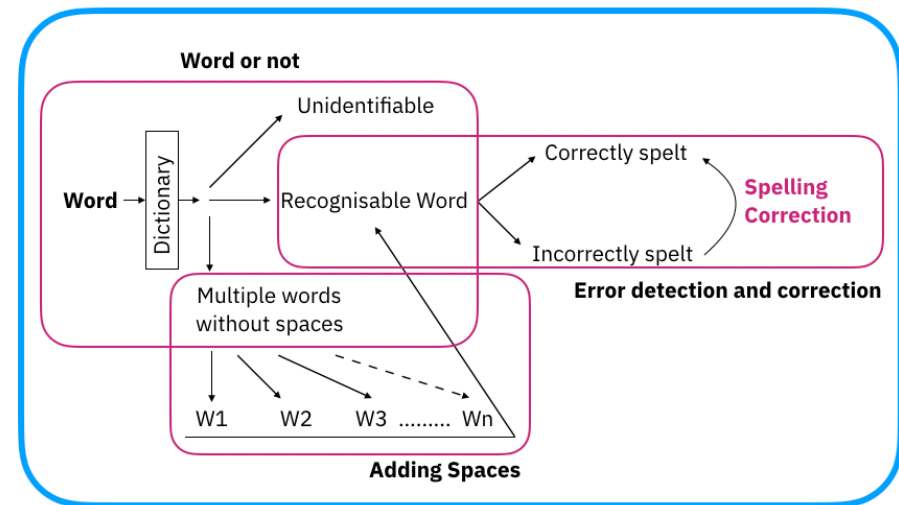


Fig 10- Scope of my game includes these three tasks

also compromise the user opinion I want to capture for each word. Splitting the tasks means different people's interpretations can get mixed in the process of correcting one word. For these reasons I considered the first three microtasks as one activity to build a game around.

4.3 Ideation

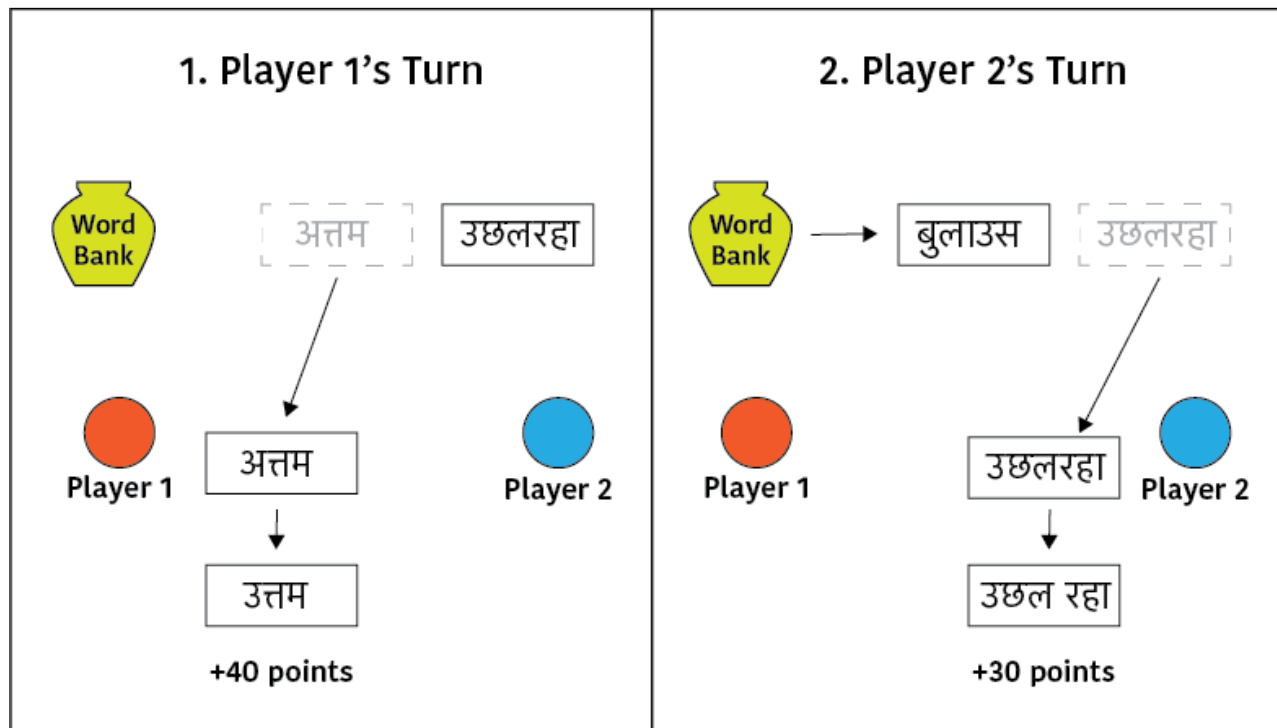
The core mechanics of the game would be built around the various subtasks that would be involved in cleaning words. Following are the concepts I came up with.

Idea 1: Points based game

In this game players choose one of two words turn by turn and correct/tag them. Different actions have different points and the words keep getting replenished by a word bank. This game involves luck and skill as the word which comes out of the word bank is unknown and getting points is dependent on player's skill with correcting words. There would be a fixed

number of rounds and the person who collects the most points would win.

Words can have more than one type of error in them. For example, सरकहि is a word from the word list. It can have a missing space and can be split into सर and कहि. कहि can be further corrected to कही or कहीं. In such cases players will get the sum total of points for all the actions they perform.



Declaring Correct Word	10 points
Declaring Non Word	20 points
Adding spaces	30 points
Spelling Correction	40 points

Fig 11- Points based gameplay

Idea 2: Set Builder

This game retains the point based approach of the first game but also adds an element of planning and strategy to it.

Words are drawn turn by turn from a pool of 4 words. The player drawing the word has to fix/tag the word. The points given for this are similar to the points in the previous game.

Once fixed/tagged the player will put the word on a 13x4 grid given to him. The player can place it in any of the 4 rows but must start filling in the words from the left without any gaps. He must try to create 4 rows of words that end exactly at the 13 letter mark. Making a perfect row gives the player a huge sum of bonus points. This quest to make perfect rows leads players to pick words carefully from the pool and think ahead such that the arrangements they create fit perfectly. Players are allowed to pick words that are missing spaces, split them into their constituent words and place these individually (Fig 13). Players can also interfere with each other's moves as they draw from a common pool.

Exceeding or falling short of the 13 letter mark will mean reduced bonuses for players based on how far they are from the mark.

Challenging words: Word correction/tagging can be challenged in this game. When a player tags or fixes a word, the other player can disagree with his action. To challenge a player you must offer the correction to the mistake made by the other player. If you get challenged on your turn, you lose your turn and the word you picked is discarded.

The game ends after each player picks 15 times. The player with the most points wins.



Fig 12- Azul board game

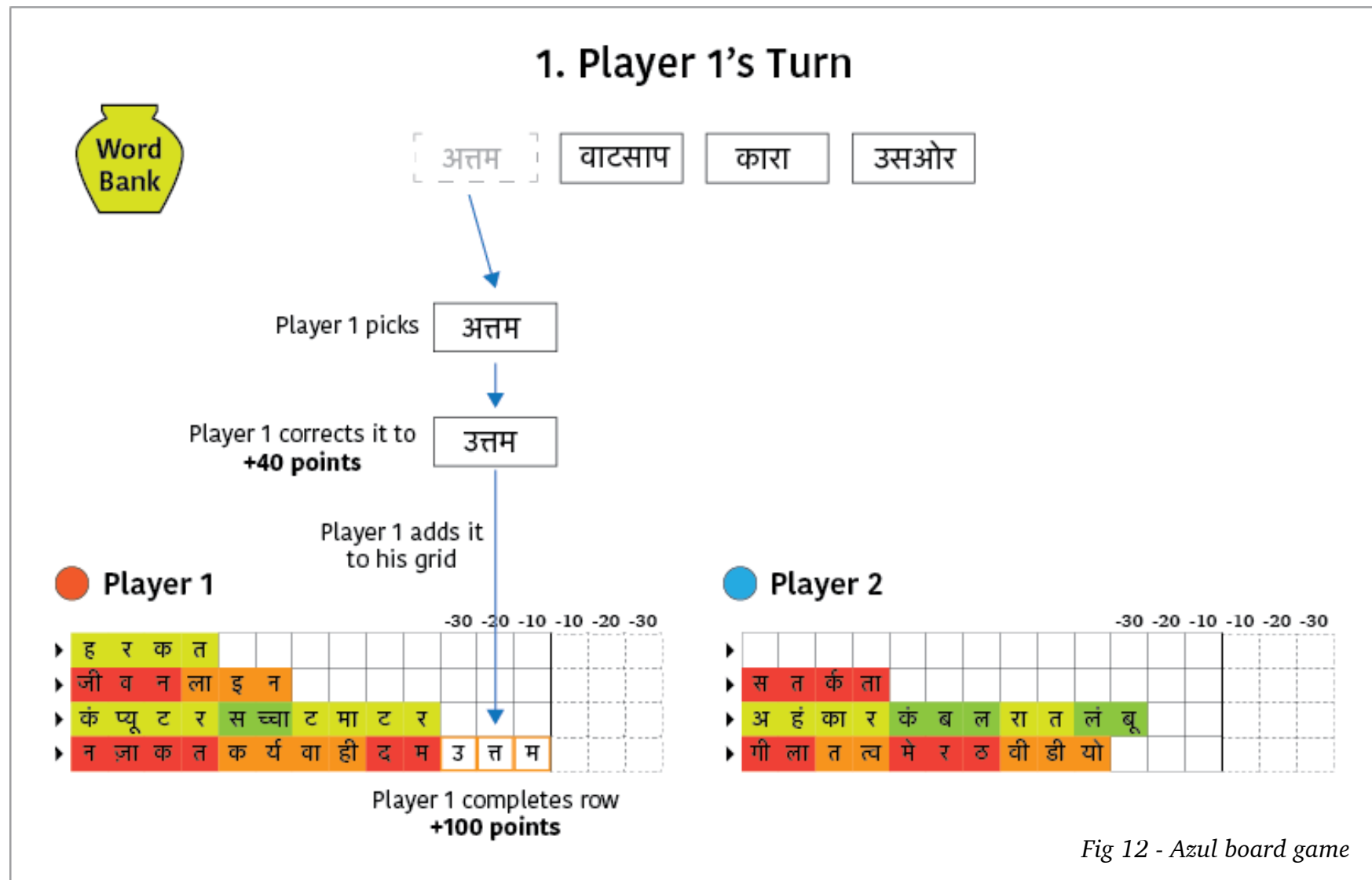


Fig 13 - Set builder game(1)

This

game was inspired from Azul[15]

Word Bank → word bank gives new word

उछलरहा वाटसाप कारा उसओर

उछलरहा Player 2 picks

उछल रहा Player 2 splits the word
+30 points

Player 2 adds both words to her grid

Player 1

ह	र	क	त																
जी	व	न	ला	इ	न														
कं	प्यू	ट	र	स	च्चा	ट	मा	ट	र										
न	ज़ा	क	त	क	र्य	वा	ही	द	म	उ	त्त	म							

-30 -20 -10 -10 -20 -30

Player 2

▶	स	त	क	ता															
▶	अ	हं	का	र	कं	ब	ल	रा	त	ल	बू	र	हा						
▶	गी	ला	त	त्व	मे	र	ठ	वी	डी	यो	उ	छ	ल						

-30 -20 -10 -10 -20 -30

Player 2 completes 2 rows
+200 points

Fig 14 - Set builder game(2)

Gamified Word List Cleaning

common pool and arrange them in patterns to score points.

Idea 3: Guessing game

This game follows a different pattern than the other two and does not rely on the sub tasks model I used in the previous two games. It is more directly inspired from the ESP game model.

It is a two player game where players try to guess words from clues and in the process correct their spellings. It goes something like this:

- **Player 1: gets a raw word from the list - बोटेल्. He realises the intended word was बोतल. He now has to make Player 2 guess the word by giving clues. Player 2 will see the first letter of the word with the length of the word. He can type clues to the word without writing the actual word to help Player 2.**

- **Player 2: gets the following clues from Player 1:**

बो _ _

जिसमे से पानी पीते हैं

Player 2 successfully guesses बोतल

The basis of this game is that when people guess the word and write it, they will write the correct spelling of the word. The guessing takes precedence and they hence won't be inclined to cheat by typing random words. Furthermore, the clues generated by pairs of players playing the game can be collected and then used in single player versions as well. The system will feed into itself and clues can be reused.

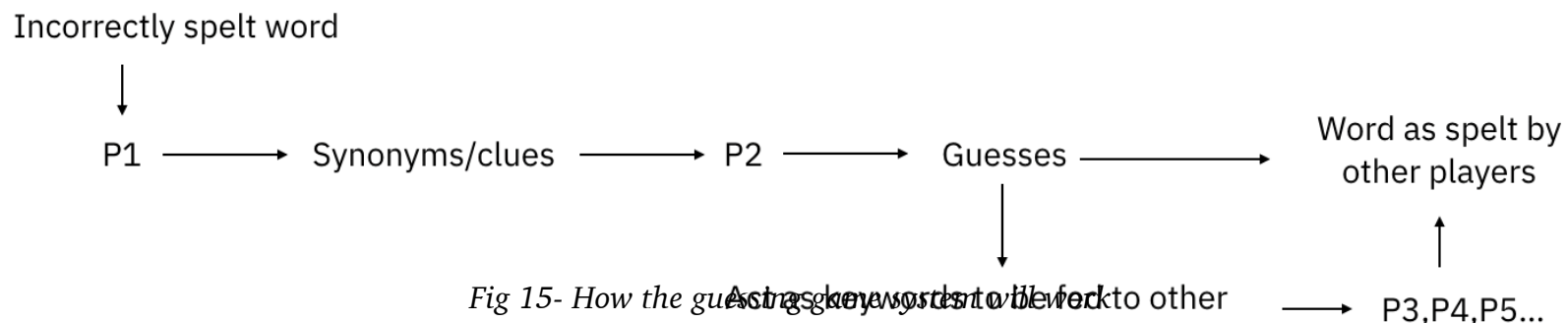


Fig 15- How the guessing game works to help other players to get them to spell the word

4.4 Evaluation of Ideas

Between the first and the second game ideas, the second one was more appealing as it included the game mechanics of the first and added new elements to it. In comparison, the third idea was interesting but had possible problems - typing clues again and again would become cumbersome and the concept only accommodated misspelt words and would face difficulty with multiple words (without spaces). I therefore decided to focus on the set builder game. The final game which would come out of this project would be a digital game but coding the idea just for the purpose of testing the gameplay was impractical as well as outside my skillset. Its important to mention that at this stage of my project the lockdown (because of Covid-19) was in effect. Given the constraints I decided to make printable paper prototypes and test the game with people I knew who were native Hindi speakers.

The testing was done as follows:

- I made printable paper prototypes and sent it to two pairs of participants. They contained pieces that could be cut out, that were required to play the game.
- I called/videocalled the participants and explained the rules of the game to them. I also showed a sample of a filled in grid to remove ambiguity about the way the letters would be filled in, specially in relation to matras and conjuncts.
- I asked them to play the game and I asked them to record the gameplay and send it to me. I also requested a picture of

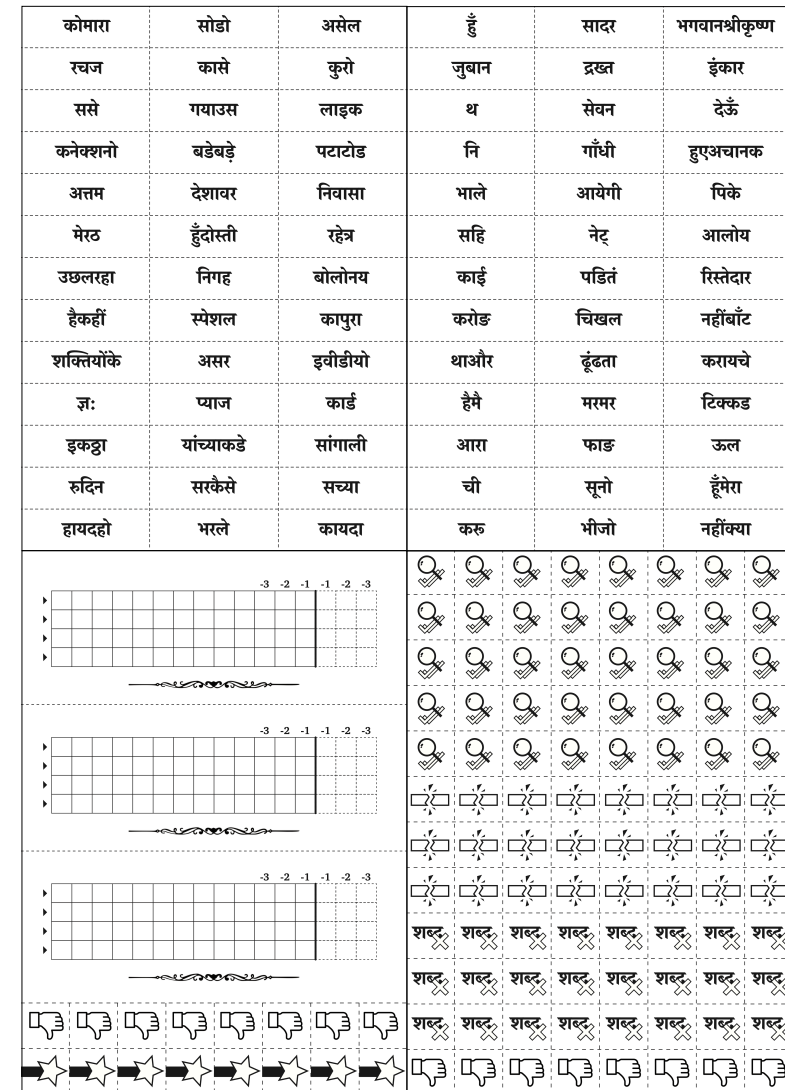


Fig 16- Printable Paper Prototype

the filled in grid as well as the words they had corrected to see how well the word cleaning had happened. Finally I spoke to them about their experience in an unstructured manner to get an understanding of whether they enjoyed the game or not.

4.5 Findings and Feedback

These were the findings:

- When asked players what was their experience playing the game, they said the game was uneventful with the strategy element not coming out until they were reaching the end of the rows. This was contradictory my assumption that players would participate in forward thinking to make sure the letter fit perfectly.
- The correction of letters did not prove to be enough of a challenge since given a pool of 4 words they picked the one which was easiest to correct. Out of the words that were corrected, tagged, all of them were done correctly. They stayed away from unknown and unfamiliar words which would be harder to correct. This meant that players were not incentivised to hone their skills over time.
- The concept of completing rows of 13 letters seemed to be an arbitrary goal especially in relation to the other game mechanics which dealt with word correction. The mechanic was not endogenous but it didn't need to be as the game was not trying to teach a concept but just be a medium of entertainment.

- What was specified as a letter to be filled in one box was ambiguous and somewhat arbitrary. Conjuncts(how would you fill in स्वास्थ्य) and half letters(is it okay to write both त त्व and त त् व).

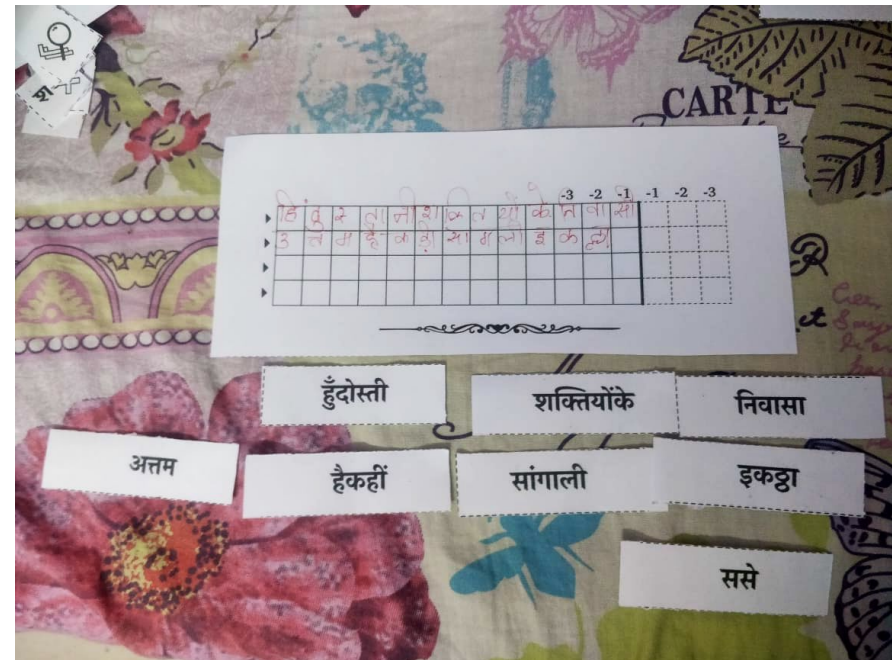


Fig 17- Filled in grid from one of the tests with the words that were filled in

4.6 Further Insights through Reading

The games I had come up with so far seemed to fail to generate any sort of interest in the people I showed them to. Till this point I was running with the assumption that the only thing game needed to offer was entertainment and that would be enough to get people interested in playing the game. I had not considered other incentives until this point and started doing so since the games were falling short on entertainment value. Here the most significant input was the paper written by Kathleen Tuite from the University of Washington. The paper, titled ‘GWAPs: Games with a Problem’[14], was a critique of existing crowd-based games with suggestions for improving the quality of experience for players.

The paper starts by critiquing Luis Von Ahn’s original idea about crowd-based games - “People play not because they are personally interested in solving an instance of a computational problem but because they wish to be entertained.” In it, she quotes how this approach of dressing tasks as games reduces boredom but it provides a fairly superficial form of work satisfaction. This also risks making GWAPs come off as exploitative which can even drive players away.

Foldit was a digital game about protein folding introduced in 2008. In this game players manipulated 3 dimensional protein structures to form the most plausible configuration (lowest energy form). This game, like the ESP game, gave players a task which was computationally hard to do. However, unlike

the ESP game, it didn’t demand common sense but spatial reasoning skills. There was a chance for players to solve increasingly complex folding problems depending on their skill level. Players could find themselves invested in learning the underlying concepts of biochemistry and pride themselves on making significant contributions which often had groundbreaking real world impact. There was clear difference between how Foldit treated its players as compared to the ESP game. It gave players a chance to grow with the game and make meaningful contributions. There were collaborative and competitive reward structures in the game.

Building on the success of the insights for effective design of GWAPs that came through Foldit, the paper laid down the following recommendations:

- **Transparency:** By making the purpose of the game clear to players, GWAPs can provide them the opportunity to personally identify with the purpose and hence be intrinsically motivated by it. By participating players can get a sense that they are contributing to a purpose they believe in. In my case, this approach can appeal better to Hindi language enthusiasts who pride themselves in their knowledge of words and spellings.
- **Make Players Drivers not Processors:** In games like the ESP game players are treated as Human Processing Units (HPUs) whose sole function in the system is to perform the task given to them and generate data. Players should instead be drivers of the system, they should take decisions

which control the fate of the system. This provides a valuable opportunity to utilise the knowledge, ideas and creativity of players. In the case of my game, it means giving more voice to players to decide the fate of words where they feel empowered and not held back by the system.

- **Make Contributions Visible:** Players should be able to not only make contributions to the purpose but also observe and measure their specific contributions. Players should also be able to see the impact of the collective contributions of all players.

- **Provide Timely Feedback:** Feedback should be provided about whether players are attaining their goals and contributing effectively to the purpose.

These insights made me look at the problem in a new way and led to a new line of ideation which eventually manifested as my final concept. Going forward I tried to incorporate all of the above recommendations in my designs.

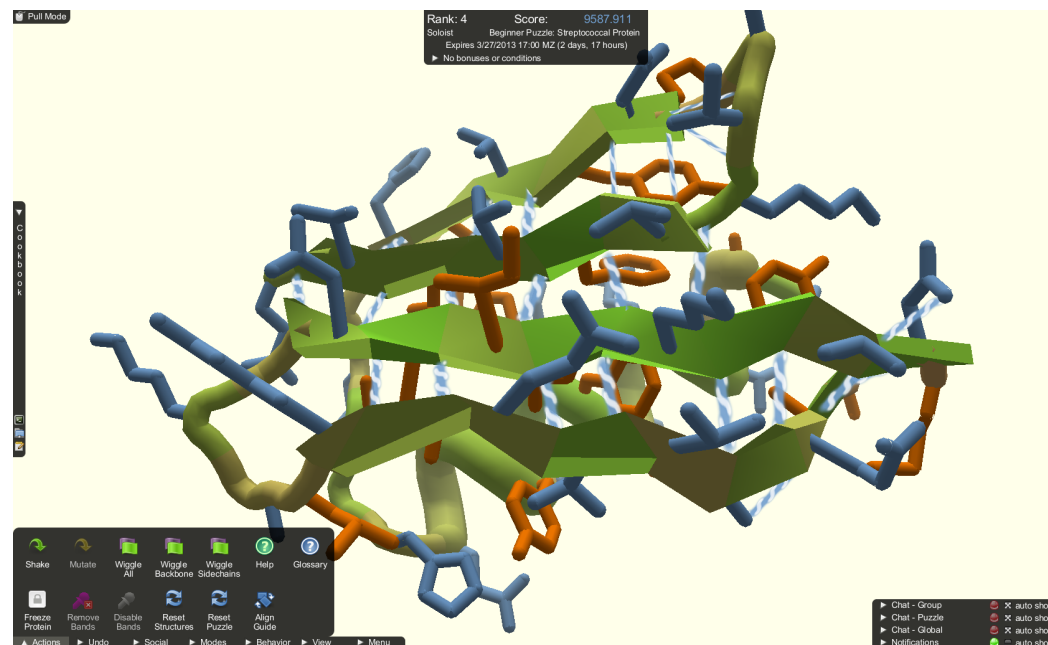


Fig 18- Foldit

4.7 New Ideas

Idea 4: Contribution Game based on Word Frequency

This is a two player game idea. Players would compete by trying to clean words correctly and scoring points. In this game, unlike the previous games, the fact that players are correcting words typed by Swarachakra users will be made known to them. The score of correcting a word would be based on the frequency of that word in the word list. This is meant to indicate the number of people who committed the mistake in that word. Correcting a word with higher frequency would mean correcting a mistake made by a greater number of people and hence would mean a larger contribution. This would also give the players some bragging rights and appeal to those 'Grammar Nazis' who take pleasure in correcting mistakes made by other people.

सिधार: **इकठ्ठा** से **इकठ्ठा**
इसमें आपने कुल **76** लोगों की गलतियाँ सुधारी!

इनाम: **76** पोइन्ट्स

Fig 19- Rewards for contribution

Introducing Quality Control - reCAPTCHA model

In the previous games, there was no way of ascertaining the quality of the response through the system. There were mechanisms for one player to challenge another but the conflict resolution was sketchy. To ensure that players don't get away with feeding random spellings instead of honestly corrected ones, there had to be a mechanism which prevented players from cheating the system and corrupting the data. For this purpose, I used the reCAPTCHA model[16].

reCAPTCHAs were created by Luis Von Ahn in 2007. They are used to authenticate users as humans on the web. Initially this test was based on people typing in characters on the screen that a machine would not be able to read. This was called CAPTCHA which stood for Completely Automated Public Turing test to tell Computers and Humans Apart. Von Ahn saw this human labour as being wasted and fed CAPTCHAs with characters from texts that needed to be digitised (things that



Fig 20- reCAPTCHA

algorithm could not figure out). This is how reCAPTCHAs came to be. The millions of users on the web, in the process of authenticating themselves, were digitising text for free. To ensure that users typed in correct transcriptions, two words are shown on the screen for users to transcribe. The correct answer to one is known and the other is unknown. Users are not made aware of this and their answers are evaluated only on the basis of the known word. Even if a person wanted to cheat a reCAPTCHA, they would not know which word is known and which is unknown hence it is in their best interest to transcribe both words with integrity. This ensured that people were giving the system quality data without cheating.

I use a similar technique for judging the correctness of a response when players type in words. Instead of asking players to correct a single word, the game gives them two words to correct, with the answer to one of them being known. The players would not be made aware of this fact. They would correct both words and receive feedback if they did so properly, as if the answers to both were known.

Player Profiles

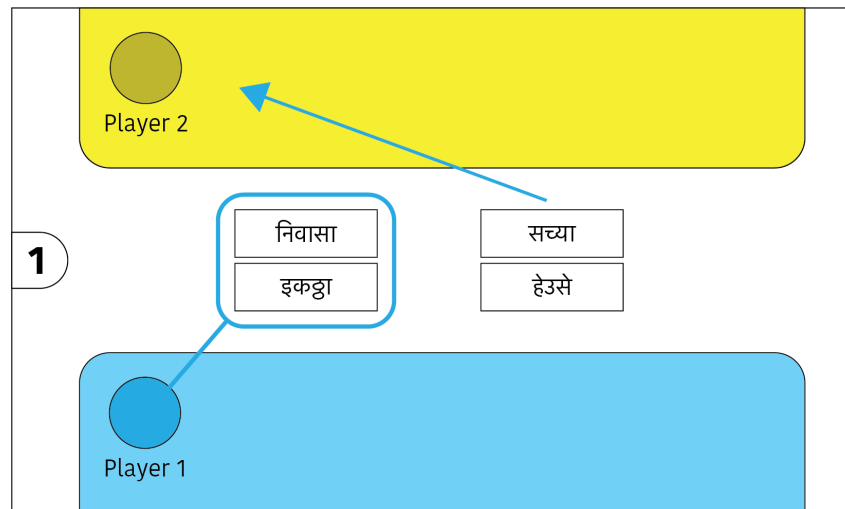
Another feature inspired by the recommendation that contributions of players should be made visible was a player profile in the game where a player would be able to see how many mistakes made by keyboard users did he/she correct. This could be made publicly visible to all players who are in the system.



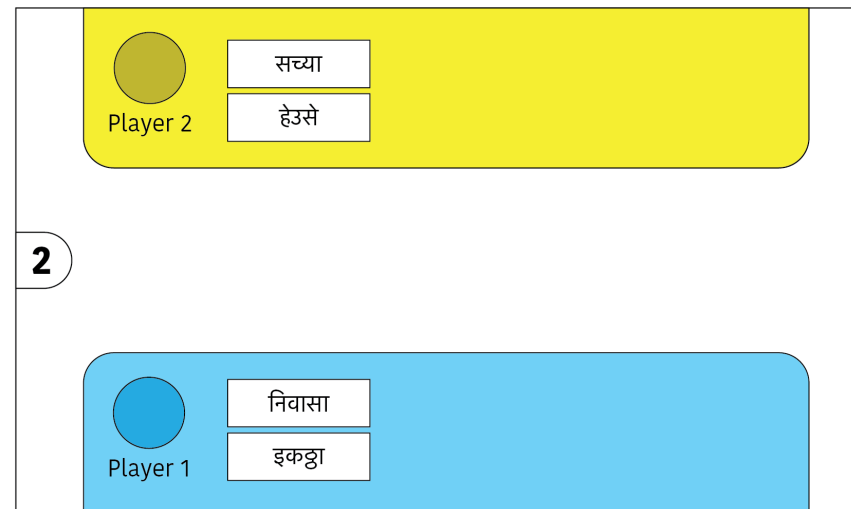
Fig 21- Player profiles showing overall contributions

Gameplay

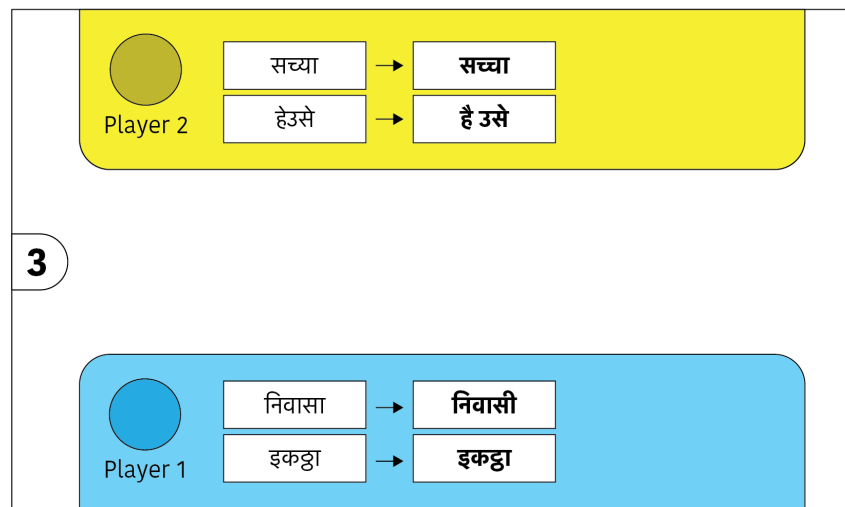
- Two pairs of words will be presented, visible to both players.
- The player whose turn it is will choose the pair of words he/she would like to correct. This choice will be based on his/her best guess as to which pair of words would have been gotten wrong by more people since those words would yield more points. The factors that could loosely indicate this are the length, complexity and general rarity of usage. The other pair goes to the other player to correct.
- Guessing(not completely blind, yet ambiguous) introduces an element of unpredictability and somewhat becomes like betting/gambling which players could find engaging.
- The players then try and correct the words. Only after they correct them are the scores revealed. The corrections of the unknown words are recorded as data.
- In the next round, the other player chooses the pairs.



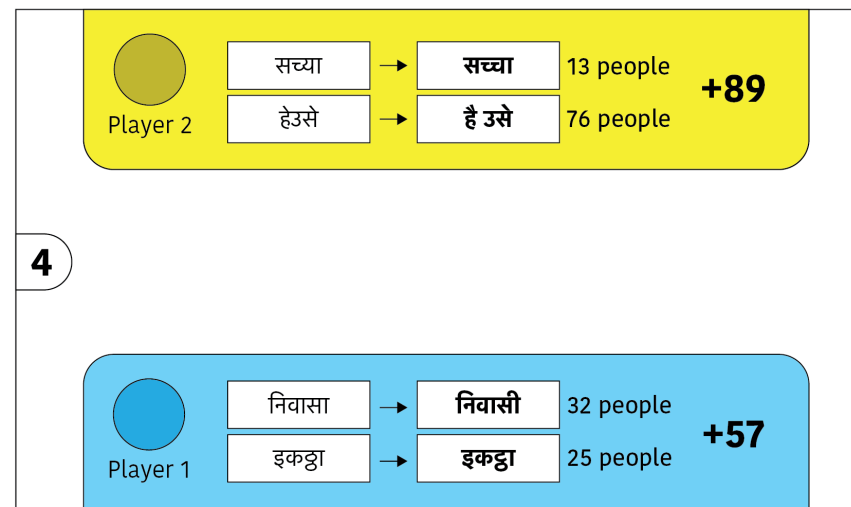
Two pairs are given. Player 1's turn, he guesses which will pair of words was gotten wrong by more people, for more points.



Player one chose left pair. Player 2 gets the other pair by default.



Both players correct their pairs of words.



After they are done, the scores are revealed. Turns out Player 1's guess was wrong. Player 2 scored more and won this round.

Fig 22- Frequency based contribution game

4.8 Feedback

There were a number of issues with this idea, all of which were pertaining to the game itself. The other elements like player profiles and quality control mechanism seemed to be useful so I decided to keep them. The game had three major logical flaws:

1. In reCAPTCHA the assumption that if the user types in one word correct then the other word would also be correct was fair as both words required the exact same basic skill. In the case of this game, the same assumption becomes shaky because even if the player can fix one word correctly the other word might lie outside of the player's knowledge.
2. The other problem was that of inappropriate feedback. Giving the feedback that both words are correct based on the answer to one word can give false positives to the user. Repeatedly doing this could create undesirable feedback loops.
3. Finally, the action of looking at a pair of words and determining how many people made those mistake is next to impossible. A large section of words from the middle of the wordlist show no discernible patterns in terms of their relationship to their frequency. This gave players no control in the game as they would mostly be making blind guesses at the end. This was not something that offered players scope to grow in the game.

Other points from feedback were:

- There should be a way of representing life cycle of words in the system which is visible to the player as well as the public.
- The game should reward skill and give players a way of improving their skills.
- There should be a way for players to debate spelling of words if need be.
- There could be delayed gratification where words you correct could pay off later as the system confirms them.

5. The Final Concept

For the final concept I chose to go with a **mobile based platform**. This made sense as Hindi text input on mobile is more widespread than Hindi text input on desktops/laptops.

5.1 Word Pairs, Selection and Rewards

The final concept after all the iterations, was based on incentivising correction of words based on difficulty. The basic structure was the same with two players being presented with two pairs of words and one player choosing the pair they want to correct with the other one automatically going to the other player. Unlike the previous concept, value of the words is not determined by their frequency but by the difficulty of correction. The known words will be given a score based on how hard they are to correct since the correct answers to these words will be known. They will be paired with words to which the answers are unknown.

The players will be told that one of the words is known and the other is unknown. However, they will not know which is which. They will also be told that their score in the game will only come from the known word (called a Skill Word) whilst the unknown word (Contribution Word) is their contribution to the platform. To help players make a choice between two pairs of words, especially since the scoring word is not known, the score of the known word will also be shown (but not attached

to that word). Effectively, players will be shown their potential reward in the case of each pair of words without disclosing which word out of the pair it is coming from. This mechanism ensures that they can make an informed decision while choosing without guessing blindly while still preserving the reCAPTCHA model where the uncertainty makes players correct both words honestly.

After players choose a pair, they will be asked to correct both words. Since they still don't know which word is the scoring word, they will correct both to minimise risk. After they submit their corrections, which word was the Skill Word and which was the Contribution Word, will be revealed. If the Skill Word is corrected properly then the player receives the Skill Score equal to the score that was shown before. The Contribution Word gets recorded by the system and becomes the player's contribution to the platform. Unknown words like this can be passed through several games to collect answers from many players and then depending on the consensus of the word, a correct spelling can be confirmed. There is an element of delayed gratification where if the player's spelling for that word gets confirmed as the right spelling over time then that player will get bonus skill points that will be added to his player profile.

5.2 Two-Player Game

The game element of this solution would be the two-player game. A game can be played against a stranger or someone you know on the platform. In this game, two players would compete to score the most skill points within 10 rounds. Each player will get to choose word pairs in 5 rounds, in an alternate manner. The actions of choosing word pairs as well as correcting them will be time bound to add to pressure and thrill of the game. After both players are done correcting their word pairs, they will be shown their skill scores and

contribution words. Skill scores will be added up at the end of ten rounds.

Special Action - SWITCH

Player-player interaction is facilitated by a special action called SWITCH. SWITCH is used when in a turn, the other player is going to make the selection for the word pairs. A player can use this action before the other player selects. SWITCH reverses the selection made by the other player in any round. This means the pair selected by the other player will come to you instead of going to them and the unselected word which

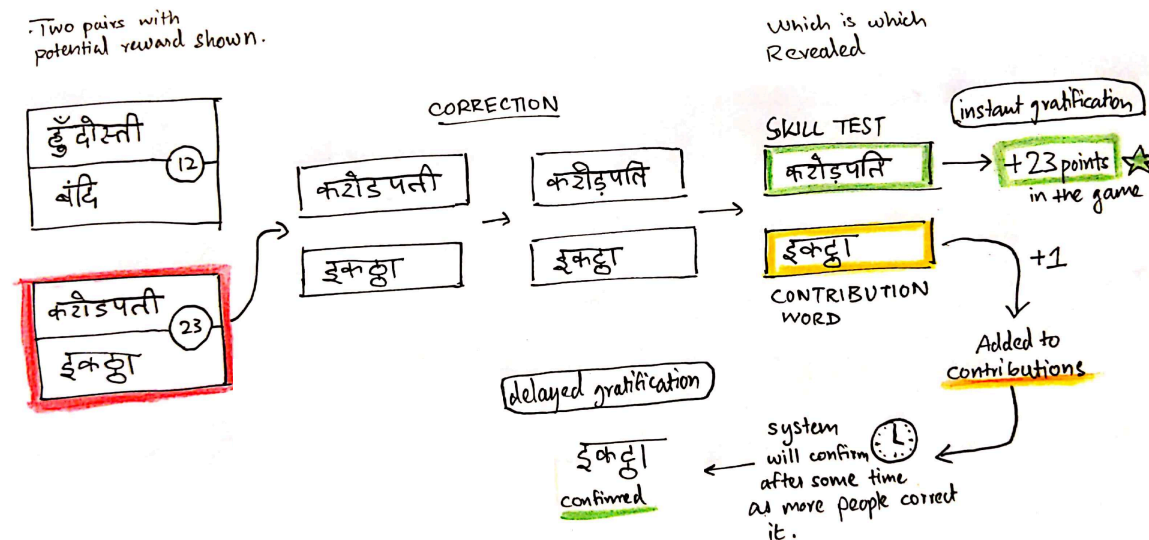


Fig 24- Selection, correction and rewards



Fig 24- Two Player Game

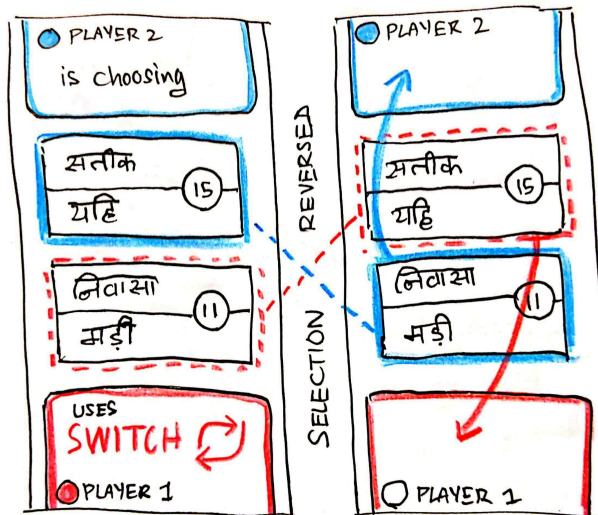


Fig 25- SWITCH action

was supposed to come to you will go to them. There will only be 2 SWITCH actions provided to each player which can be used in any of the 5 turns where the other player is selecting. This allows players to trick each other and keep them on their toes. While making any selection you must consider the possibility that the opponent has used a SWITCH. Whether or not they did will only be known after you make the selection.

5.3 Single Player Mode

There will also be a single player mode where players can both test their skills(also collect skill points) as well as make

contributions voluntarily(increasing their contribution score). This mode can be played by players at any time to advance their progress in the games by increasing their skill and contribution scores.

5.4 Player Profiles

Player profiles are an important part of this concept since they give players an identity within the system and provide a place to follow their contributions and their journey through the platform. All the words that have been contributed by a player will visible on the profile page with their status. The status of a

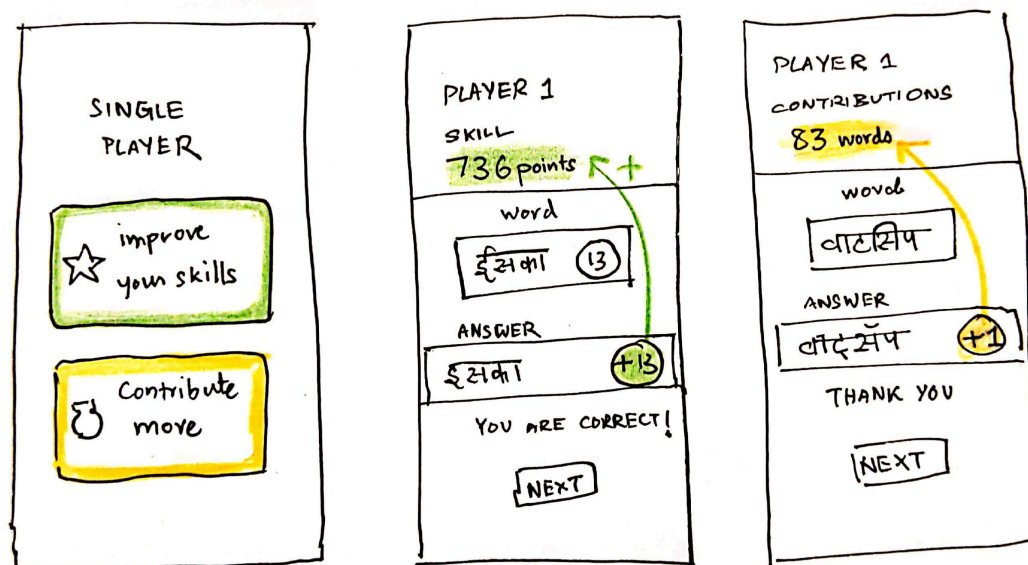


Fig 26- Single player mode

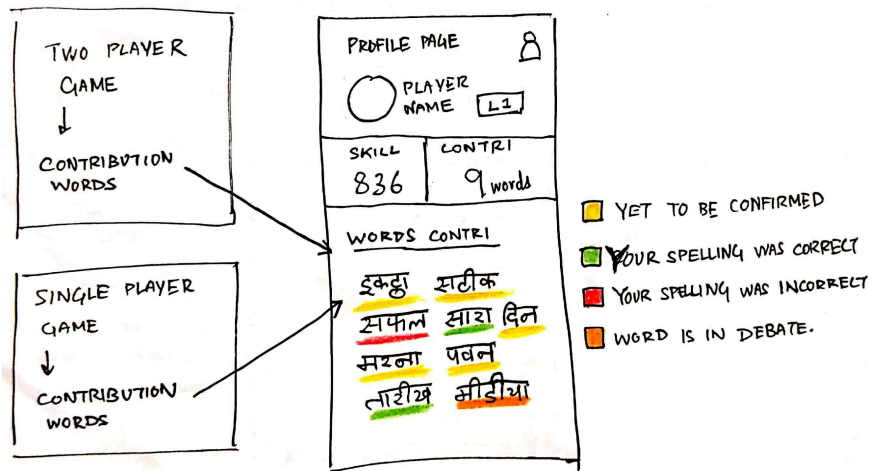


Fig 27- Player Profiles

word is whether a correct spelling has been accepted in the system. Players will be able to access individual details of each word from this page as well.

The profile page will be also be publicly visible to others in the platform and everyone will be able to see each other's skill and contribution scores.

5.5 Player Levels

Another important detail associated with player profiles is the player level. The player level determines the status of the player on the platform. There will be two player levels.

Beginner level players and Expert level players have the same privileges on the platform except that Expert level players have the power to open debates about words. All players will start out as Beginner level players on the platform but reach the upper level status as they pass a threshold of skill score and contribution score. This will be more fully detailed out in the next section.

5.6 Word Pages

Each word in the system will have its own page which will hold all the information about that word. This would include the original spelling, the corrected spellings as responses from players along with the numbers and percentage value of each response. It would also hold the link to the debate about the word, if there is any. Each word page will be publicly visible to all players.

5.7 Debates

There would be an option to start a debate on a word. Debates would only be started by upper Expert players. Beginner level players would only be able to make requests for debates. This would ensure that debates are only being started about words and issues that are necessary. It also would give more power to Expert level players as they are qualified to have it and would give Beginner level players something to achieve.

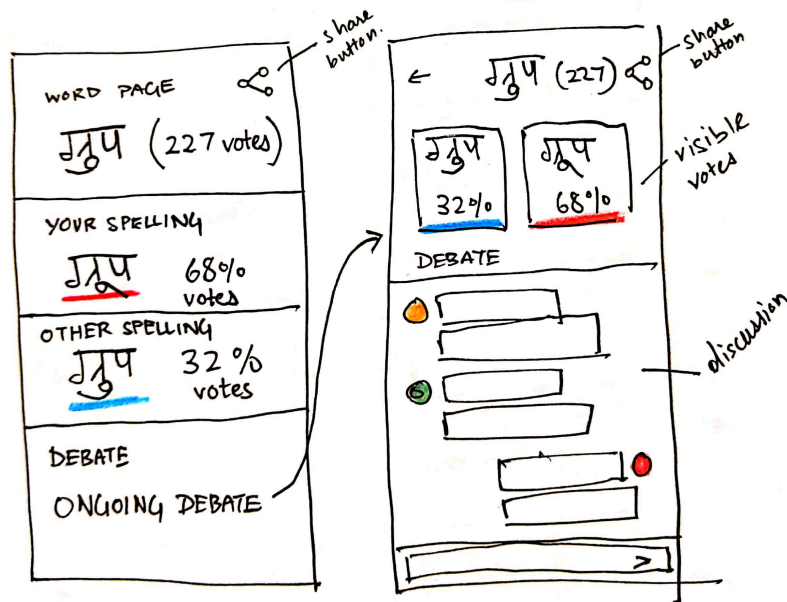


Fig 28- Word Pages and Debates

The option to start a debate would be associated with every word in the system and if a Beginner level player feels like a debate needs to be had about a certain word or spelling then he/she would be able to make a request for a debate. These requests would go to the pool of requests which will be visible to all Expert level players. They could go through these requests and make judgements about where debates are warranted.

5.8 Overall App Layout

The platform will be split into 4 pages:

1. Homepage: This page would contain links to the player profile, 2-Player game, Single-Player Game and Popular Debates.
2. Explore Page: This page would allow players to explore the data in the system. They will have access to all the words in the system along with their responses and statues. They will also be able to see the most recent confirmed words, controversial words (with higher levels of disagreements between spelling) and other popular debates.
3. Updates Page: This page would have relevant updates like notifications of contribution words getting confirmed in the platform with information about whether the player's spellings were proven to be correct or not. There would also be updates about whether debates were started about any of the player's contribution words.
4. Chats and Debates page: This page would have two parts, one where players could chat with other players and one where they could access the debates which they were involved in. The idea of having a chat feature is to allow open communication within the platform.

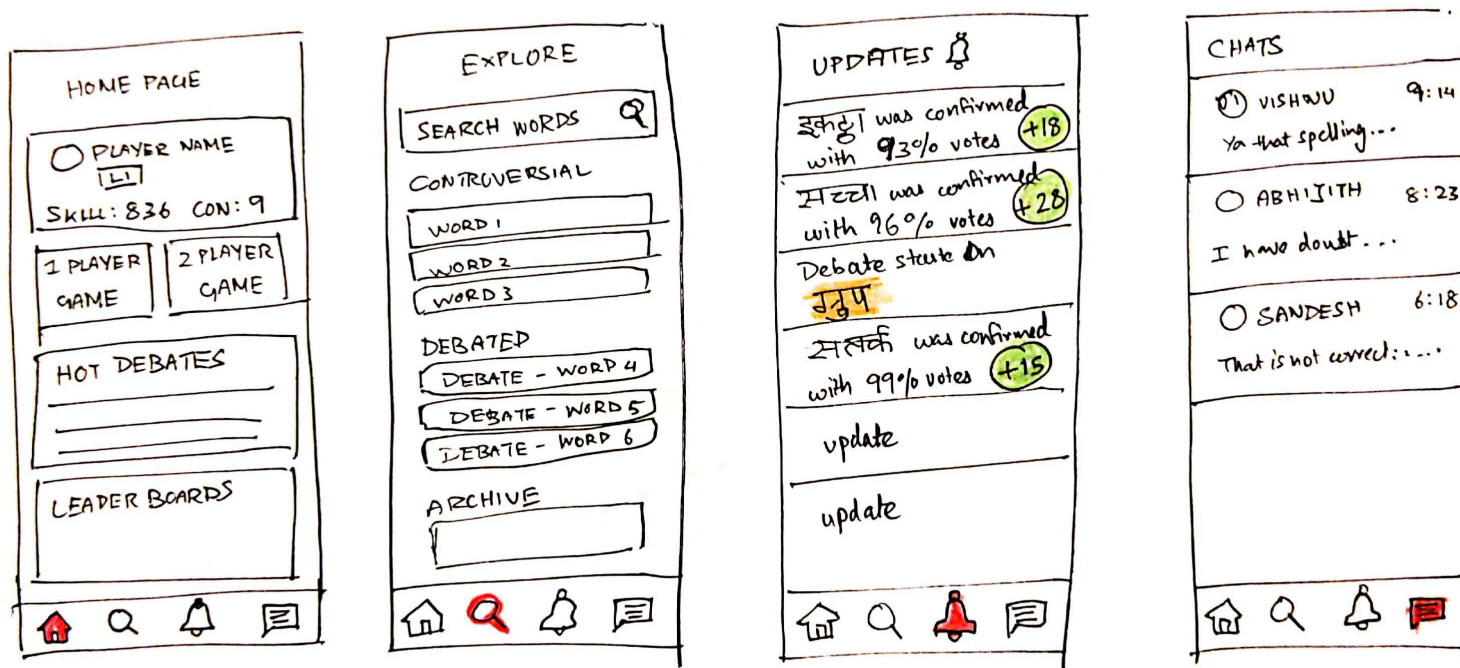


Fig 29- Overall App Layout

Final design

शब्द-कुशल

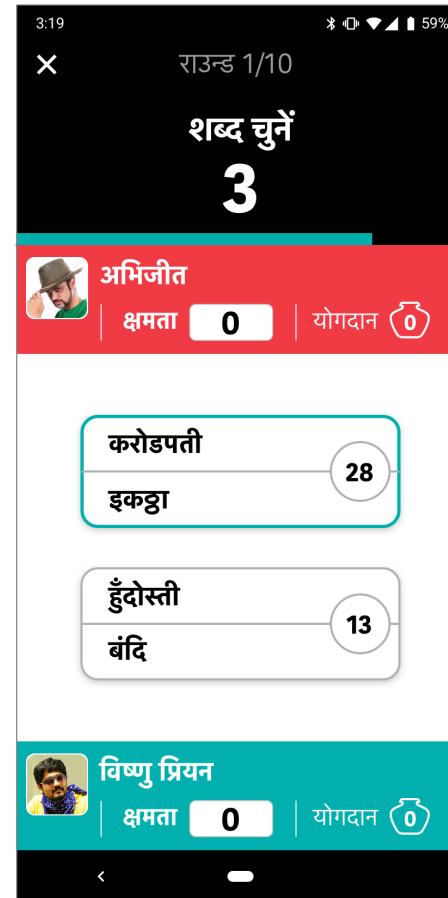
Two-Player Game



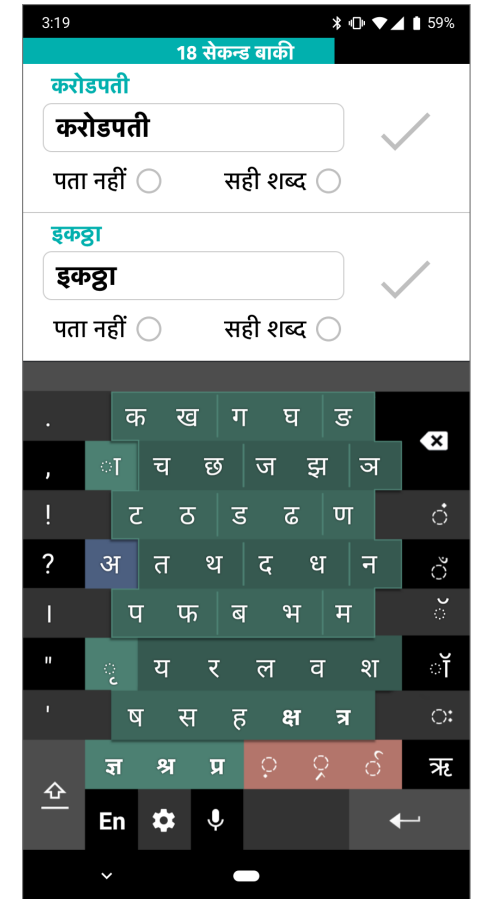
Two player game landing page. There is an option between playing with a stranger or playing with a friend.



Two pairs of words are presented and 5 seconds of time are given to the player who is choosing to make a decision.



The player picks the top pair and the bottom pair goes to the other player by default. There is 3 second window to perform the act of choosing.



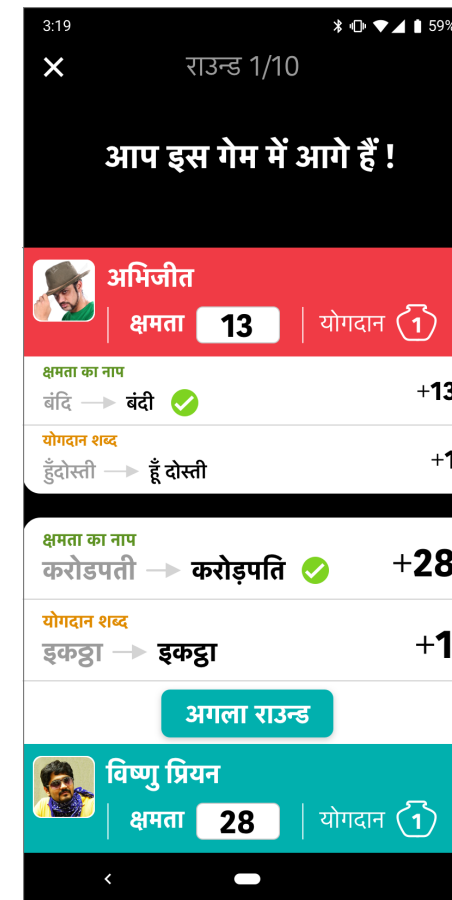
Now the player must correct both the words or decide if he does not know or if the word is correct in which case he must select that option. The time for this is 30 seconds.



The player is done and waits for the other player to finish.



The answers are now revealed and players are told which word was the 'Kshamta ka naap'(skill test) and which was 'Yogdaan shabda'(contribution words). Skill points are give along with the contribution words.



The 'Kshamta points' contribute towards winning the game and the overall 'Kshamta score' of the player. The 'Yogdaan shabda' are added to the list of 'Yogdaan shabda', in the player profile, waiting to be confirmed.

Ulat-Pulat



Now it's the turn of the other player to choose the word. In the 5 second period where the other player decides, there is an option for the player to use Ulat-Pulat. There are only 2 Ulat-Pulats available to each player in the game.



Ulat-Pulat has been applied and now when the other player makes the selection, it will be reversed.



From the perspective of the other player, he must preempt whether the other player could have used Ulat-Pulat in this round. Then he must take the risk and make the selection.



He selects the pair with the higher reward but unfortunately, the other player has used Ulat-Pulat and his selection has been reversed.



After the game, the Kshamta points are compared and the one who has the higher score, wins.

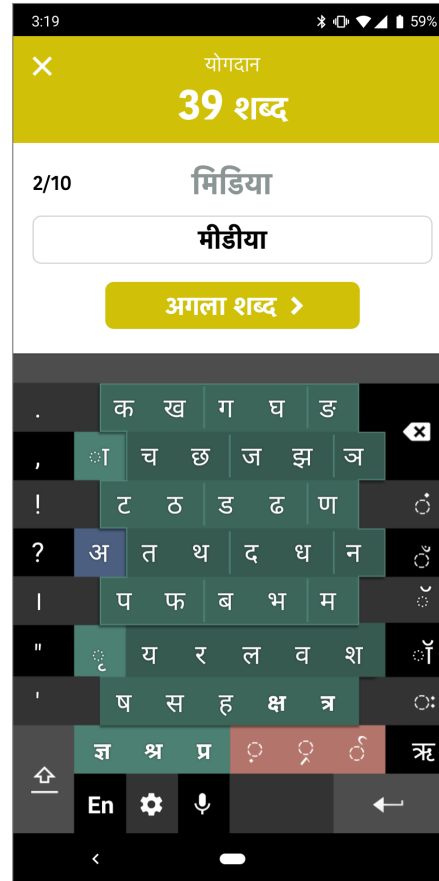


The reward for the game is shown where the Kshamta points and the Yogdaan words are visible.

Single-Player Mode



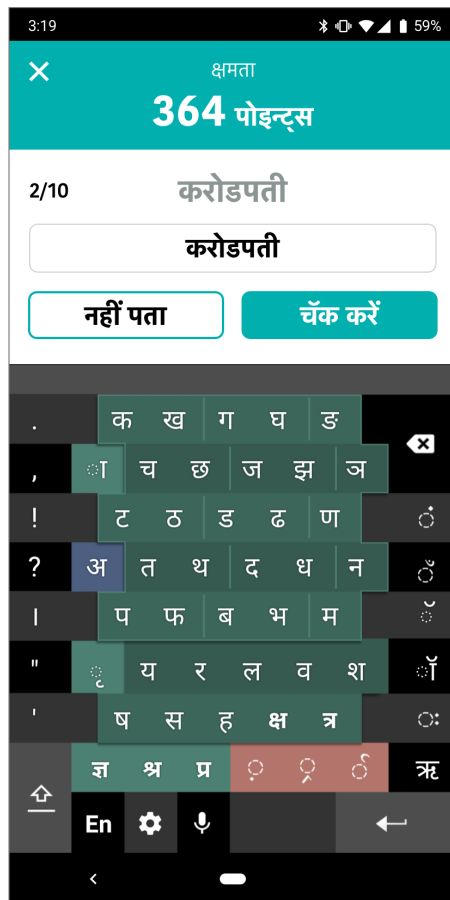
The single player mode has two options, to improve your Kshamta score and to increase your Yogdaan shabda.



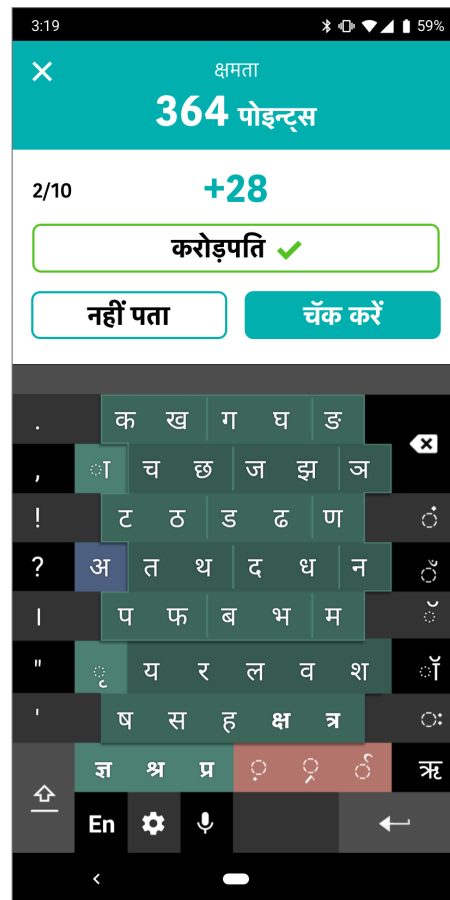
Adding to your Yogdaan shabda by correcting new unknown words.



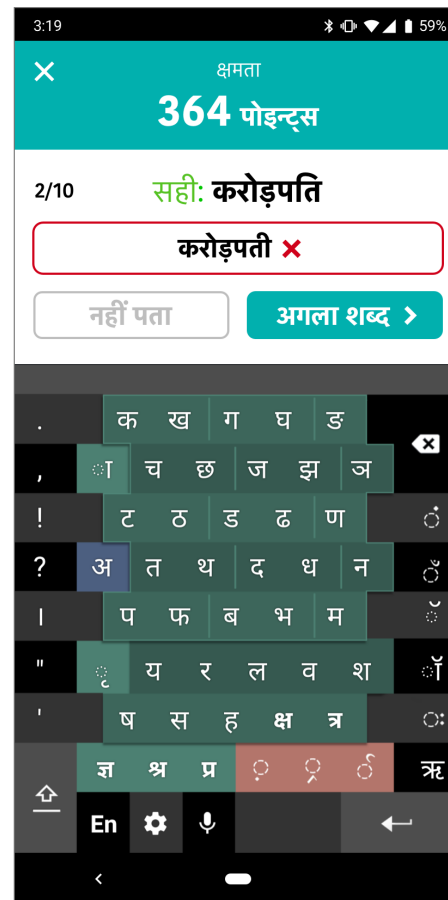
The total contribution, Yogdaan, made through the game is shown.



Kshamta score is improved by correcting known words and seeing how well you performed.



Correction is entered and answer is checked. If correct, the corresponding number of points are allotted depending on how difficult the correction was.



If wrong, no points are allotted and the correct answer is shown.



The total Kshamta points earned is shown at the end of the game.

Profile Page and Word Page

Player profile shows your name and profile picture.

Your level

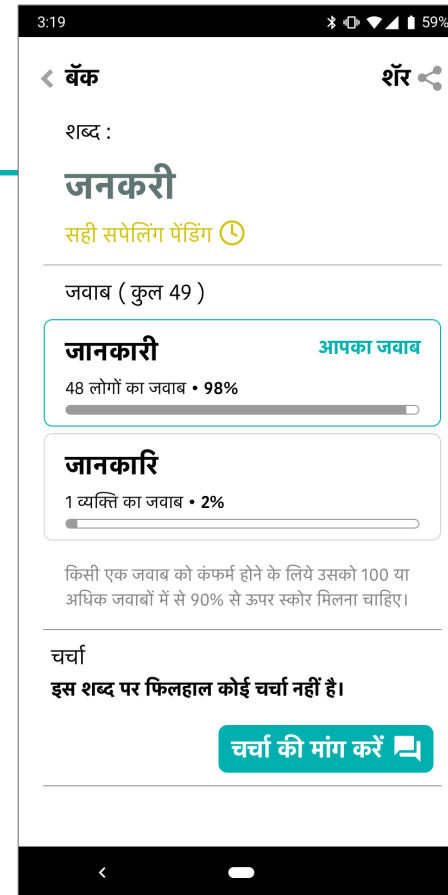
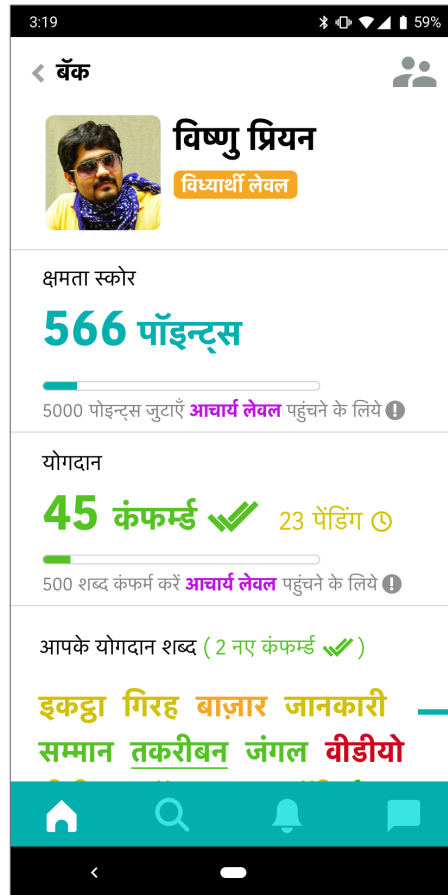
Your Kshamta Score, accumulated from the games you played

Your Yogdaan Score, this is determined by how many yogdaan shabda got confirmed as correct

All of your Yogdaan words from single and two-player games.

The colour of the words indicates the status

-  Pending confirmation
-  Your spelling confirmed as correct
-  Your spelling confirmed as wrong
-  Word is in discussion



Each word has an individual page which hold all its information

It shows the status of the word, whether it is pending or if a correct spelling has been confirmed

The different responses from people along with the frequency of each numbers and percentage of each.

Associated discussions, if any. If there are none, there will be an option to request one.

There are two player levels:

- Student (Vidyarthi) Level - They don't have power to start discussions(charcha). They can only request discussions. Need 5000 Kshamta points and 500 confirmed Yogdaan words to reach Acharya Level.
- Master (Acharya) Level - Have the power to start discussion(charcha) by approving requests from Vidhyarthi level players.

Instances of Word Pages

< बँक

शॉर

शब्द :

जनकरी

सही सपेलिंग पेंडिंग

जवाब (कुल 49)

जानकारी

आपका जवाब

48 लोगों का जवाब • 98%

जानकारी

1 व्यक्ति का जवाब • 2%

किसी एक जवाब को कंपर्म होने के लिये उसको 100 या अधिक जवाबों में से 90% से ऊपर स्कोर मिलना चाहिए।

चर्चा

इस शब्द पर फिलहाल कोई चर्चा नहीं है।

चर्चा की मांग करें

< बँक

शॉर

शब्द : वीडियो

विडियो

3 घंटे पेहले

शब्दार्थ

इस शब्द का अर्थ फिलहाल उपस्थित नहीं है।

शब्दार्थ लिखें

जवाब (कुल 135)

विडियो

आपका जवाब

124 लोगों का जवाब • 91%

वीडीयो

आपका जवाब

11 लोगों का जवाब • 9%

किसी एक जवाब को कंपर्म होने के लिये उसको 100 या अधिक जवाबों में से 90% से ऊपर स्कोर मिलना चाहिए।

चर्चा

इस शब्द पर फिलहाल कोई चर्चा नहीं है।

चर्चा की मांग करें

< बँक

शॉर

शब्द : जगल

जंगल

3 घंटे पेहले

शब्दार्थ

इस शब्द का अर्थ फिलहाल उपस्थित नहीं है।

शब्दार्थ लिखें

जवाब (कुल 122)

जंगल

आपका जवाब

122 लोगों का जवाब • 100%

किसी एक जवाब को कंपर्म होने के लिये उसको 100 या अधिक जवाबों में से 90% से ऊपर स्कोर मिलना चाहिए।

चर्चा

इस शब्द पर फिलहाल कोई चर्चा नहीं है।

चर्चा की मांग करें

< बँक

शॉर

शब्द :

बजार

सही सपेलिंग पेंडिंग

जवाब (कुल 179)

बाज़ार

आपका जवाब

92 लोगों का जवाब • 61%

बाजार

आपका जवाब

51 लोगों का जवाब • 24%

बजार

आपका जवाब

36 लोगों का जवाब • 15%

किसी एक जवाब को कंपर्म होने के लिये उसको 100 या अधिक जवाबों में से 90% से ऊपर स्कोर मिलना चाहिए।

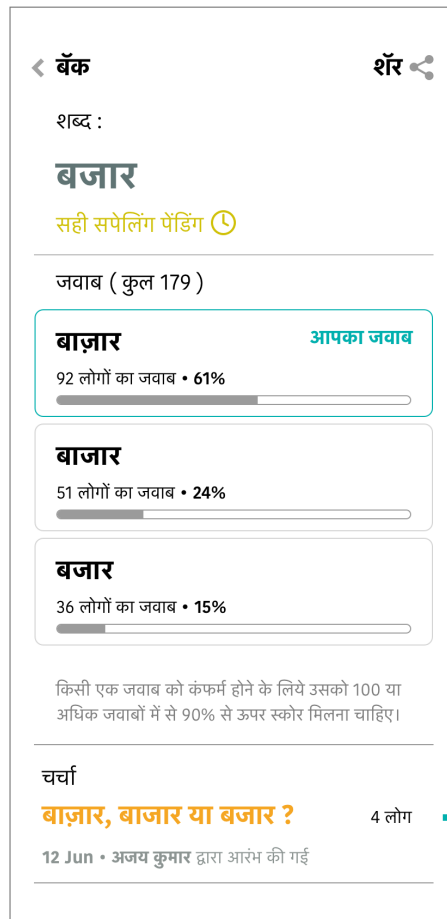
चर्चा

बाज़ार, बाजार या बजार ?

4 लोग

12 Jun • अजय कुमार द्वारा आरंभ की गई

Discussion(Charcha) Page



Discussions are shown in word pages



Discussions(Charcha) Pages show the conversation threads along with information about the word in question and details about who started the discussion and when.

Requesting a Discussion

< बेंक

शब्द : वीडियो

विडियो ✓

3 घंटे पहले

शब्दार्थ

इस शब्द का अर्थ फिलहाल उपस्थित नहीं है।

शब्दार्थ लिखें

जवाब (कुल 135)

विडियो ✓

124 लोगों का जवाब • 91%

वीडीयो

आपका जवाब

11 लोगों का जवाब • 9%

किसी एक जवाब को कंफर्म होने के लिये उसको 100 या अधिक जवाबों में से 90% से ऊपर स्कोर मिलना चाहिए।

चर्चा

इस शब्द पर फिलहाल कोई चर्चा नहीं है।

चर्चा की मांग करें

3:19

चर्चा का नाम :

सही उच्चारण 'वीडीयो' है

शब्द : वीडियो

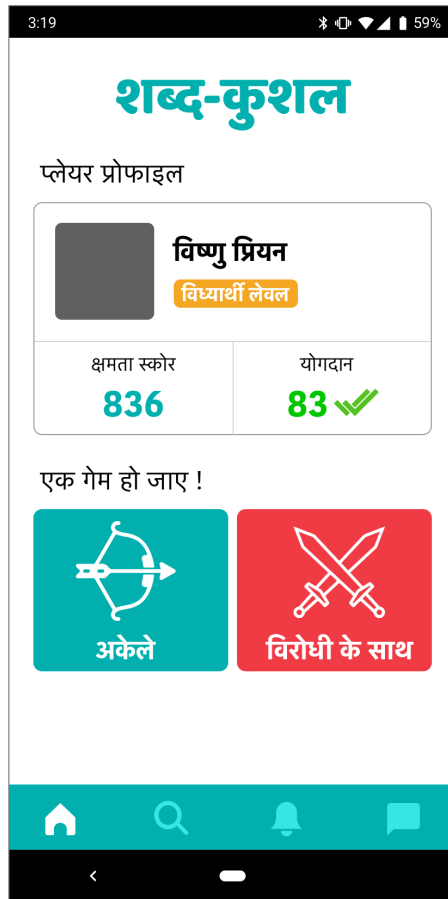
आपकी क्या कहना है ?

जबकी ज्यादातर लोगों का कहना है की 'विडियो' साही उच्चारण है, मेरा मानना है की इस शब्द का 'वीडीयो' लिखा जाना चाहिए।

मांग करें

Student Level (Vidyarthi Level) Players can request request discussions to be started about certain words in case they feel there is something that the responses from the public are missing out on.

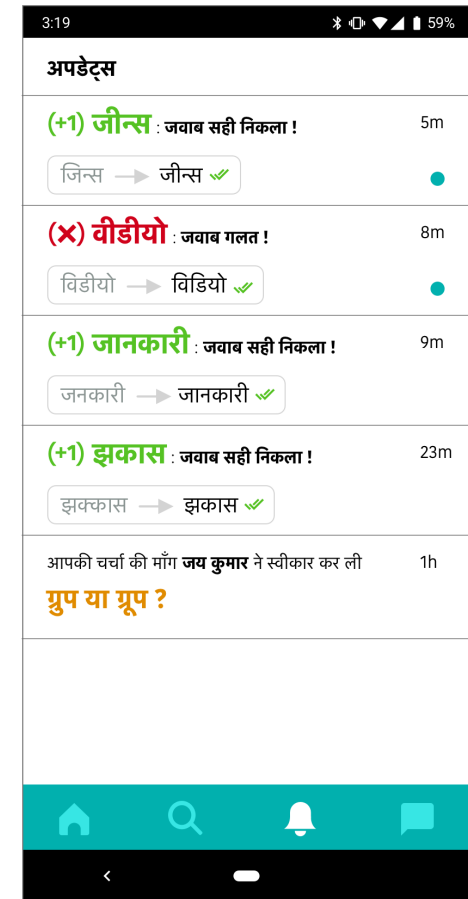
Overall App Layout



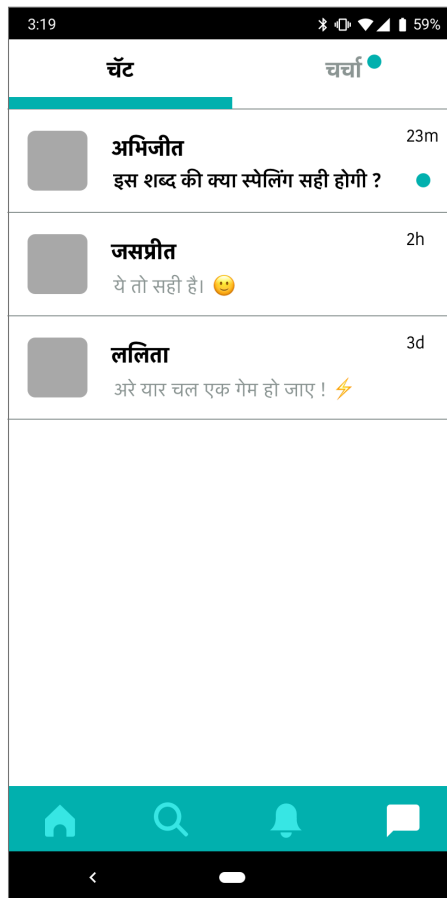
1. Homepage: This has links to the player profile, single-player and two-player games.



2. Explore: This page gives players access to all the data of the platform. They can browse words, find other players, find popular discussions and controversial words.



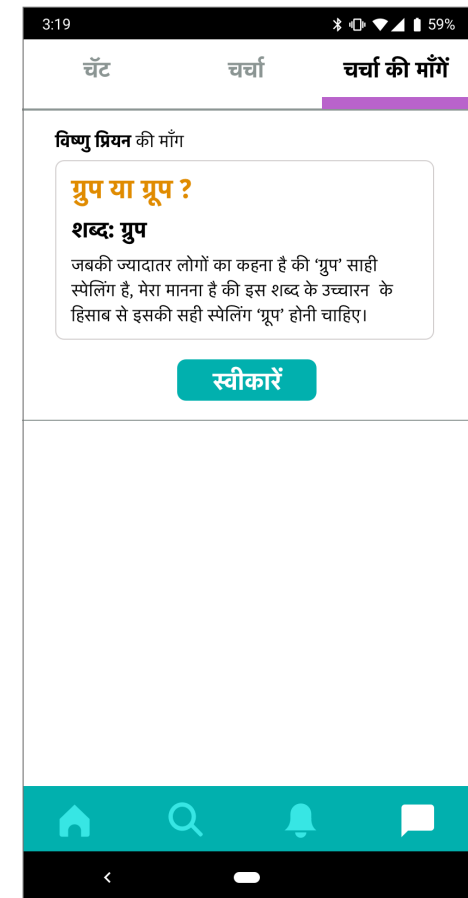
3. Updates: This page shows all relevant updates to players like Yogdaan words getting confirmed as correct or wrong and requests for discussions(charcha) being accepted.



4. Communications: This page holds all the conversations and discussion. This first tab shows chats with individual players



This tab shows the discussions you are involved in.



For Acharya level players there will be another tab which will show all the open requests for discussions(charcha) they can accept to start these discussions here.

6. Reflecting on the Design

This concept incorporates the recommendations I had noted in section 4.6:

- There is complete transparency in the system as players can view all the information about all the words in the system. There are no elements which are being hidden from them in terms of their purpose. Even within the games, the meaning of the skill test (Kshamta ka naap) words and contribution (Yogdaan) words are clear and they know exactly how each of them contributes to their progress as players. They can track the status of the words they interact with and keep note of how their contributions play a role in their fate.
- Players are the ones driving the system as they are directly responsible for the contributions and the output of the platform. Once they get to a certain level within the platform (Acharya level) they control discussions within the platform and can make more informed judgements about words.
- Player contributions are made visible by showing all of a player's contribution (Yogdaan) words in his/her player profile. They can keep track of how many of these got confirmed and how many got rejected. The overall output of all the players together is visible in the explore page where the number of words corrected on the platform are displayed.

- There is an attempt to provide as much feedback as possible. Within games, players are given instant feedback by using known words (skill test of Kshamta ka naap) which players correct. There is also an element of delayed gratification in the form of contribution (Yogdaan) words being confirmed with time adding to the contribution (Yogdaan) score.

Aligning with the objectives of the project this concept would potentially lead to a system of cleaning words from the Swarachakra wordlist with a full awareness of the people who participate in this activity. It captures the debates about words and language (which I had stated in the introduction) through discussions as well. It would allow people to represent their interests in legitimising colloquial and regional words as well as include words from other languages like transliterated English words.

The final concept is confined to the design stage as it is outside my skillset to develop this extensive an application. The decision against designing something that I could make a working prototype of, was from the idea that I should not compromise on a potentially good solution due to a limitation of skills and making something overly simplistic might result in a solution like the ESP game which leaves out a lot of the elements listed above.

7. Conclusion

In conclusion, while the design I came up with represents my attempt at tying together my learning about crowd based games and crowdsourcing platforms, there are many elements which need to be tested and improved upon. While the broader direction of my final solution was influenced by the theory I read, the details were design decisions that I took. To prove these as legitimate I would have liked to find a way to evaluate my design. This however seemed impossible given that its an extensive application with many social components(chats, multiplayer games, discussions, public profiles). Predicting user behaviour in systems like these is difficult without observing their interactions with a finished platform. There are many factors, including long term investment in the platform, that cannot be simulated. Such a solution could only be tested fully if developed in its entirety with all the interacting components which work together to complete the system.

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9. Appendix

Here I have performed a comparative analysis of spellcheckers by feeding into each of them some words which one would not expect to be part of formal hindi. These include slang(झकास), transliterated words(मुप) and regional words(लफुसड़ा). As is evident, most spellcheckers detect these words as errors and not legitimate words. They also do not offer any corrections which may represent a correct version of that word.

word		stars21.com	awgp.in	Google docx	dict.hinkhoj.com	Hunspell	MS word
झकास	Detected as error	yes	yes	no	yes	yes	yes
	Correction offered	झकास	झक	no	no	no	no
बिंदास	Detected as error	no	yes	no	yes	yes	yes
	Correction offered	no	बिंदी	no	no	no	no
लफुसड़ा	Detected as error	yes	yes	no	yes	yes	yes
	Correction offered	लफुसड़ा	लफंगा	no	no	no	no
चोमु	Detected as error	yes	yes	no	yes	yes	yes
	Correction offered	चोमु	चौच	no	no	no	no
लंबू	Detected as error	no	yes	yes	yes	yes	yes
	Correction offered	no	लंब	लंबू	no	no	no
विडियो	Detected as error	no	yes	yes	yes	yes	yes
	Correction offered	no	वीडियो	वीडियो	no	no	no
गुप	Detected as error	no	no	no	yes	yes	yes
	Correction offered	no	no	no	no	no	no
फॉन	Detected as error	yes	yes	yes	yes	yes	no
	Correction offered	फॉन	फडकन	जॉन	no	no	no