# **Developing EFL/ESL Cognitive Structures Using a Mobile App to Exploit a Spatial Morphology of Verb Forms in Simple Sentences**

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## Abstract

Ubiquitous language learning requires appropriate learning objects to be made accessible to learners in the right form, at the right time, and in the right place. This need can be met through providing appropriate spatial morphologies of content, utilizing mobile devices and relevant apps. English verb tenses and forms cause understandable confusion for EFL/ESL students. But by situating the required learning objects in the learner's awareness, she may creatively imagine the necessary schema, navigate through them, and determine the correct formal expression of what she intends. A spatial morphology of English verb forms and tenses is proposed that generates simple sentences. This encourages the formation of appropriate cognitive structures in the language learner's mind, while the spatial schema provides for feasible on-screen implementation in interactive mobile applications for smartphones and tablets. The primary intended realization is thus of two complementary forms: as an aidemémoire in the learner's mind, and as an App for the iPad and for tablets in general.

*Keywords:* mobile app, language learning object, EFL, ESL, English verb structure, iPad, iPhone, SLA, CALL, verb tense, simple sentence, iOS, spatial morphology, cognitive structure.



# 1. Introduction

Figure 1. Simulations of the (as yet unrealized) App, on the iPad 2

Fiaidhi [1] makes the timely observation that in the rush towards ubiquitous learning, appropriate learning objects need to be made accessible to learners at the right time and in the right place. This applies to second language learning, where EFL/ESL students quite understandably face confusion in their recall, choice and use of English verb tenses and forms that are appropriate to an intended communicative act.

The best place to locate such learning objects is, through assimilation, in the learner's own awareness. She can then creatively imagine the necessary schema, navigate through them, and so determine the correct formal expression for the communicative act she intends. More effective EFL/ESL learning can thus be achieved if students are provided with an adequate spatial morphology of English tenses and forms. This supports the assimilation of appropriate cognitive schema, in combination with exposure to relevant interactive apps. I use the term "spatial morphology" not in the normal linguistic sense, but in the traditional sense of a spatial organization of form.



Figure 2. The basic structure showing the main grammatical categories.

Ρ	finite / non-finite	past	present	future		VE	RB		singular / plural	PC
d mødality selection -		þer	fect			perfé	ect cont	tinuous		irst / second / third
ling to mood and	(typicc comple	lly: connection b tion of somethir	etween events ir ng by a particula	n time; r time)	(t	ypically: cont	inuity up to	a particular	· time)	neutral f
will vary accord	(tubica)	sim	iple	ations)		(	continuc	ous	wing	iale / female /
S	active / passive	declare qu	t subjunct	non- modal	modal	semi- modal	other	affirmative / negative	C	

Figure 3. Differentiation of the main grammatical categories into options.



Figure 4. Various options as actually presented (with categories added in grey text).

This paper proposes a spatial morphology of the English verb forms and tenses that is then applied to generate simple sentences. The spatial morphology enables appropriate cognitive structures to form and stabilize in the language learner's mind. The visual spatial structure allows ready implementation in landscape mode in interactive digital resources, particularly the software that drives on-screen displays. The primary intended uses are for apps for mobile devices such as smartphones - which students are increasingly likely to have with them both within and outside class, as I have elsewhere surveyed [2, 3, 4]. More particularly, this morphology, together with the Apps that I envisage would exploit it, is suited to tablets such as the iPad - which will increasingly be used by students [5, 6]. Further suggested applications are for head up displays (e.g. by computer gamers, Sloodle users, pilots, vehicular drivers etc.); and for electronic dictionaries and online resources (e.g. online dictionaries and other grammatical resource webpages). Thus the primary intended realization of this proposal is two-fold and complementary: firstly as an *aide-mémoire* in the learner's mind; and secondly as an App for the iPad (and for other tablets). These two realizations complement one another: using the App will help the learner form and stabilize appropriate language structures, while a developing facility with those structures can encourage further exploration and mastery of the App. Having students use the proposed App should significantly assist their learning of correct linguistic cognitive structures.



Figure 5. Finite/Present/Active/Declarative/Non-modal/Affirmative showing archetypal sentence construction.

## 2. Formal structure and usage

#### 2.1. Spatial morphology

The spatial morphology derives from configurations commonly found in Sacred Geometry, Art and Architecture. In traditional use, these are effective in assisting the learning and contemplation of what are often highly complex cosmologies and thus the realities that they are deemed to mediate (as in Lawlor [7]). The primary geometrical form I have used is the archetypal fourfold *aedicule*, well known in traditional art, architecture and symbolism. Here it becomes a flat vertical rectangular surface in the normal field of vision - rather than a horizontal plan - as in Figure 2. As the most basic and essential form that the verb takes, the Infinitive form of the verb is imagined at the center (though in practice, it would usually be displaced to the upper right periphery). For a given verb, the inner surface developed as a four-fold zone displays the verb's four primary aspects, sentences that accord with those aspects, their construction, and their use. The other main grammatical categories are located on the peripheral border, as in Figures 2-4.

For the most common Finite verbs and forms, the Simple verb - located in the bottom left inner quadrant - is the starting point for the four fundamental grammatical Aspects. The Simple form may be imagined to be displaced and extended to the right to generate the Progressive/Continuous form of the verb located at bottom right. An (imaginary) octave of the Simple may be imagined directly above to locate the Perfect form at top left. Finally, that Perfect form may be imagined displaced and extended to the right, while simultaneously providing an octave of the Progressive directly above it, to generate the Perfect Progressive/Continuous located at top right.

The other major grammatical categories are located on the border around the four edges, which comprises interactive buttons, tabs, and drop-down menus as required. The important TENSE-ASPECT-MODE dimension is provided vertically, as in Figure 2. The bare Infinitive - the base form of the verb - is entered in the right-hand major top field or selected from its drop-down menu. Grammatical categories of QUALITY (i.e. Finiteness), NUMBER, VOICE and POLARITY are located as side options of the top and bottom borders. The top right NUMBER, the right side PERSON, and the left side GENDER fields work in conjunction. On the bottom border, MODE is differentiated into major fields of MOOD and MODALITY. These options are further expanded by context-aware fields that are located on the left side border. Verbs are here presumed to be either Intransitive or Optionally Transitive, thus sentence objects are not required, nor are they displayed. (If required, the left border could instead display Obligatory/Optional Transitive/Intransitive TRANSITIVITY fields, and could interact with Dynamic/Stative verb PROCESS. Verb VALENCY 1/2/3 could also be included; refer Crowley et al. [8]).

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Ρ	1 ∞	past	present	future	v	valk		PC			
/hom whose		l have	walked		l ho	ave been walkin	g	1st			
how v	-	_ have `	VERB-eı	า	_ have	e been VERE	8-ing	2nd			
which	(typically:	<b>presen</b> past action with	t perfect	connection)	<b>þresen</b> (typicall	t perfect contin	<b>UOUS</b> sent)	3rd			
why				to v	valk						
when		l v	valk		I am walking						
where		_v	ERB		_	be VERB-ing	z	4			
what	(the bird	presen	t simple	(ations)	pre	esent continuou	S	<u>B</u>			
who	(typico	iny. general time	e, permanent situ	lauonsj	(typically: actions	conunuing at the momen	it of speaking)	+			
S	-	declare qu	estion dire	ct subjunct	non- modal <sup>moda</sup>	l semi- modal other	+ -	С			

Figure 6. Singular/First Person sentence construction and with central Infinitive.

Ρ	1	8	past	present	future		wa	lk				PC
whose												1st
w whom		I	have be	en walking			havo	hoon V	CDD	ing		2nd
nov hov		Yo	ou have b	een walkin	g	- 5	resent d		ontinu			
vhy which		He/S	She/It has	s been wall	king	P	(typically: co	ontinuity up to	the prese	nt)		3rd
when		Ν	/e have b	een walkin	g							8
where		Yo	ou have b	een walkin	g							ዯ
what		Th	ey have l	been walkii	ng							7
who												<u>¢</u>
S		_	declare qu	estion direc	t subjunct	non- modal	modal	semi- modal	other	+	Ι	С

Figure 7. A full conjugation of Number, Person and Gender.

### 2.2. Envisaged usage

In use, the first act of the ESL/EFL learner is to enter at top right a base verb i.e. the bare Infinitive form of the verb. This is done either by selecting from a drop-down menu, or by typing combined with intelligent word recognition/completion. (If preferred, this could also display in the center as in Figure 6, and an associated dictionary could display its meanings). Ideally, default settings of grammatical categories would accord with the most common states for English of the target learner level. However, these could be reset in a Settings menu, as might varieties of English (UK/US/Konglish/Singlish etc.). The user then navigates through the grammatical schema, by choosing options from the border fields in accord with the desired use. On the top and bottom borders, minor (i.e. narrow) side fields represent binary choices; these are exclusive "or" choices, except NUMBER, which allows neither, either, or both options to be selected. The top border QUALITY (i.e. "Finiteness") at left provides for an exclusive choice of Finite or Non-finite Verb form. At bottom, VOICE at left allows for exclusive Affirmative or Negative choice.

The major (i.e. wide) top, bottom and right border fields allow for more than two options. TENSE is a context-aware item; when Finite Quality is selected, it provides an exclusive *Past, Present* or *Future* choice, assuming MODALITY is *non-modal*. QUALITY is also context-aware, and provides for Finiteness; when it is *Non-finite,* the options will depend upon other settings e.g. whether VOICE is *Active* or *Passive*. Along the bottom border, MOOD at left provides an exclusive choice of Declarative (Indicative) "declare", Interrogative "question", Imperative "direct" or Subjunctive "subjunct". The context-aware menu along the left side border may be activated by these choices, e.g. when the Interrogative Question is selected, the left border could show Wh- Question words *who/what/where* etc. as prompts and/or could toggle with Polar Question auxiliaries *do/does/am/are/is/will/can/may* etc. The bottom border at right provides for the exclusive selection of MODALITY: *Non-modal, Modal, Semi-modal*, or *Other* modal. When Modal is selected, the contextual menu of the left side border displays the Modals *may/might/can/could* etc. (which could then be further conditioned by Tense).

Ρ	1	ω	past	present	future	wa	alk			PC		
nom whose			you had	l walked		you h	ad been walki	ng		1st		
how wh			_ had V	ERB-en		_ had been VERB-ing						
hy which		(typica	past ‡	a particular pas	t time)	past p (typically: contin	erfect continue uity up to a particular (	DUS bast time)		3rd		
when w			уои м	valked		you were walking						
nat where			_VEF	RB-ed		_ be		4				
who wh			past s (typically: p	simple past events)		<b>þa</b> . (typically: actions c	<b>st continuous</b> continuing at a particulo	ır þast tin	ne)	<b>Ng</b>  -		
S	I	—	<b>declare</b> qu	estion direc	t subjunct	non- modal modal	semi- modal other	+	-	С		

Figure 8. Finite/Past/Singular/2P/Active/Declarative/Non-modal/Affirmative.

Ρ	1	$\infty$	past	prese	nt	future		wa	alk				PC	
whom whose		1	they ha	ven't wall	ked		t	hey hav	ven't be	en walk	cing		1st	
how		_ I	have r	otVER	B-(	en	h	ave no	ot bee	n VER	RB-ii	ng	2nd	
which	(t	present perfect (typically: past action with some present connection)					Þ	(typically: co	perfect	<b>continu</b> to the prese	IOUS ent)		3rd	
why														
when			they	don't wall	k		they aren't walking							
t where			_ do	n't VER	В		_ be not VERB-ing							
who wha		(typico	prese ally: general t	e <b>nt simple</b> ime; permanent	e situa	itions)	<b>present continuous</b> (typically: actions continuing at the moment of speaking)						<u> </u>	
S		—	declare	question o	lirec	t subjunct	non- modal	modal	semi- modal	other	+	-	С	

Figure 9. Finite/Present/Plural/3P/Active/Declarative/Non-modal/Negative.

Ρ	1	8	past	present	future		ea	at				PC
iom whose			they have	en't eaten		;	they ha	ven't be	en eat	ing		1st
how wh		_ I	have no	t VERB-	en	_ h	ave no	ot beer	n VER	RB-ii	ng	2nd
ly which	(t	ypically:	present	some present co	onnection)	Þ	(typically: co	perfect (	c <b>ontinu</b> o the prese	IOUS ent)		3rd
when wh			they do	on't eat		they aren't eating						
nat where			_ don'	tVERB		_ be not VERB-ing						Ŷ
who wh		(typica	<b>presen</b> ally: general time	<b>t simple</b> ; permanent situa	ations)	(typicall)	prese y: actions con	ent cont atinuing at the	inuous e moment	of speal	king)	<b>№</b>  -
S	I	—	<b>declare</b> qu	estion direc	t subjunct	non- modal	modal	semi- modal	other	+	-	С

Figure 10. Finite/Present/Plural/3P/Active/Declarative/Non-modal/Negative with eat.

Ρ	1 ∞ past present future	decompartmentalize 🛛 🔡 PC	С
whom whose	they haven't decompartmentalized	they haven't been decompartmentalizing	st
how	have not VERB-en	_ have not been VERB-ing <sup>2</sup>	nd
which	present perfect (typically: past action with some present connection)	present perfect continuous (typically: continuity up to the present)	rd
when why	they don't decompartmentalize	they aren't decompartmentalizing	7
at where	_ don't VERB	_ be not VERB-ing	2
who whi	present simple (typically: general time; permanent situations)	present continuous (typically: actions continuing at the moment of speaking)	5
S	declare question direct subjunct	modal modal semi- modal other + - C	( )

Figure 11. Finite/Present/Plural/3P/Active/Declarative/Non-modal/Negative long verb.



Figure 12. Finite/Future/Singular/3P/Active/Interrogative/Non-modal/Positive.



Figure 13. Finite/Past/Plural/1P/Active/Interrogative/Non-modal/Negative.

The right side border differs in that the choices need not be exclusive, but as for NUMBER may be (partially or totally) inclusive, and are intended to function in conjunction with the Number selection (at right of the top border). PERSON can be selected as none, one, some or all of *First/Second/Third*. GENDER can be selected as none, one, some or all of *Male/Female/Neutral* (of course in English it is usually only of relevance if Third Person Singular has been selected). These provisions of exclusivity allows the display of just one PERSON, or of a restricted selection (by user choice), or of a full conjugation.

The App then displays in the inner quadrant the four Aspects of the specific verb base and chosen grammatical categories, showing the four simple sentences, sentence constructions, tenses, and typical uses (here the uses have been adapted from Swan [9]). The same Verb form thus assumes the same relative position in each inner rectangle. For any given TENSE, the relation between Simple, Continuous, Perfect, and Perfect Continuous aspects is readily apprehensible. I anticipate this sustained spatialization of Aspectual relationships will significantly assist the learner in internalizing the target language structure.

#### 2.3. Finger gestures

When the FINITE quality is chosen, double-tapping any ASPECT (i.e. an inner quadrant) zooms that quadrant to fill the entire inner space, and allows more detailed information to be displayed. A full conjugation could be shown, as in Figure 11. A two-finger single tap of a zoomed interior collapses it to return to the four-quadrant view.

Cycling through the TENSEs is achieved by horizontally swiping the interior, as shown in Figures 8-12 and 15. Swiping right regresses the Tense being displayed, while swiping left advances the Tense from Past to Present, or Present to Future. Settings allow the horizontal swipe to include the Infinitive, so the user can cycle through Past-Present-Future-Infinitive.

Provided just one NUMBER and PERSON has been selected, vertical swiping of the interior zone allows cycling through the six Number/Person combinations, refer Figures 8-12:

... - 1PS - 2PS - 3PS - 1PP - 1PP - 3PP - ...

(... - First Person Singular - Second Person Singular - Third Person Singular -

First Person Plural - Second Person Plural - Third Person Plural - ...).

The Number/Person displayed is advanced by swiping the interior (quadrants) upwards e.g. 2PS > 3PS, while it is regressed by swiping downwards e.g. 2PP > 1PP.



Figure 14. Simulation of the App on the iPhone 4S.



Figure 15. Simulation of the App on the iPad 2 with touch gesturing.

Ρ	1	8	past	present	future		wa	ılk				PC
om whose		I	he had be	en walked	1	he	had be	en bein	g walke	ed (?,	)	1st
how wh		_	had bee	n VERB-e	en	_ had been being VERB-en						2nd
ly which		(typica	bast perfe	e <b>ct þassive</b> a þarticular þas	t time)	pas (typ	t perfec ically: continu	<b>t contir</b> ity up to a f	<b>iuous þ</b> Þarticular þó	ast time	/ <b>e</b> )	3rd
when wh			he was	walked		he was being walked						3
lat where			_ been \	/ERB-en		_ been being VERB-en						Ŷ
who wh			past simp (typically:p	le passive Past events)		(typica	past co lly: actions co	<b>ntinuou</b> Intinuing at	<b>IS Þassi</b> a þarticular	<b>VE</b> past tir	ne)	<u> </u>
S		_	<b>declare</b> qu	estion direc	t subjunct	non- modal	modal	semi- modal	other	+	—	С

Figure 16. Finite/Singular/3P/Passive/Declarative/Non-modal/+ve: Past/Male.

Ρ	1 ∞	past	present	future		wa	lk				PC	
hom whose	s	she has b	een walked		she	e has be	en being	g walk	ed (?)	)	1st	
work w	_	have be	en VERB-e	en	_ have been being VERB-en							
which	<b>ףו</b> (typically:	past action wit	rfect passiv	<b>e</b> nnection)	prese	ent perfe (typically: co	e <b>ct contii</b> ntinuity up to	<b>TUOUS</b> the prese	<b>þass</b> nt)	sive	3rd	
when why		she is	walked			she is	being w	valked			S	
at where		_ be V	ERB-en			_ be b	eingVE	RB-e	n		Ŷ	
who wh	(typico	resent sir	n <b>ple passiv</b> e; permanent situa	e tions)	<b>ل</b> (typicall	resent c y: actions com	tinuing at the	IS ÞAS moment (	<b>SiVE</b> of speak	king)	-18 <u>v</u>	
S	-	declare qu	uestion direct	tsubjunct	non- modal	modal	semi- modal	other	+	—	С	

Figure 17. Finite/Singular/3P/Passive/Declarative/Non-modal/+ve: Present/Female.

Ρ	1 ∞	past	present	future		walk				PC	
hom whose	itv	will have	been walk	ed	it will	l have been l	being wa	lked (	(?)	1st	
how wl	_ wi	ll have b	been VERI	B-en	_ will	have been	beingV	ERB	-en	2nd	
/ which	ft (typicall)	uture þer y: action before	<b>fect þassiv</b> a þarticular futu	<b>e</b> re time)	futur (typica	e perfect cor ally: continuity up to c	n <b>tinuous</b> particular fut	<b>þassi</b> ture time	<b>ve</b> 9	3rd	
when why		it will b	e walked			it will be bei	ing walke	ed		2	
at where	-	_ will be	eVERB-er	ı	_ will be being VERB-en						
who wh	f (typically: i	<b>uture sin</b>	<b>ple passiv</b> out the future; futu	e ure events)	f (typicall)	uture continu y: actions continuing a	<b>IOUS ÞASS</b> It a þarticular	S <b>iVE</b> future tir	me)	<u>8</u>	
S	-	declare q	uestion direc	ct subjunct	non- modal	modal semi- modal	other	+	-	С	

Figure 18. Finite/Singular/3P/Passive/Declarative/Non-modal/+ve: Future/Neutral.

## 3. Pros and cons

For the motivated student, the App encourages playful exploration of the effects of varying the values of different grammatical categories and a deepening appreciation of the structure of the English language. Correspondences between verb forms for a particular tense are evident in relation to other tenses, e.g. the relationships revealed by a horizontal left swipe sequence of Past Progressive below with Past Perfect Progressive above, through Present Progressive below with Future Perfect Progressive above, to Future Progressive below with Future Perfect Progressive above. The learner can then realize that the same Verb form assumes the same relative position in each configuration: the Perfect Past is in the top left quadrant of the Past tense, the Perfect Present is in the top left quadrant of the Future tense. This spatialization of grammatical structure should significantly assist learning, given that space is one of the most important aspects of our experience of the world, as can readily be appreciated in the fundamental importance of spatial prepositions in structuring diverse kinds of formal complexity [10].

The limitations of this spatial morphology of grammar are primarily those of the structural complexity of language in general and of the English language in particular (even expert Grammarians argue over issues of linguistic structure). These constraints must be set against the honest and understandable limitations of the second language learner, who is not infrequently overwhelmed when faced with the structural complexity of the target language.

Thus the spatial morphology I am advancing seeks to maintain a satisfactory compromise between a simplicity that can be comprehended, and a complexity that does the language justice. To that end, this morphology does not include verbal objects (though it readily could), and is restricted to simple sentences (so compound and complex sentences are not dealt with).

Ρ	1	8	mo	dal pres	ent		wa	alk				PC
hall should			l may hav	ve walked			l may h	ave bee	en walk	ing		1st
s pluow		_ r	nay havo	e VERB-	en	_ m	ay hav	ve bee	en VEF	RB-i	ng	2nd
ist will	(t	ypically:	past action with	<b>Þerfect</b> some present co	nnection)	I	<b>nodal þ</b> (typically: co	oerfect c	to the prese	OUS ent)		3rd
could m			l may	walk		l may be walking						
ght can			_ may	VERB		_ may be VERB-ing						우
<b>may</b> mi		(typico	modal ally: general time;	simple permanent situa	itions)	(typicall)	moc y: actions cor	<b>lal cont</b> ntinuing at th	<b>inuous</b> ne moment	of speal	king)	101
S	I	—	declare qu	estion direc	t subjunct	non- modal	modal	semi- modal	other	+	-	С

Figure 19. Finite/Modal Present/Singular/1P/Active/Declarative/Modal/+ve: may.

Ρ	1 ∞ modal past	walk 🗖 🛗	PC				
shall should	couldn't she have walked?	couldn't she have been walking?	1st				
pinow	could not _ have VERB-en	could not _ have been VERB-ing?	2nd				
will	modal past perfect (typically: action before a particular past time)	modal past perfect continuous (typically: continuity up to a particular past time)	3rd				
must			٦				
could	couldn't she walk?	couldn't she be walking?	S,				
ght can	could not _VERB?	could not _ be VERB-ing?	ᡩ				
may miç	. modal past simple (typically: past events)	modal past continuous (typically: actions continuing at a particular past time)					
S	declare question direct subju	nct non- modal <b>modal</b> semi- modal other <b>+ -</b>	С				

Figure 20. Finite/Modal Past/Singular/3P/Fem/Active/Interrogative/Modal/-ve could.

Ρ	1	∞		infinitive			VER	В				PC
whose												1st
whom												
how		(t	o) have	VERB-e	n	(to) have been VERB-ing						2nd
which			perfect	infinitive		Þ	erfect cor	ntinuou	ıs infin	itive		3rd
why												
when												2
where												<b>우</b>
hat			(to)'	VERB			(to) b	e VER	RB-in	g		
M			simple	infinitive			continu	ious in	finitive	;		6
who												Ť
S		—	de	clarative mo	od		non-mo	dal		+	-	С

Figure 21. Non-finite/Infinitive/Active/Declarative/Non-modal/Affirmative.

Ρ	1	∞	pas	sive infinitiv	/e		VE	RB				PC
om whose												1st
how wh		(to)	be bei	ing VERB-e	(to) have been being VERB-ing						2nd	
y which		þс	issive per	fect infinitive	passive perfect continuous infinitive						3rd	
when wh												S
lat where		(	to) be`	VERB-ing		(to	) have	e beer	n VERI	3-in	g	ዯ
who wh		þ	assive sin	nple infinitive	passive continuous infinitive						18	
S		—	de	clarative mood			non-r	nodal		+	-	С

Figure 22. Non-finite/Infinitive/Passive/Declarative/Non-modal/Affirmative sentence.

The treatments of passive and of non-finite forms have been greatly simplified; and imperative and subjunctive moods as well as semi-modal and other modalities, though provided for, have as yet to be included. The proposal thus seeks to balance an adequate complexity with a desirable simplicity that will thus provide accessibility, in accord with the learner's interlanguage.

The proposed App, including all finger gestures, is designed to meet the Apple iOS Human Interface Guidelines [11]. As initially developed, the display resolution accords with the 960 x 640 px iPhone 4 and 4S screens as in Figure 14, but is more appropriate for the 1024 x 768 px iPad 1 and iPad 2 screens, on which it fits comfortably, as in Figures 1 and 15. (The anticipated release of a hi-res iPad 3 in February 2012 suggests the App would then benefit from redesign to exploit that higher resolution). Border widths of 50 px at top/bottom and 48 px left/right mean both dimensions of the 864 x 540 px interior are rich in factors, allowing convenient subdivision into equal columns and rows ( $864 = 2^5.3^3$ ,  $540 = 2^2.3^3.5$ ), while minimum button sizes are adequate. Illustrations in this online publication show the color-coding of buttons and tabs, which greatly enhances intelligibility. Please note that images have been reduced in size: it may help to visualize the iPhone or iPad screen for each image, as shown in Figures 14-15.

## 4. Conclusion

In common with other categories of human existence, pedagogy is being radically impacted by the rapid development and convergence of the ICT revolution. This is evident in second language pedagogy, as I have elsewhere stressed [12]. In language learning, appropriate cognitive schema are required that might be effectively utilized in conjunction with new language learning strategies that are suited to our digital age. As Fiaidhi observes [1], the pervasive impact of the Internet, mobile apps, smartphones and now tablets means that online learning objects are required to satisfy an accelerating demand for ubiquitous learning at the right time and in the right place. It is my belief that - as the ways in which language is conceived, imagined, learnt, and utilized are rapidly changing - these learning objects will also need to be provided in the right form. Envisaging and developing spatial morphologies that aid learning - via a dialectic between the cognitive space of the imagination and the digital environment of mobile apps - will I trust contribute to that exciting educational and technological evolution.

## 5. Acknowledgments

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