Karuchā Ships Invaders: Cultural Issues on the Design/Development of a Japanese CALL Game made by/to Brazilians

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Abstract—**The crescent use of computational resources for supporting learning, including the language learning field, is taking place for Computer Assisted Language Learning (CALL), and related to this, there is the growing use of games for educational purposes, also including language learning, and it is known that this is an approach that shows significant results in the learning process. This paper presents a study about the design and development of a CALL game to teach Japanese language by/for Brazilians taking into consideration the cultural issues of both – Japan and Brazil – countries and their impact over the interface/interaction features of the CALL game developed called Karuchā Ships Invaders.**

Keywords—japan; culture; edutainment; gamification; hiragana; roma-ji.

I. INTRODUCTION

The use of technological resources is present in most of the daily activities, and it is not different in the educational domain. These resources are being largely used informally for helping language learning in several contexts, this is called Technology Enhanced Language Learning (TELL), and it encompasses the use of computational tools for the same purpose, in literature called Computer Assisted Language Learning (CALL). Furthermore, there is the rising of educational games bringing a new way to study manifold themes, the so called gamification [16]. Gamification is basically to use game design elements in non-gaming contexts [1], to bring out motivational factors that are usually applied on games, to another activities, with the goal of arousing people to practice what would be boring activities, just for the enjoyment of doing that. Once these motivating factors are put in the context, and the tasks can become rewarding, it can cause positive effect on the user.

An interesting approach about educational games is edutainment – i.e. education + entertainment –, which is to mask the educational piece of the tool with fun, sometimes with gamified learning activities, to make the learning to be a consequence of playing a game. Language learning is also included in the field of edutainment and gamification, in the attempt of making the process of learning a new language to be a pleasant activity for the student. In this context, for example, Pereira et al. [13] present a game for helping children learn Portuguese language.

Japan is an island nation located in the Asian continent, which is, in culture ways, very different from occidental countries, as Brazil. Its language is the Japanese, a language that owns a lot of particularities: it has three main alphabets, being two of them syllabics, i.e. hiragana and katakana (which together can be called kana), and the kanji, which are logographic characters adopted from China, and they also use roma-ji – Latin script – in some cases, for example, imported acronyms. This characteristic itself already defines a challenge and/or a barrier for occidental people that aim to learn about Japanese language. From the three main alphabets, the most important and basic to know is hiragana. Hiragana characters are the first taught in school for little children; furthermore, it is the most used alphabet: for words that do not have kanji, for adjective and verb endings, and also used for identify readings of unknown kanji, being inserted little hiragana letters by its side (in this case, called furigana).

In previous works, we presented the state of the art of Japanese CALL tools which have been developed in the academic environment [9], the state of the practice of Japanese CALL web tools [10], and the state of the practice of Japanese Android MALL apps [11]. All these works brought questions that needed to be answered about Japanese CALL, and an important axis that remained unexplored is Japanese culture – and what is the importance of that influence on the design/development of a CALL tool – in the sense of providing improvement on the learning experience by giving the user a more immersive environment related to the target language. It was also perceived with these works that, in general, games for helping Japanese language learning are scarce, specially for native Portuguese speakers; and still, this kind of game usually do not take into consideration cultural aspects of the involved countries.

This work introduces a CALL game directed to Japanese language learning, considering some aspects of the Japanese

culture. In this work we intend to available a tool – a game – that can help Brazilians to get conversant to basic Japanese language elements, through an entertaining gamified way. The game was designed and developed by/for Brazilians, being necessary a study of Japanese cultural features, which is performed with the purpose of drafting elements to be used in the interface as well as in the different levels of the game, for contextual and educational purposes. The game developed in this work intends to teach and fix the main basis of Japanese language, which is hiragana alphabet, in addition to teach cultural words that can be written with these characters for learning vocabulary too.

This paper is organized as follows: Section II presents works and CALL games for Japanese language related to this work; Section III presents an overview of the Japanese culture and describes the influence of Japanese culture on the design of the game developed; Section IV presents the developed game; Section V presents a discussion; and Section VI concludes the paper.

II. RELATED WORKS AND GAMES

Focusing on Japanese language learning, in the academic field, Stubbs [15] presents a Kana no Senshi, a desktop game that intends to teach Japanese beginner students to read kana quickly, for them to be able to start kanji classes efficiently. The game can analyze player's performance, i.e. speed and accuracy, and with the progress, the enemies – that come like zombies – become faster, stimulating the player to read and identify kana faster too; this makes the game effective for learning and also fun. The author, based on the validation process of their system, defend that it has good acceptance by the users because it unites fun with learning.

In the practical field, the Kana Invaders [8], the player has a ship too, but this one is controlled by the keyboard arrows; the enemies fall down similarly to [7]. When the player is sailing through the air and the ship's sight meets the target, a signal is showed on that character, asking the player to type the corresponding roma-ji for it. One more desktop-based game is Kana Attacks [3], with the particularity that the player has to sail to meet the target, but when it is done, spacebar has to be pressed and a dialog box will appear showing momently the hiragana for the player to type roma-ji related. After typed the correct roma-ji, the screen with the ship and enemies comes back and a shot is fired to the typed letter.

The web-based game Kana Invaders [7] allows the user to choose between hiragana and katakana at the beginning of the game; then the user is given a ship and enemies start to fall bringing characters with them. For the ship to shoot, the player just has to type the roma-ji corresponding to the enemy to be shot. Also, there is another web-based game with same name [6], which brings different approach, i.e. several enemies are displayed in rows and columns on the screen, each one with a hiragana character, and a roma-ji is given on the top left; the player just has to click pointing at the corresponding symbol, the click itself is the shot and the player has to hit the correct character; at the end of each level, time and accuracy are given. Another web-based game is Kana Drop [5], in which the player can also choose between hiragana and katakana characters at

the beginning; the enemies – characters – come falling down and the player has to type the corresponding roma-ji and press the Enter key for the enemy to be destroyed. The game provides a view of what the player is typing, and also it is possible to erase the typed characters whether a mistake is perceived.

The Kana Attack [2] brings the enemies as animals holding plaques with kanas written on it, and the player is given a hammer charged with a roma-ji that matches some of the enemies. The player has to hammer on the corresponding enemy related to the pronounce charged on the hammer at the moment. The Kana Drop [4] brings a Japanese scenario where fixtures fall down bringing kanas, and the player has to type the corresponding roma-ji using the virtual keyboard of the device; for that, this game is more suitable for the iPad tablet.

Table I shows a synthesis of the related works and games, with the name of the game, version, platform for which it is been developed, interface language, and information about if it is free. Fields with "-" means the information was not specified by the author/developer.

TABLE I. RELATED WORKS AND GAMES

Ref.	Name	Version	Platform	Language	Free
[15]	Kana no Senshi	-	Desktop	English	-
[8]	Kana Invaders	0.3beta4	Desktop (Windows)	English	Yes
[3]	Kana Attacks	0.91.0.13	Desktop (Windows)	English	Yes
[7]	Kana Invaders	beta	Web	English	Yes
[6]	Kana Invaders	-	Web	English	Yes
[5]	Kana Drop	1.0.3	Web	English	Yes
[2]	Kana Attack	1.1	Mobile (iOS)	English	No
[4]	Kana Drop	1.2	Mobile (iOS)	English	No

It is important to notice that all these works and games cited above do not contemplate cultural aspects of Japan, they only bring kanas and some of them bring interface elements that remind Japan. In this study, we intend to open space for cultural aspects attached to the most elements of the game that are possible. Next section we present some aspects of Japanese culture, opening possibilities of what can be used in this field to bring a more immersive and contextualized learning environment inside the developed game.

III. OVERVIEW OF THE JAPANESE CULTURE

We organized the Japanese culture in this work in some main aspects, i.e. communication, clothing, feeding, arts, popular culture, beliefs, and people's names, as described below. As Japanese culture is very large, we present an overall perspective of main points, not intending to embrace the whole theme, but to understand better the context and the usefulness of these elements on the game design.

Related to its own language, **communication** between people in Japan has its particularities. Japanese verbs have several forms, representing levels of politeness, being the two basic forms, i.e. (i) dictionary form (informal), and (ii) "masu" form (polite). Depending on whom the speaker is talking to, one or the other form is more suitable, and the use of the correct form is deeply important, because it shows the respect due to the interlocutor. Still, in Japanese verbs there is no

difference between present and future grammatical tense, as well as there is no gender or plural for substantives; besides, it is usual that some terms of a phrase are not said or written, to be tacit; all this making conversations plenty related to concerned context. The calligraphy – shodō (in roma-ji) – in Japan has also a tradition, and it is an artistic way of writing Japanese characters that contains several techniques, special brushes, inks and papers. Communication aspect is strongly present in the game, since it is its core. The main goal for what the game presented in this work was developed by our research group is to help the learning of Japanese language from the basis – hiragana alphabet –, that is, the beginning of communication.

Japanese modern **clothing** is composed by western and Japanese clothing. Since the former is being largely used on the daily, the Japanese traditional clothing passed to be used in special events, like ceremonies, festivals and funerals. The Japanese traditional clothing contains several variations of a special garment that looks like a robe. They have kimono and yukata as the most known and used kinds, being the former a formal garment that differs from male to female, and for the women, it can also vary depending on age or marital status, for example. Yukata is a most casual version of the kimono, and can be used at home and inns, after bathing. There are more several garments in the traditional Japanese clothing, e.g. nagajuban, haori, haori himo, hakama, tabi, zori, and obi. Clothing aspects influence the pictures that appear on the game in every picture that contains a garment, and the words are present on the bosses.

Japanese **feeding** has many traditional and known dishes. It is based on rice, soup, vegetables and meat (often fish), that can be uncooked, baked, fried and so on. Some known dishes are agemono, which is fried food; yakimono, grilled meat, poultry, fish and vegetables; nabemono, the baked ones; sashimi, the traditional raw meat, fish and seafood; and sushi, that is made of cooked vinegared rice combined with other ingredients, usually raw fish or other seafood. Japanese cuisine has also some known sauces, as shoyo (soy sauce), karashi (kind of mustard), mentsuyu, ponzu, warishita and wasabi, for example. Another particularity of Japanese feeding is its cutlery: instead of fork and knife, they use hashi, which are chopsticks used for eating; this is because they believe there is no good in having weapons on the eating table. The feeding aspect is also availed for bosses.

The **arts** in Japan are sundry, including painting (kaiga – that embraces several genres and styles), sculpture (the traditional clay figures), ukiyo-e (woodblock print), ikebana (artistic flower arrangements), literature, being these all part of traditional Japanese culture. The modern **popular culture** contemplates Japanese movies (with famous genres as horror, tokusatsu, anime, and sci-fi); music – being the most famous J-rock and J-pop – that nowadays is spread all over the world through cartoons and games; and manga, the Japanese cartoon magazines. In Japan, most people do not follow a single religion; instead, they incorporate elements of several beliefs, and this is what they call shinbutsu shūgō. The main **beliefs** are Buddhism and Shintō, but there are a few representations of Christianity, Islam, Hinduism, Sikhism, Judaism, and Taoism, that are practiced with the religious freedom enjoyed by all

Japanese. The arts, popular culture and beliefs are mainly present in the interface and interaction features of the game, as design and sound, and also in the cultural words (bosses).

In Japan, **people's names** is taken as a very important thing, there is a belief that a name's meaning can influence personality and fate for the whole life of a person [14]. When a baby is born, the parents choose a name that can bring the desired fortune and/or behavior. Japanese also have their own numerology for people's names, called seimeihandan, which can also influence on the name's choice. Japanese have also a preferred number of kanjis in a name, which says that the sum of first name and surname should not have more than five kanjis. Beyond the choice of pronounce, there is also the choice of the kanjis that will compound the name, since several kanjis can have the same reading. Futhermore, in Japan there is a list of allowed kanjis to use in people's names. This list is authorized by the Japanese Ministry of Justice and contains about 2,200 kanjis. Another particularity is that, to have a surname, or a family name in Japan was, until Meiji era, a privilege of higher society classes. This cultural aspect in particular has influenced on the game story, for the choice of names with meaning and in the name of the game itself.

IV.   KARUCHĀ SHIPS INVADERS

The Karuchā Ships Invaders CALL game[1] brings a story where a Brazilian city is being "invaded" by cultural Japanese ships, actually they are coming in peace and just want to be well received, and the player has to make the ships land safely in the Brazilian city. The name of the game was also inspired by a Japanese word, i.e. culture in Japanese is written in katakana as カルチャー and your roma-ji is karuchā. The game is invaders-like, and is also inspired in the work of Miranda et al. [12].

A. Plot, Gameplay and Features

Karuchā Ships Invaders starts when a couple of Brazilian exchange students go to Japan to learn about its language and culture. They have the mission of learn it and rehearse the knowledge to their friends who stayed in Brazil – which is the player –, because soon Japanese ships are coming to visit Brazil, and they will need Brazilian help to land; for that, it is necessary that Brazilian know about basic Japanese language and cultural aspects, so they can guide the ships to land safely in Brazil. Each day, the duo learn new things about Japan and communicate with the friends by means of text and pictures that are presented before some levels, teaching about new hiragana letters they learnt and new cultural experiences in Japan.

The player has a laser to guide the Japanese ships to the ground, which works in a particular way, i.e. using Japanese language knowledge. Each ship is a visitor that comes with a hiragana character written on it, and the player has the power to help it land, by typing the corresponding roma-ji to load a shot of light on the laser. Whilst the laser is charged, it will direct the shot to the corresponding ship – i.e. a hiragana character or an icon that represents one aspect of Japanese culture – whose

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[1] Available for download at http://code.google.com/p/karuchashipsinvaders/.

roma-ji was typed, and then the player just do the command for the laser to shoot the guiding light, which is to press the Enter key or backspace. If a ship is not well received (the player do not type its corresponding roma-ji in time), it hits the city and the player will lose a percentage from their hit points. Also, if the player gets to pass a level without allowing any ship to hit the city, the player wins 10% more of their hit points for the next levels until the end of the in progress game.

Karuchā Ships Invaders is a game developed to help beginners in the Japanese language to learn the hiragana alphabet in a different and more fun way, and being more immersive in the Japanese culture and the differences between it and the Brazilian one. This game is intended to be played for firming content learned by other methods, as for learning new content by playing. Though, we provide a sort of tutor presenting a story with characters – the two exchange students – that introduce the player to cultural elements that will be present in the game (as bosses). It still can be played for those who are yet conversant to hiragana, for practice of content and evaluation of knowledge, and also for improving vocabulary, by means of the cultural words (bosses).

The difficulty of the game contains three modes: easy, normal, and hard. They differ in the average time the ships and bosses fall down on the screen, being easy from 5 to 7 seconds between each ship/boss, normal is 4 to 6 seconds, and hard is 3 to 5 seconds. Withal, bosses' falling speed is decreased depending on the number of characters they have, i.e., for example a word containing five hiragana characters will fall down slower than a word that contains three hiragana characters, according to the following formula, where "t" is the time of fall, "dm" is the difficulty mode, with the values 1 for hard, 2 for normal, and 3 for easy; and "noc" counts the number of hiragana letters used to form the word.

$$t = dm * 3 + dm + noc$$

The game, available initially in Brazilian-Portuguese (PT-BR) and English languages, is composed by 30 levels, each one adding a new "gyo" – i.e. column with a family of five or less hiragana characters in the Japanese alphabetical order – for the player to practice hiragana. Table II shows the 107 hiragana characters, each level of the game with the respective gyos (families/columns of each hiragana character, in alphabetical order), the new characters that are presented in each level and total number of new characters included in the level. Levels 15 and 30 are totally dedicated to cultural aspects, and that is why they do not contain new single hiragana characters.

TABLE II.   BASIC ELEMENTS OF THE GAME

Level	Gyo	Hiragana (with its corresponding roma-ji)	
		Character	#
1	あ(a)	あ(a) + い(i) + う(u) + え(e) + お(o)	5
2	か(ka)	か(ka) + き(ki) + く(ku) + け(ke) + こ(ko)	5
3	さ(sa)	さ(sa) + し(shi) + す(su) + せ(se) + そ(so)	5
4	た(ta)	た(ta) + ち(chi) + つ(tsu) + て(te) + と(to)	5
5	な(na)	な(na) + に(ni) + ぬ(nu) + ね(ne) + の(no)	5
6	は(ha)	は(ha) + ひ(hi) + ふ(fu) + へ(he) + ほ(ho)	5
7	ま(ma)	ま(ma) + み(mi) + む(mu) + め(me) + も(mo)	5
8	や(ya)	や(ya) + ゆ(yu) + よ(yo)	3
9	ら(ra)	ら(ra) + り(ri) + る(ru) + れ(re) + ろ(ro)	5

Level	Gyo	Hiragana (with its corresponding roma-ji)	
		Character	#
10	わ(wa)	わ(wa) + を(wo)	2
11	ん(n)	ん(n)	1
12	が(ga)	が(ga) + ぎ(gi) + ぐ(gu) + げ(ge) + ご(go)	5
13	ざ(za)	ざ(za) + じ(ji) + ず(zu) + ぜ(ze) + ぞ(zo)	5
14	だ(da)	だ(da) + ぢ(dji) + づ(dzu) + で(de) + ど(do)	5
15	-	-	0
16	ば(ba)	ば(ba) + び(bi) + ぶ(bu) + べ(be) + ぼ(bo)	5
17	ぱ(pa)	ぱ(pa) + ぴ(pi) + ぷ(pu) + ぺ(pe) + ぽ(po)	5
18	きゃ(kya)	きゃ(kya) + きゅ(kyu) + きょ(kyo)	3
19	ぎゃ(gya)	ぎゃ(gya) + ぎゅ(gyu) + ぎょ(gyo)	3
20	しゃ(sha)	しゃ(sha) + しゅ(shu) + しょ(sho)	3
21	じゃ(ja)	じゃ(ja) + じゅ(ju) + じょ(jo)	3
22	ちゃ(cha)	ちゃ(cha) + ちゅ(chu) + ちょ(cho)	3
23	ぢゃ(dya)	ぢゃ(dya) + ぢゅ(dyu) + ぢょ(dyo)	3
24	にゃ(nya)	にゃ(nya) + にゅ(nyu) + にょ(nyo)	3
25	ひゃ(hya)	ひゃ(hya) + ひゅ(hyu) + ひょ(hyo)	3
26	びゃ(bya)	びゃ(bya) + びゅ(byu) + びょ(byo)	3
27	ぴゃ(pya)	ぴゃ(pya) + ぴゅ(pyu) + ぴょ(pyo)	3
28	みゃ(mya)	みゃ(mya) + みゅ(myu) + みょ(myo)	3
29	りゃ(rya)	りゃ(rya) + りゅ(ryu) + りょ(ryo)	4
30	-	-	0

In level 29, it is also added the study of sokuon, which is a little "tsu" character (っ) that has as its function to double the consonant that comes right after it. Sokuon does not appear in Table II because this table represents hiragana gyos whose characters will be presented alone for the player to type its reading, and once sokuon does not have a single reading – because it depends on the consonant that follows it – it is only used in bosses words, where it can be typed according to its reading in that context. For example, in the word "happi" (はっぴ in hiragana), the first 'p' is represented by a sokuon, ergo, its reading in roma-ji is 'p'; in another example case, there is the word "korokke" (ころっけ in hiragana), where the second 'k' is also represented by sokuon, i.e. in this case, sokuon reading in roma-ji is 'k'. With that said, it is understood that it is not possible to type sokuon's reading when it is presented alone, since it depends on another characters, and that is why this character is only practiced in words, in this case, Karuchā Ships Invaders' bosses.

Hiragana characters also have different influence/weight depending on the level. The more time a character was presented on the game, the more it will cause damage to the city. For example, in level 2, the character "あ" (a) will cause twice more damage than the character "き" (ki), once (a) was presented since level 1, while (ki) is a new hiragana character, presented for the first time in level 2. And the calculation goes on like this, each level of distance adds 50% more damage strength to the ship. For a guarantee that the user will practice more the recent presented characters, there is also a mechanism similar to the one cited above. For each level that passes, the characters presented on previous levels would lose frequency of appearing. Using the same characters on the previous example, in level 2, (a) has 50% less chance to appear than (ki). Also for guarantee that new characters will be practiced, from each two ships, one contains a new character inside, as a way to make sure that new hiragana letters will be presented indeed.

Also, the game contains bosses once every three levels, which are pictures related to some of the culture elements cited on Section III, and in the same way, the player has to type the corresponding roma-ji to the picture presented. The bosses are graphically represented by a box with a parachute, with pictures inside that represent a cultural word, and that, if not guided, will bring a lot of damage to the city below. The hiragana and roma-ji for each picture is presented to the player in the stories told by the exchange students, for the player to learn the word associated with a picture, and then be able to type its corresponding roma-ji when the boss falls down, i.e. the boss pictures do not contain tips in hiragana or another alphabet.

The percentage of bosses that contain both pictures and characters is 50% for hiragana characters alone and 50% for pictures (bosses). Levels 15 and 30 are different from the others because they are only-boss levels, i.e. no hiragana character alone will fall down, but only cultural pictures will appear on the screen. In level 15, it is possible to appear any boss since level 3 until level 12, plus the new bosses that come as new in the own level. In level 30, the bosses that can appear are all the bosses of the game, since level 3 until level 27, plus the bosses that are first presented in the level 30 itself.

Table III presents the levels that contain bosses, i.e. stronger ships – boxes with parachutes – that contain, instead of a hiragana character, a picture related to some of the cultural aspects explored in Section III; this Table presents examples of words contained in each boss level, once there are many. The frequency of appearance of bosses – every three levels – demonstrates the dedication Karuchā Ships Invaders has to cultural aspects in the learning of cultural vocabulary through the game. It is important to enhance that each boss level respects the limit gyo, i.e. the cultural elements that are in each level only can contain characters that have already been presented in the game before. Level 3 only contains feeding words, since it is difficult to form words that dovetail in the cultural aspects' context, with only the first three gyos of hiragana.

TABLE III.   SOME EXAMPLES OF BOSSES OF THE GAME

| Level	Cultural aspect (word in hiragana and roma-ji)			#
	Clothing	*Feeding*	*Arts & popular culture*	
3	-	すし(sushi) さけ(sake) したけ(shitake)	-	3
6	うちかけ(uchikake)	はし(hashi)	とくさつ(tokusatsu)	3
9	きもの(kimono) ゆかた(yukata) はかま(hakama)	さしみ(sashimi) てまき(temaki) のり(nori)	あにめ(anime) からおけ(karaoke) ようかい(youkai) かまくら(kamakura)	10
12	はおり(haori) げた(geta)	にぎり(nigiri) ごはん(gohan) すきやき(sukiyaki)	まんが(manga) うんけい(unkei) えんくう(enkuu) ががく(gagaku)	9
15	よめそで(yomesode) ふりそで(furisode) いろそで(irosode)	てりやき(teriyaki) しめじ(shimeji)	おりがみ(origami) へいあん(heion) すどく(sudoku) やくざ(yakuza)	9

18	おび(obi) たび(tabi) じかたび(jikatabi)	わさび(wasabi) やきそば(yakisoba) てんぷら(tenpura)	いけばな(ikebana) かぶき(kabuki) ぶがく(bugaku) さむらい(samurai)	10
21	いろむじ(iromuji) じゅうにひとえ (juunihitoe)	しょよ(shoyo) しゃり(shari)	うきよえ(ukiyoe) じょうもん(joumon) げいしゃ(geisha)	7
24	ぞり(zori) おはしょり (ohashori)	ぎゅどん(gyudon) しゃぶしゃぶ (shabushabu)	しょどう(shodou) きょうげん (kyougen)	6
27	わらし(warashi) きゃはん(kyahan)	わがし(wagashi) さくらもち (sakuramochi)	しんとう(shintou) おんあが (onnagata)	6
30	はっぴ(happi) しっぱり(hippari)	ころっけ(korokke) あまなっとう (amanattou)	にんぎょうじょう るり(ningyoujoururi) くまどり(kumadori)	6

The game contains the follows requirements for Japanese language learning games identified in a previous work [11]: i) customizable options, i.e. three difficulty modes (i.e. easy, normal, and hard); ii) immediate feedback (loss of points when a ship hits the city); iii) levels increase, i.e. from 1 to 30; iv) score, i.e. hit points of the player; v) statistics, i.e. top 10 and achievements; and vi) time, i.e. 60 seconds to survive for each level. There are 18 achievements in the game that the player can get, by filling some requirements; these achievements are presented in Table IV, with their symbols (that are highlighted in the achievements screen when got), name and description of requirements to win each one of them.

TABLE IV.   ACHIEVEMENTS OF THE GAME

Symbol	Name	Description
	Karuchā newbie	Finish the first boss level – level 3 – in any difficulty mode
	Hiragana newbie	Pass the first 5 levels in any difficulty mode
	Karuchā beginner	Finish the first 3 boss levels in any difficulty mode
	Karuchā reckless	Did not read any of the stories during a whole game
	Karuchā cautious	Read all the stories during a whole game
	Karuchā on the go	Finish level 15 in any difficulty mode
	Hiragana on the go	Finish levels with basic characters – until level 11 complete – in any difficulty mode
	Hiragana warrior	Finish the game in any difficulty mode
	Hiragana lover	Finish the game in all the difficulty modes
	Karuchā master	No loss of hit points in the levels 15 and 30 in any difficulty mode
	Karuchā sensei	No loss of hit points in all boss levels in any difficulty mode
	Gojuon master	No loss of hit points in levels where new gyo are gojuon in any difficulty mode
	Handakuten sensei	No character with tenten or maru hits the city during the 30 levels in any difficulty mode

	Youon sensei	No youon character hits the city during the 30 levels in any difficulty mode
	Hiragana master	No single character hits the city during the 30 levels in any difficulty mode
	Karuchā master	No boss hits the city during the 30 levels in any difficulty mode
	Karuchā ships invaders sensei	No loss hit points during the whole game in any difficulty mode
	Karuchā and hiragana addicted	Played the whole game 10 times in any difficulty mode or summing the modes

It is significant to explain some terms used in the achievements and its importance to hiragana learning. The term "gojuon" designates the most simple hiragana characters, i.e. the ones which do not contain accents. The accents in hiragana can be "tenten" or "maru". Tenten is a symbol that reminds a quotation mark, put on the top right of a letter to make it sound differently; for example "ka" (か) with a tenten is read "ga" (が). Maru is a small circular symbol used only on the "ha" gyo to make it sound with 'p'; for example "ha" (は) with a maru is read "pa" (ぱ). The "youon" symbols are combined characters in which the first one is a hiragana that ends on 'i', written in normal size, and the second is some character of the "ya" gyo, written smaller, and they create combination of sounds. For example "ki" (き) plus "yo" (よ) gives "kyo" (きょ).

B. Interface Design and Implementation

Karuchā Ships Invaders was developed to be a game that presents an immersive environment to the player, and this characteristic is meant to be present in all aspects of the game, since the plot, the gameplay and, the most remarkable: interface. Fig. 1 shows Karuchā Ships Invaders main menu interface, with its available options and demonstrating the concept of Japanese ships' arrival in Brazil.

Fig. 1. Main menu interface of the game.

It is important to notice and highlight the presence of key elements that suggest a Brazilian city, in this case, Rio de Janeiro – a worldwide known Brazilian city –, with elements as Christ the Redeemer's statue – considered one of the modern Seven Wonders of the World –, Maracanã Stadium, favela and the famous Copacabana boardwalk on the beach. The elements that suggest Japan are the ships, which come with a Japanese flag and a hiragana letter and the laser that will guide the ships to the ground, which suggests advanced technology, by whom Japan is widely known.

Since every three levels it is presented a set of new cultural words, that are introduced to the player by reporting of the characters (Brazilian exchange students), the level's choice screen was designed to highlight that (Fig. 2). This screen is divided in the difficulty mode choice area and the level choice area, which presents the unlocked levels corresponding to the selected difficulty mode. Also, the level area is subdivided, and the levels grouped every three, once every three levels, the third is a boss level; still, below each group of three, there is a button that takes to a story, which presents the elements corresponding to the three levels above. There are also two big groups with 15 levels each, indicating that they end up in an only-boss level (levels 15 and 30).

Fig. 2. Level and difficulty mode interface of the game.

For each three levels that pass, there is a scenario transition – from morning to evening, from evening to night, and from night to morning again (Fig. 3) – meaning that the experiences of the exchange students are happening in several days and moments of the exploring trip, showing that no matter the hour or the day, there is always something new and interesting to be learned about language and culture of Japan; and this also represents that Japanese language learning is a process that takes a long time and effort to be well done.

Fig. 3.   Scenario transitions of the game, i.e. from/to (a) morning, (b) evening, and (c) night.

Fig. 4 shows design elements where characters and words will be put into, being Fig. 4a the element that contains a hiragana inside, and Fig. 4b the element that contains a cultural picture representing a cultural word presented on stories before the level it appears. Following the plot, there are Japanese visitors coming to Brazil, and they are represented by the ships and boxes during the levels. At the end of each level, it is presented the player's results and score for that level (which is the remaining hit points the player has for that level), and with that, appears a Japanese character which is a sort of pilot of the ship that demonstrates happiness or sadness according to the performance of the player.
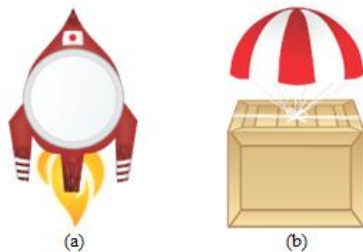

Fig. 4.   Ships of the game for (a) hiragana character (b) cultural element.

In Fig. 5a there is the character presented when the player passes the level without losing any hit points, and thus, gets the 10% hit points' bonus; Fig. 5b shows the character presented when the player passes the level but lost some hit point in the process; and Fig. 5c exhibits the character presented when the player could not pass the level and receives the "game over" message.

Fig. 5.   Japanese character that represents the player's performance on a given level, i.e. (a) passed level with bonus (b) passed level (c) game over.

Fig. 6 presents a screenshot of the game in execution, explaining the main elements contained on the screen. In Fig. 6 it is possible to observe a ship with a hiragana falling down (Fig. 6a); a box with a parachute bringing a picture of a cultural aspect – in this case, sushi – (Fig. 6b); the area of the city, where ships and boxes will cause damage if not received, represented by a sort of force field around the city – highlighting that this element suggests a Brazilian city (Rio de Janeiro) – (Fig. 6c); the hit points bar, where the green shows how much hit points the player still has (Fig. 6d); indication of the difficult mode being played at the moment (Fig. 6e); the indication of the current level (Fig. 6f); the remaining time the player needs to survive (Fig. 6g); and the element that will shoot the guiding light to the ships and boxes, i.e. the laser machine (Fig. 6h). As a way to differ new characters from previous, new hiragana characters appear with the font color deep gray, whilst characters that have been presented in previous levels come with font color red.

Fig. 6.   Components of the game (a) hit points bar (b) time (c) difficulty mode (d) level of the game (e) ship of hiragana (f) ship of cultural aspect (g) guidance laser ray (h) city (i) laser cannon (j) feedback area of user's typing.

Karuchā Ships Invaders CALL game was developed using MOAI platform [2] for games development, with Lua programming language[3]. This development decision was made based on the results of the previous work [10], where it was found out the issues of running applications in non native platforms; since MOAI has multiplatform resource, it was chosen for the development of this game, thinking about future distribution for another operational systems.

V.   DISCUSSION

The first remarkable difference from our game to the others – mainly the games described in Section II – is the exploration of cultural aspects clearly present in the levels of the game – as design items and bosses in certain levels. The use of cultural aspects in the whole environment of the game brings to the player a more immersive way to learn content in a different language, mainly in a case like this one, where there is a Brazilian trying to learn a language from a country – Japan – that is in so many ways different from player's native land.

The game Karuchā Ships Invaders differ from others by a noteworthy feature: it focuses on the hiragana alphabet study. Hiragana is a very important part of Japanese language learning, once it is its basis; with hiragana alphabet it is possible to write every Japanese original word, and that includes all the cultural words present on the game. This alphabet is needed to be known by anyone that aims to read in Japanese language, since it is the most used: for words that do not have kanji, for adjective and verb endings and even for subtitle rare and/or unknown kanji characters. To bring katakana with the idea of the game, it would be necessary to create more different stories of situations that protagonists would go through, with new words to learn, since this alphabet is used mainly to write foreign words, i.e. which do not originate from Japan; with that, more modern Japanese cultural knowledge would be needed, to bring these new words related to experiences that can be lived by foreigners in Japan.

Japanese language learning has many particularities, and some of them are directly related to cultural aspects, as the communication means they use daily. When explained out of a context, it can be hard for a Brazilian person to assimilate a topic as language hierarchy, for example, since in Portuguese language we don't have such thing used often day by day. Another important question about using cultural elements in the design is that it shows Japan to the player, not only in the gameplay – with the relation between hiragana and roma-ji learnt by playing – but in the whole process of being in contact with the game itself – through images and sounds, for example. These elements bring the player to know more about Japan whilst learning the language of this country, and the harmony between learning and design is pleasant, helping and encouraging even more the learning process.

It is also important to notice the influence of Brazilian culture itself on the development of this kind of game. Since it

is planned and designed by/for Brazilians, it is expected that the life experiences of the programmers and designers, and the cultural environment where the game was developed, can influence on the final result too. Still, this is a game developed thinking first in Brazilian students of Japanese, so it is necessary to think over the knowledge and experiences of the players and how to take them and, in an effective way, bring them to the game and the learning process too. That is why the game mixes Brazilian and Japanese elements, since the plot, where the two Brazilian exchange students go to Japan and inform their friends in Brazil about what they learn every day; to the arrival of Japanese ships in a Brazilian city, that will be received and guided for these friends with the knowledge they got from the students.

Another particularity of our game is to bring out several game requirements, as choice of difficulty, for attending since the beginner willing to learn hiragana, a student that wants to learn more of the Japanese popular vocabulary with the cultural aspects, until a more expert student that just wants to practice knowledge; several levels that increase hardship for the player, avoiding the game to become boring and keeping it interesting for the player to get motivation to go through all the levels; a top 10 with the names and scores of the players who went better, being also a motivation trigger for the player to get best scores and play more, thus learning more of hiragana and Japanese culture.

Karuchā Ships Invaders is available in PT-BR language, once it is focused on the Brazilian Japanese learners, and this feature allows a lot more Brazilian users to access this kind of resource, because with the games currently available for this purpose, the student was forced or needed to know the English language to be an intermediate between Portuguese and Japanese. This kind of situation is harmful for the learning process, whereas each language has its own particularities that are already difficulty to perceive from one to another; once a third different idiom is brought into the process, it becomes a lot easier to lose details that can compromise a good knowledge of a given language.

VI. CONCLUSION

This work presented a CALL game with the purpose of helping teaching Japanese language, introducing the hiragana alphabet; developed taking into account aspects of the Japanese culture – included in the gameplay as the biggest enemies (bosses) –, also introduced in this paper. It was also performed a study of Japanese cultural features to include it in the game design, creating a more immersive environment to the user, improving the learning experience.

As future work, we intend to develop katakana mode, with all of its symbols and combinations as hiragana, and brand new cultural words that are written with this alphabet. In a super advanced mode, it is planned to add kanji words in the bosses. Also, we point out the accomplishment of tests with Japanese language students to collect data related to learning and interface/interaction evaluation of the game.

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