Porul: Option Generation and Selection and Scoring Algorithms for a Tamil Flash Card Game

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Abstract—Games can be the excellent tools for teaching a language. There are few e-learning games in Indian languages like word scrabble, cross word, quiz games etc., which were developed mainly for educational purposes. This paper proposes a Tamil word game called, "Porul", which focuses on education as well as on players' thinking and decision-making skills. Porul is a multiple choice based quiz game, in which the players attempt to answer questions correctly from the given multiple options that are generated using a unique algorithm called the Option Selection algorithm which explores the semantics of the question in various dimensions namely, synonym, rhyme and Universal Networking Language semantic category. This kind of semantic exploration of the question not only increases the complexity of the game but also makes it more interesting. The paper also proposes a Scoring Algorithm which allots a score based on the popularity score of the question word. The proposed game has been tested using 20,000 Tamil words.

Keywords—Porul game, Tamil word game, option selection, flash card, scoring, algorithm.

I. INTRODUCTION

THE Millionaire Game is one of the most popular multiple choice question games, where players need to find the correct answer for a question. If the multiple options in such games are easy, then the player can guess the correct answer by eliminating the options that are not related to the question. For instance, for the question "What is the capital of Australia?, the probability of the player to choose the right option is higher when the options (New Delhi, Canberra, Colombo, Islamabad) are given than giving the options (Sydney, Melbourne, Canberra, Tasmania). This indicates that if the relationship between the question and the options are tightly bonded, then it becomes difficult for the player to decide on the correct answer. This idea has been explored by the proposed Porul game.

The Porul game generates questions in Tamil and options in English which are based on the following four categories of relations that exist between the question word and the options. The game is described as follows:

- English equivalent of the question word. The English equivalent describes the direct meaning of the question. Since at times, the words are literature specific, and the synonyms also induce complexity to the player.
- English equivalent of a rhyme of the question word. RA rhyme is a word agreeing with another in terminal sound [1]. A rhyme word for the game is obtained through the online Rhyme Finder tool [2].

- English equivalent of the Universal Networking Language (UNL) category of the question word. UNL is a language independent representation which converts every Natural Language (NL) word of a text into a Universal Word (UW) and semantically relates it to other UWs present in the text using UNL relations [3]. Each UW will have two components namely, the head word and the semantic constraint. The semantic constraint expresses the context in which the UW has been used in the text. For instance, for the NL word Elephant, the UW is Elephant (Icl>animal), where the head word is Elephant and the semantic constraint is icl>animal. The semantic constraint is used as one of the options by the proposed game.
- English Equivalent of a similar word of the question. Similar word refers to the equivalent popular word of the question word. The popularity of a word depends on its usage in the web [4].

Hence, the Option Selection algorithm generates options that are closely related and makes the player think more in order to land on the correct option. All the synonyms are obtained from the Agaraadhi online dictionary [5]. This way the vocabulary level of the player is tested. Furthermore, through the semantic categories of the options, the player's ability to think about a word in different dimensions has also been tested. This eventually increases the knowledge of the player towards the Tamil vocabulary. Scoring is calculated based on five different levels. The levels are classified according to popularity of words.

The rest of the paper is organized as follows. The second section presents the state of the art games. The third section describes the scoring model and option selection algorithm used in the proposed Porul game. Section four discusses the results and evaluation, and the fifth section summarizes the paper and also discusses the future extensions of this work.

II. LITERATURE SURVEY

The volume of computer games has increased steadily in recent years. There are online games which cover Categories such as "Art", "Books", "Entertainment", "Fashion", "Games", "Places & People", "Science" and "Sports" etc. Few games are time-bound, they demand the player to answer a question within a given time period. Parimalakanthan has proposed a Tamil Game which enhances Tamil learning. The game focuses on Idioms matching [6]. Elachezhiyan et al. have proposed a scoring model which assigns a score based on its usage frequency [4]. Verbs Quiz [7] is a quiz game where the players need to choose the correct missing word from a given sentence. The number of questions that the player needs to

answer per game is five. PowerVocab Word Game [8] is an Android application, which is one of the most popular English word games designed to build a strong vocabulary, and contains a list of challenging words. Tamil crorepati [9] is an Android application that aims to improve general knowledge in the Tamil language. This game includes 12 questions in Tamil. The player gets promoted to the next level based on his/her success in the current level.

The proposed Porul game differs from the existing games through its different levels, positive & negative scoring, unique option generation and scoring techniques. Porul generates multiple complicated options that are closely related to the question word in English that tests the bilingual thinking capability of the player. The game is developed in a way to increase the complexity by creating confusion in the player while choosing the correct option. Also, the scoring model is designed to increase replayability.

III. PROPOSED WORK

In this section, the Option selection algorithm and scoring algorithm of the proposed Porul game are presented. Option Selection algorithm enhances the inquisitiveness of the player to find out the correct meaning from the list of confusing options. The Scoring algorithm encourages the player to achieve a high score and move on to the next level without getting negative scores.

A. Porul's Option Generation and Selection Algorithm

The basic idea of Option Selection Algorithm is to increase the difficulty level of the question as well as to kindle the interest of the player. The major complexity of this Algorithm is to generate the options in English that are semantically bonded to the Tamil question word.

For instance, if the Flashword is கேழல் ("Kezhal", "Pig") the list of Option words generated from option selection algorithm will be,

- நவ்வி ("Navvi", "Deer") is generated from the UNL category of the question.
- வாரணம் ("Vaaranam", "Elephant") is the equivalent word of the question.
- யாழல் ("Yaazhal", "White Ant") is the rhyme word of the question.

The set of Options for the word கேழல் will be {"Deer", "Elephant", "White ant", "Pig"}. The obtained options are displayed in random order to the player.

Porul's Option Generation and Selection algorithm is as follows:

Let $F^w=\{f_1,f_2,\ldots\ldots,f_n\}$ be the set of Flash words for which the meanings are to be found.
Let $O^r=\{o_1,o_2,\ldots\ldots,o_n\}$ the list of Option words for each F^w.
Let C be the correct meaning for f_n.
Let $O^p=\{l_1,l_2,\ldots\ldots,l_m\}$ be the set of Options, where $l_m= C\ U\ O_k$
  for each f_i in F^w where i= 1 to n do
    for k= 1 to 3 do
      if(k=1), find $O_k = O_k\ U$ find rhyming(f_i);
if(k=2), find $O_k=O_k\ U$ find unl(f_i);

if(k=3), find $O_k=O_k\ U$ find equivalent(f_i);
end for
 for len=1 to $|O_k|$ do
$l_m = l_mU$ find meaning(O_{len});
end for
$l_m=l_m\ U$ findmeaning(fi);
 end for

In the above algorithm, the method find rhyming(word) finds rhyming word for the flash word, the method find unl(word) finds a word that has the same UNL category as the flash word, the method find equivalent(word) finds a word of same popularity score of flash word, the method find meaning(word) finds the meanings for the option words and the flash word.

B. Levels and Scoring Model

The player needs to find meaning for 20 words in a game. Flash words that are given as question are classified into five levels. The First level starts with easy words and the fifth level ends with difficult words. Each word is displayed with 4 meanings in the card. Popularity of a word depends on its usage in the web [4]. The words are classified into levels just because individual scores can be allotted to each level, to enhance the interestingness and replay-ability of the player. The game starts with first level (i.e. popular word), if the player finds the correct option then the game will be progressed to next level question, else the level will be decreased. The State Transition Diagram shown in Fig. 1 explains how the levels and scores progress, i.e. the Game starts from Level 1 and if the answer is right, the player will earn 25 points and if the answer is wrong, the player loses 125 points. In Level 2, if the answer is right, the player will earn 50 points and if the answer is wrong, the player loses 100 points. In Level 3, if the answer is right, the player will earn 75 points and if the answer is wrong, the player loses 50 points. In Level 4, if the answer is right, the player will earn 125 points and if the answer is wrong, the player loses 25 points.
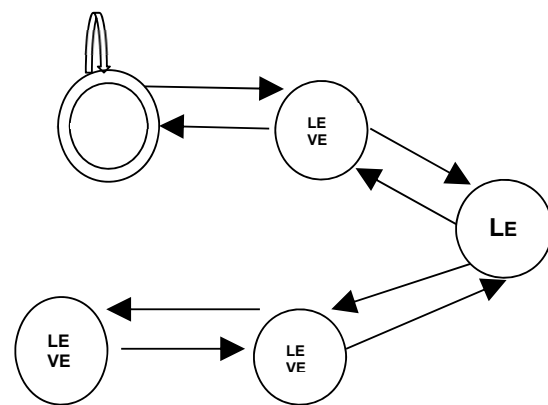

Fig. 1 State Transition Diagram

1. Porul's Scoring Algorithm

Scoring algorithm has been designed in a way to consider

both the Correct and Wrong option selected by the player. Each Wrong option carries negative points, so every question becomes more valuable. To explain the scoring process more clearly, let us assume that the player plays Level 1 and Flash Word is சாதனை and if the player selects the Correct Meaning, the Score will be increased by 25 points or the Score will be reduced by 125 points. Let us now assume that the player is at Level 5 and the Flash Word is தாழி and if the player selects the Correct Meaning, the Score will be increased by 125 points or the Score will be reduced by 25 points.

Porul's Scoring algorithm is as follows:

Let $Fw=\{f1,f2,\ldots\ldots,fn\}$ be the set of Flashwords for which the meanings are to be found
Let S_m be the selected meaning
Let $M=\{m1,m2,\ldots\ldots,mj\}$ be the set of meanings selected by the player for each Fw
Let Sc be the total score
Let $|L|$ be the Level number
Let l_i be the level score where i= 1 to 5
for each fk in Fw where k= 1 to n do
      if $(S_m = m_j \in M$ & $m_j= Meaning(F^w))$ do
               $Sc= Sc+ l_i$
      Otherwise
               $Sc=Sc-l_{(|L|-(i-1))}$
      end for

Table I describes the scores for five levels of popularity.

TABLE I
SCORES AND LEVELS

	Level1	Level2	Level3	Level4	Level5
Right	+25	+50	+75	+100	+125
Wrong	-125	-100	-75	-50	-25

The next section describes the implementation details of the Porul game.

IV. RESULTS

The game - "Porul" is developed using the algorithm and scoring model as described in the methodology section. It is developed using Java Language and the interface is designed using the .css() and JQuery method. The game is evaluated with 20,000 Tamil words and checked that the game could generate scores and options as per the algorithms explained. The words tested fall into all difficulty levels. This was done automatically through test cases. The snapshots of the game and their explanations are shown in Figs. 2-4. Fig. 2 shows the front side of the flashcard, which contains the Flash word, corresponding Olingoa [10] word and options with level number and question number. The flashcard flips once the player proceeds with the submit button.

Figs. 3 and 4 show the backside of the flashcard which displays the correct answer along with the score.
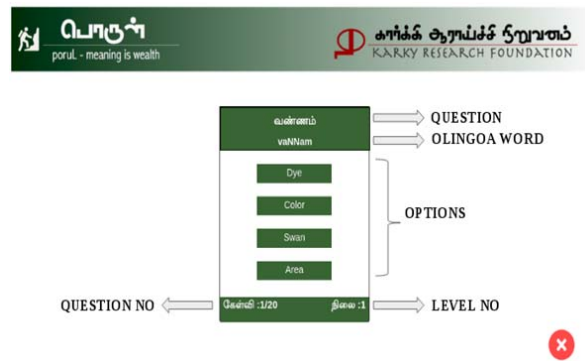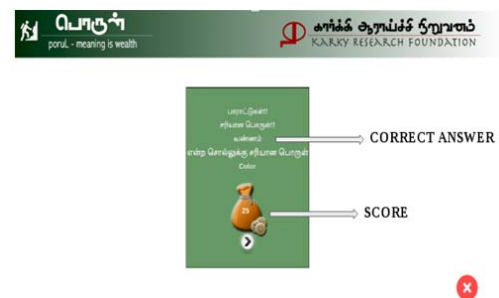

Fig. 2 Flashcard front side
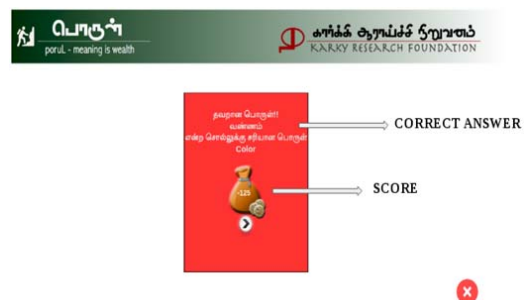

Fig. 3 Flashcard backside

Fig. 4 Flashcard Backside

V. CONCLUSIONS AND FUTURE WORK

Learning a new language can be a great experience when one's approach to learning is geared towards having fun. Nowadays, we can learn languages through social media, movies, games etc. There are many online language games. The proposed Tamil word game Porul is designed to involve the player by thinking about the words in different bilingual dimensions. The option selection and scoring algorithms adapted by Porul are designed in an intelligent and interesting way. The same algorithms can be adapted for option-based games for any language. This makes the algorithm language-independent. They can also be used for generating multiple-choice options for quiz. Through this game, the player can learn and understand the synonyms of Tamil words. In the future, the game can be made more interesting by categorizing the questions in different types like colour names, places, actions etc. Furthermore, the game can also be incorporated

with a timer thereby testing the agility of the player.

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