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Editorial

I am delighted to introduce the **19th edition of the ITB Journal**, the academic journal of the Institute of Technology Blanchardstown.

In the first paper, Dr. Zari Saeedi T. examines Event Structure of Prepositional Nuclear Junctures in Persian. This paper analyzes one group of complex predicates or nuclear junctures (NJs) in Persian (as an Indo-European language) in terms of its event attribute within the framework of Role and Reference Grammar. These complex predicates fuse with prepositional phrases and the impoverished forms of the verb referred to as light verbs.

The second paper, by Judith Gottschalk of the Heinrich-Heine-Univerität Düsseldorf, in Germany on 'Storage of linguistic knowledge in the mental lexicon also employs the RRG linguistic model. This paper aims to give an account of a theory of a mental lexicon for German verbs of motion. The issue under analysis here is how Aktionsarten in general and particularly verbs of motion, with their various alternations, are structured and how they are stored in an RRG-compatible lexicon. A time line model for RRG-Aktionsarten based on Reichenbach (1947) is developed to give a description of the structure of events assumed. Human knowledge is often represented in terms of inheritance networks and therefore this paper uses a model of inheritance networks to modify the present version of the lexicon in RRG.

This paper by Gudny Bjork Thorvaldsdottir, of ITB, entitled 'The Beginnings of Phonetic and Phonological Coding in the Signs of Ireland Digital Corpus: The Representation of Handshapes' discusses some of the research that has been done on phonetics and phonology in signed languages, and makes an important contribution to our knowledge of the handshapes employed within Irish Sign language. She discusses aspects of a few phonological models in relation to two particular parameters that have been proposed for signed languages, that is: hand configuration and local movement.

Importantly, her discussion addresses a range of issues with respect to expanding the annotation of the Signs of Ireland (SOI) corpus to incorporate phonetic and phonological coding. This forms part of ongoing Irish Government SIF Cycle-2 research work that explores the phonology-morphology interface in Irish Sign Language (ISL), in a collaboration project between ITB and TCD. This research uses the TCD-based Signs of Ireland sign language corpus which includes data from Deaf ISL users across Ireland in digital form. It contains glossed lexical signs, classifier constructions and non-manual features. Classifier handshapes have also been annotated. It is my intention to identify the phonemes and the allophones of ISL using the corpus and it is thus neccessary to incorporate a detailed annotation at the phonetic level.

Aiden Carthy, Celesta McCann and Sinead McGilloway, all of ITB have a paper on 'Exploring the differences in emotional competency across subject domains for Irish first year undergraduate students' This study generated composite emotional competency profiles for Irish first year undergraduate students in four separate subject areas and tested for statistical significance between student groups. Within this study, social care students had statistically higher scores than computing and engineering students, and additionally, business students also had statistically higher scores than

computing students. Reference is made to issues relating to curriculum design, student support services and the design of interventions for at-risk students.

An interesting paper on 'Mobile Phone Game Localisation', based on recent research at ITB is presented by Leonie Troy, Matt Smith, Richard Gallery, all of ITB. This paper explores localisation issues in the development of games for mobile phones. Because of the additional work and complexity that localisation requires, such games are frequently produced without localisation in mind. Mobile phone game localisation involves various types of language transfer on a small scale, which challenges the localisation process carried out on a game. This work investigated the workflow for the localisation of a mobile phone game into Spanish and German using a LISA Standard TMX (Term Base Memory Exchange) and the Oasis standard XLIFF (XML Localisation Interchange File Format). Using Unicode the game was also localised into one Altaic language (Korean) and one Semitic language (Arabic).

The sixth paper, from Kieran Harkin, Kevin Curran, Eoghan Furey , a group of researchers at the University of Ulster, in Northern Ireland looks at 'Voice Enabled Indoor Localisation'. This paper examines the ability to track objects in real time using location based systems that incorporate a voice control function into to solve interaction problems that are sometimes to be found with location based systems. This paper provides an overview of integrating voiceXML with an indoor location positioning system to locate objects through voice commands.

The seventh and final paper by Pat O'Connor of ITB looks at 'Effective Teaching and Learning in Higher Education'. In this he examines the perspective on HE within the United Kingdom. Specifically, he examined in great detail the current teaching and learning environment in higher education in the UK, concentrating on England, and asked some very significant questions about how we do out business as educators within higher education. He asks: Is there a positive and supportive environment for learning and teaching in the UK? As part of his study, the conceptual and theoretical foundations underpinning practice in higher education teaching and learning are examined as is the support and impetus provided by government and policy. The nature of academic identities and the structure and engagement in academic development is also assessed. The answers to these questions are of major importance to Irish higher education particularly in the light of the soon to be delivered Irish Government strategic plan for Higher Education in Ireland.

We hope that you enjoy the papers in this issue of the ITB Journal.

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Event Structure of Prepositional Nuclear Junctures in Persian: A Role & Reference Grammar Account

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Abstract

In the present research study an attempt has been made to analyze one group of complex predicates or nuclear junctures (NJs) in Persian (as an Indo-European language) in terms of its event attribute within the framework of Role and Reference Grammar (Van Valin & Lapolla 1997, Van Valin 2005). These complex predicates fuse with the prepositional phrases and the impoverished forms of the verb referred to as 'light verb' (Cattell 1984). In this study a distinction is made between predicative and non-predicative prepositions providing some examples along with schematizing their layered structure of the clause. To determine the verb class of the prepositional (P) light verb constructions (LVCs) the main five diagnostic tests are applied to a wide range of examples from our collected Persian data. It has emerged from the findings of this study that all the prepositional phrases in Persian prepositional nuclear junctures are of locative type and the light verbs in these constructions belong to the phase class of verbs i.e. the continuative, terminative, and resultative event phases.

1. Types of Preposition

In Modern Persian or Farsi, there are generally two types of prepositions: simple/bare as in (1a-b) and compound as in (1c) below. Simple or bare prepositions include such prepositions as:

(1) a. *ændær* 'in', *æz* 'from', *ba* 'with', *bær* 'on', *bæraye* 'for', *bæhr* 'for', *be* 'to', *beyn* 'between', *bi* 'without', *joz* 'except', *næzd* 'with, by', *miyan* 'among', *piš* 'front', *pey* 'after', *ta* 'up to', and *dær* 'in'.

Some of the simple prepositions in Persian, as Mahootian (1997) also notes, take *ezafe* (the suffix *–e* or sometimes *-ye* is called *ezafe* in Persian and is the same as 'of' in English), which include:

b. *bedun-e* 'without', *birun-e* 'outside', *jelow-ye* 'in front of', *næzdik-e* 'near', *miyan-e* or as pronounced in spoken Persian *miyun-e* 'between', *pæhlu-ye* 'by', *pošt-e* 'behind', *ru-ye* 'on', *tu-ye* 'in', and *zir-e* 'under'.

As noted by Shamisa (2000: 214), compound prepositions may be formed by combining prepositions, for example:

c. *æz bæraye* 'because of' (Lit.: 'from for'), *æz bæhre* 'for' (Lit.: 'from for' *bæhre* is more formal than *bæraye*) , *æz ruye* 'out of' (Lit.: 'from on'), *dær bareye* 'about' (Lit.: 'in about'), and *dær næzde* 'front, with' (Lit.: 'in with/by').

Prepositions can also refer to: a) the place or location (e.g., *dær xiyaban* 'in street'); b) the direction (e.g., *betæraf-e mædrese* 'towards school'); and c) the time (e.g., *qæbl æz mædrese* 'before school' (Lit.: before from school). In Persian prepositional phrases

(PP) the preposition take a noun phrase as its argument and heads the PP; their canonical position is before the verb and after the direct object (Mahootian 1997) such as in (2) below:

(2) Ali ketab-ra æz dust-æš gereft.
Ali book-DOM from friend-his take.Past.3rd.Sg.
'Ali took the book from his friend.'

In (2) above, the preposition *æz* 'from' takes the noun *dust* 'friend' as its argument and the whole prepositional phrase *æz dust-æš* 'from his friend' follows the direct object *ketab* 'book' preceding the verb of the sentence (*gereft* 'took'). The prepositional phrases can appear in other positions i.e. they can sometimes be moved to the right of the predicate of the sentence (especially for some prepositions such as the simple preposition *be* 'to', or the compound prepositions *tu-ye* 'in-Ezafe', *ru-ye* 'on-Ezafe'). Consider the sentence in (3) below:

(3) Ali ræft be mædrese.
Ali went to school
'Ali went to school.'

As clear from (3) above, the prepositional phrase *be mædrese* 'to school' appears to the right of the verb (*ræft* 'went') and *mædrese* 'school' is in fact the noun taken by the preposition as its argument.

In RRG it is maintained that the predicative role of sentences is not always played by the verbal elements rather sometimes the noun, adjective, adverb or preposition predicates the ideas expressed in the statements. Thus, prepositions or prepositional phrases can be of a predicative type like other classes of words. That is, prepositions or prepositional phrases can be of two types i.e. predicative vs. non-predicative. In RRG those adpositions in the periphery of the clause are of former type (predicative) and those marking oblique core arguments belong to the latter class (non-predicative) (Van Valin & Lapolla 1997: 52, Van Valin 2005: 21). According to RRG, whether a preposition is predicative or non-predicative basically depends on which verb it appears with i.e. the English preposition *'from'*, for instance, is non-predicative when it appears with the verb *'take'*, licensing a source argument, (for example: Sally took the book from the boy) while it is predicative with a verb like *'die'* (for example: She died from malaria) and its semantic argument is treated as a core argument structurally with the NUC and PRED nodes dominating the preposition (Van Valin & Lapolla 1997, Van Valin 2005).

Another form of predicative prepositional phrases is where a copula accompanies this class of words as in 'the book is on the table' i.e. in RRG it is postulated that in these constructions the copula is a grammatical word dominated with the NUC node and the prepositional phrase bears the predicative function (presented with PRED node) of the whole sentence . In (4) and Figure (1) below the logical structure and the layered structure of the clause (LSC) of a similar example in Persian are presented. As clear from this Figure, the main CORE of the sentence is followed by NP, PP (prepositional phrase) and NUC which, according to RRG, is the copula or the grammatical nuclus/verb of the sentence and, in fact, does not have a predicating role (i.e. it is not followed by PRED node). The PP node is in turn followed by $CORE_P$ (the subscripted $_P$ before this node or other nodes in this Figure indicates that this CORE belongs to the

prepositional phrase and is not the main CORE of the sentence) which dominates the NP (*miz* 'table') and the preposition *ruye '*on' as the predicate of the whole proposition. The $CORE_P$ node is followed by NUC_P and the NP. In fact, the preposition *ruye* 'on' along with the NP *miz* 'table' predicate the whole sentence and the copula *ast* 'is', as pointed out before, is just a grammatical word. In the languages where copula is not used in the examples like the sentence in (4) this predicative role of the preposition is even highlighted more. As shown in Figure (1), in Persian the use of copula with the predicative prepositions is similar to English i.e. the copula *æst* 'is' is a grammatical word (NUC) without being followed by PRED node. In other words, the main predicative function of the sentence is borne by the prepositional phrase or, indeed, the preposition (P).

(4) ketab ruye miz æst.
book on table is
'The book is on the table.'

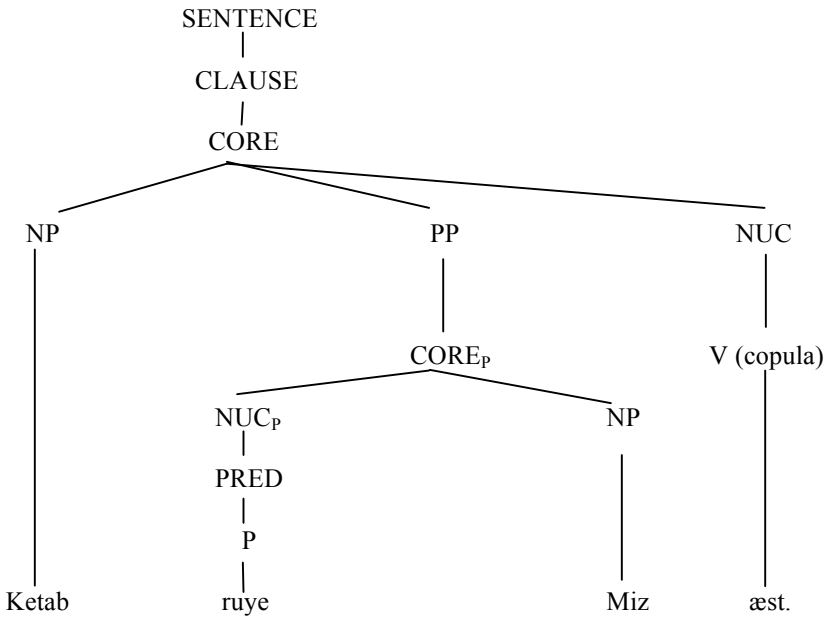


Figure 1: LSC of a copula/prepositional predicate in a Persian sentence

In RRG, three types of prepositions (prepositional phrases) are analyzed following Jolly (1991, 1993) (Van Valin & Lapolla 1997). The first type of prepositions is 'adjunct-marking non-predicative prepositions' as in 'Mary gave the book to John' where 'to John' is an argument (ARG) of the sentence followed by the preposition 'to' and the NP 'John' which have no predicating function. The second type is adjunct predicative prepositions as in 'Mary saw John after school' where the prepositional 'after school' is the PERIPHERY of the sentence followed by CORE which in turn is followed by NUC (PRED) node for the preposition 'after' and the ARG (NP) node for 'school'. That is, the preposition 'after' is indeed part of the predicate structure of the whole proposition. Finally, the third type is argument-adjunct predicative prepositions as in 'Yulanda put the book in the box' (c.f. Van Valin & Lapolla 1997: 162) where 'in the box' is AAJ (Argument Adjunct) followed by PP and CORE nodes respectively. This CORE node in turn is followed by NUC (PRED) node for the preposition *'in'* and ARG (NP) for *'the box'*. In this latter type of prepositions the predicative function and the semantic structure of the verb *'put'* is fulfilled with the preposition *'in'* which is a predicative

adjunct. That is, if the preposition *'in'* is omitted as *'Yulanda put the book ... the box'* the semantic architecture of the sentence (for the intended meaning) is damaged. In other words, in this type of preposition (argument-adjunct predicative preposition), unlike the second type (adjunct predicative preposition), the prepositional phrase is not the periphery rather it is an adjunct argument of the main CORE and the meaning of the sentence is not complete without the prepositional phrase (Van Valin & Lapolla 1997).

Persian prepositional LVCs where a light verbal element combines with a prepositional phrase to form nuclear junctures are similar to the third type of prepositions focused in RRG analysis i.e. argument-adjunct predicative prepositions. In fact, in the prepositional LVCs in Persian the meaning of the verb and the sentence is not complete without the prepositional phrase. The important point to bear in mind here is that in Persian LVCs the two predicative parts (the verbal element and the predicative prepositional phrase) form a nuclear juncture (NJ) i.e. the NUC node is followed by two NUC nodes being also followed by two PRED nodes one of which is the light verbal element and the other one is the prepositional phrase. That is, in Persian sentences like (5) below the predicative role of the sentence is played with the combination of the preverbal (prepositional phrase) and the verbal elements:

(5) Ali æz donya ræft.
Ali from world go.Past.3rd.Sg.
'Ali passed away.'

As shown above, in (5) *æz donya ræft* 'passed away' (Lit.: 'from world went') is the prepositional NJ i.e. *ræft* 'went' is the light verb (as mentioned before, it is called light verb since the semantic load of the sentence is not complete with the verbal element alone i.e. it has a light predicating role) and *æz donya* 'from world' is the prepositional phrase with *æz* 'from' as the preposition and *donya* 'world' as the argument (NP) of the prepositional phrase. In fact, the combination of the two verbal and non-verbal elements predicates the whole sentence and the omission of the preposition from the sentence (*Ali … donya ræft* 'Ali … world went') damages the semantic parameter of the sentence. The layered structure of the clause of the example in (5) is presented in Figure (2) below. (Note that in the older version of RRG i.e. Van Valin and Lapolla (1997), all the NPs are preceded by ARG node and all the predicative prepositional phrases are preceded by AAJ (argument adjunct), which are eliminated in Van Valin 2005.)

From our data it emerges that out of all the prepositions listed in (1a-c) at the beginning of this section only some of them can combine with light verbs to make prepositional LVCs. Additionally, out of all the light verbs listed in Saeedi (2009a) only some can join the prepositional phrases to form prepositional NJs. A more detailed discussion of all these LVCs are presented in section (2) below.

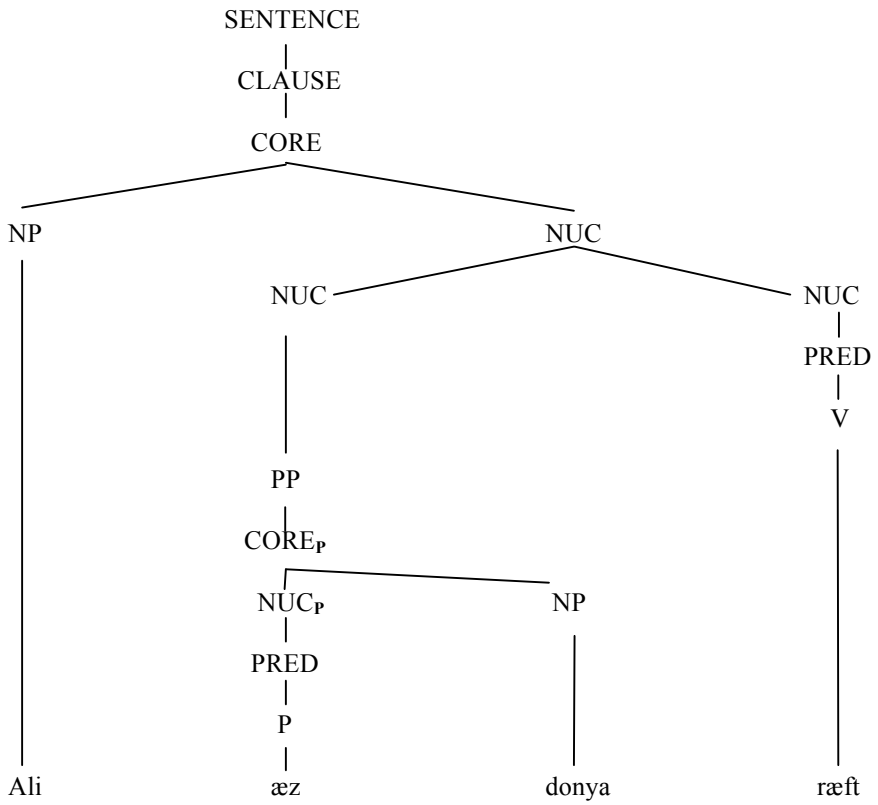


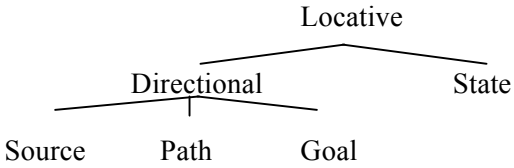
Figure 2: LSC for a prepositional/light verbal nuclear juncture in Persian

2. Discussion

As presented above in the layered structure of the clause for the prepositional nuclear junctures, there are usually three elements in the prepositional LVCs, which fill the three positions in these constructions. The first (initial) position is filled by a preposition, the second (middle) by another preposition, or a noun as complement, and the third position by a light verb. Examining the data of the present study, it became clear that out of the list of the Persian prepositions presented at the beginning of this paper six prepositions can appear in the initial position, namely, *æz* 'from', *ba* 'with', *bær* 'on/over', *be* 'to', *bi* 'without', and *dær* 'in'. There are also some limited number of prepositions such as *bær* 'on/over', *beyn* 'between', *piš* 'before', and *miyan* 'among', that appear in the second or middle position in the prepositional LVCs. In fact, not all the Persian prepositions have the capability of fusing with the light verbs to form prepositional nuclear junctures. Furthermore, the prepositions that appear in the initial position are basically of two groups i.e. the first group are those prepositions that can join either another preposition or a noun along with an LV to make a prepositional LVC, such as *æz* 'from', *be* 'to', and *dær* 'in'; the second group comprises those adpositions that can fuse with a noun (not another preposition) and an LV to construct a prepositional/light verbal construction, such as *ba* 'with', *bær* 'on/over', and *bi* 'without'.

One of the interesting findings of this study is that all the prepositions in Persian nuclear junctures belong to the LOCATIVE class of prepositions. Locative, also called spatial, prepositions refer to the location of an object, activity, or event. Following

Bjerre (2003), we have categorized these prepositions into directional and state, as schematized below.



Our investigation has revealed that the prepositions in the first group (mentioned above) capable of combining with either a noun or another preposition, namely, *æz* 'from', *be* 'to', and *dær* 'in' belong to either state or directional locative prepositions where the former refers to the stative location of entities and the latter to the directional relation that exist between the source or beginning of event, the path or process, and the goal or endpoint. In fact, the preposition *æz* 'from' denotes the source, *be* 'to' marks the goal, and *dær* 'in' shows the stative location. However, all the prepositions in the first group i.e. *ba* 'with', *bær* 'on/over', and *bi* 'without', which can combine with or be followed by a noun (not a preposition) belong to the state locative prepositions denoting the stative location of entities. In the case of *bi* 'without' it should be noted that this preposition, unlike *ba* 'with', denotes the state where something is absent when it is combined with a noun in prepositional phrase as in *bi deqqæt* 'without care' or 'careless'. We need to recall that all the prepositions in the first group discussed above appear in the initial position in the prepositional phrase of the Persian NJs.

With regard to the prepositions that appear in the second or middle position in Persian prepositional NJs, namely, *bær* 'on/over', *piš* 'front/before', *beyn* 'between', and *miyan* 'among' it has emerged that the first two prepositions (*bær* & *piš*) belong to the state locative and the last two (*beyn* & *miyan*) to the path directional locative prepositions. The finding regarding the type of the prepositions in the prepositional phrase of the Persian LVCs can be summarized in the following Table (1).

A. Initial Position Preposition	Locative Preposition Type
1. Combined with either another preposition or a noun:	
a. *æz* **'from'** ⟶	-**Source** (directional)
b. *be* **'to'** ⟶	-**Goal** (directional)
c. *dær* **'in'** ⟶	-**Stative location** (state)
2. Combined with a noun (not another preposition):	
a. *ba* **'with'** ⟶	-**Stative location** (state)
b. *bær* **'on/over'** ⟶	-**Stative location** (state)
c. *bi* **'without'** ⟶	-**Stative location** (state)
B. Second or Middle Position P.	
a. *bær* **'on/over'** ⟶	-**Stative location** (state)
b. *piš* **'front/before'** ⟶	-**Stative location** (state)
c. *beyn* **'between'** ⟶	-**Path** (directional)
d. *miyan* **'among'** ⟶	-**Path** (directional)

Table 1; Locative preposition types in Persian prepositional NJ

The effect of these locative/spatial prepositions in the prepositional light verb constructions will be discussed in more detail later in this chapter (section (3)).
In terms of the nominal element combined with different types of locative prepositions it should be noted that abstract nouns are more common than concrete ones. In general, there were thirty four adpositional LVCs analyzed in this paper out of which the most

productive prepositions are *æz* 'from' and *be* 'to' each with eleven occurrences or NJ and the least productive ones are *ba* 'with', *bær* 'on/over', and *bi* 'without' each with two LVCs. And the preposition *dær* 'in' stands in the middle with six occurrences.

With regard to the light verbs capable of combining with adpositional phrases to form prepositional NJs it should be mentioned that the most common light verbs showing this capability are *šodæn* 'become', *kærdæn* 'make', *daštæn* 'have', *ræftæn* 'go', *bordæn* 'take/carry', *gereftæn* 'take', *dadæn* 'give', *amædæn* 'come', *aværdæn* 'bring', *xordæn* 'eat', *zædæn* 'hit/strike', and *kešidæn* 'pull'. Among these light verbs the most productive ones with respect to the number of occurrences in our data are *bordæn* 'take/carry', *daštæn* 'have', and *gereftæn* 'take' each with five NJs; the least productive ones are *dadæn* 'give', *xordæn* 'eat', *zædæn* 'hit/strike', and *kešidæn* 'pull' each with one construction.

The findings of the diagnostic tests applied to the prepositional NJs (numbered as 1-34 in Table (2)) examined in this study including the verb class and the logical structure are presented in Table (2) below:

Preposition	**Verb Class**	**prepositional NJ (infinitive form)**	**Logical Structure (LS)**
æz + Prep. + LV			
æz bær + LV	Accom.	1-æz bær šodæn (Lit.: 'from on/over become') **'memorize'**	BECOME**æz bær šodæn´** (x)
		2-æz bær kærdæn (Lit.: 'from on/over make') **'memorize'**	BECOME**æz bær kærdæn´** (x, y)
	Achiev.	3-æz bær daštæn (Lit.: 'from on/over have') **'know by heart'**	INGR**æz bær daštæn´** (x, y)
æz beyn + LV	Accom.	4-æz beyn ræftæn (Lit.: 'from between go') **'be wiped out'**	BECOME**æz beyn ræftæn´** (x)
		5-æz beyn bordæn (Lit.: 'from between take/carry') **'wipe out'**	BECOME**æz beyn bordæn´** (x, y)
æz piš + LV	Achiev.	6-æz piš bordæn (Lit.: 'from front take/carry') **'manage'**	INGR**æz piš bordæn´** (x, y)
æz miyan + LV	Accom.	7-æz miyan bordæn (Lit.: 'from among take/carry') **'wipe out'**	BECOME**æz miyan bordæn´** (x, y)
æz + NP + LV	Achiev.	8-æz dæst ræftæn (Lit.: 'from hand go') **'be lost'**	INGR**æz dæst ræftæn´** (x)
		9-æz huš ræftæn (Lit.: 'from consciousness go') **'lose consciousness'**	INGR**æz huš ræftæn´** (x)
		10-æz yad bordæn (Lit.: 'from remembrance take/carry') **'forget'**	INGR**æz yad bordæn´** (x, y)
		11-æz sær gereftæn (Lit.: 'from head take') **'do all over again'**	INGR**æz sær gereftæn´** (x, y)
ba + NP + LV		12-ba xæbær šodæn (Lit.: 'with news become') **'become informed'**	INGR**ba xæbær šodæn´** (x)
		13-ba xæbær kærdæn (L.: 'with news make') **'inform'**	INGR**ba xæbær kærdæn´** (x, y)
bær + NP + LV	Accom.	14-bær bad ræftæn (Lit.: 'on/over wind go') **'be squandered'**	BECOME**bær bad ræftæn´** (x)

Table 2: LS of the Persian Prepositional/Light Verbal NJs

Preposition	**Verb Class**	**prepositional NJ (infinitive form)**	***Logical Structure (LS)***
bær + NP + LV	*Achiev.*	*15-bær bad dadæn* *(Lit.: 'on/over wind give')* ***'squander'***	*BECOME**bær bad dadæn´** (x, y)*
be + NP + LV		*16-be dæst amædæn* *(Lit.: 'to hand come')* ***'be obtained'***	*INGR**be dæst amædæn´** (x)*
		17-be huš amædæn *(Lit.: 'to consciousness come')* ***'gain consciousness'***	*INGR**be huš amædæn´** (x)*
	Achiev.	*18-be yad aværdæn* *(Lit.: 'to remembrance bring')* ***'remember'***	*INGR**be yad aværdæn´** (x, y)*
		19-be yad daštæn *(Lit.: 'to remembrance have')* ***'remember'***	*INGR**be yad daštæn´** (x, y)*
	Accom.	*20-be kar bordæn* *(Lit.: 'to work take/carry')* ***'use'***	*BECOME**be kar bordæn´** (x, y)*
		21-be kar gereftæn *(Lit.: 'to work take')* ***'use'***	*BECOME**be kar gereftæn´** (x, y)*
		22-be pa kærdæn *(Lit.: 'to foot make')* ***'put on/wear (on the foot)'***	*BECOME**be pa kærdæn´** (x, y)*
	Achiev.	*23-be dærd xordæn* *(Lit.: 'to pain eat')* ***'be useful'***	*INGR**be dærd xordæn´** (x)*
		24-be jib zædæn *(Lit.: 'to pocket hit/strike')* ***'pocket'***	*INGR**be jib zædæn´** (x, y)*
	Accom.	*25-be (xak væ) xun kešidæn* *(Lit.: 'to (soil and) blood pull')* ***'kill'***	*BECOME**be (xak væ) xun kešidæn´** (x, y)*
bi + NP + LV	*Achiev.*	*26-be miyan aværdæn* *(Lit.: 'to among bring')* ***'broach/bring up'***	*INGR**be miyan aværdæn´** (x, y)*
		27-bi hes šodæn *(Lit.: 'without feeling become')* ***'become numb/ anesthetized'***	*INGR**bi hes šodæn´** (x)*
dær+Prep +LV		*28-bi hes kærdæn* *(Lit.: 'without feeling make')* ***'make numb/ anesthetize'***	*INGR**bi hes kærdæn´** (x, y)*
dær bær + LV		*29-dær bær daštæn* *(Lit.: 'in on/over have')* ***'incur'***	*INGR**dær bær daštæn´** (x, y)*
	Accom.	*30-dær bær gereftæn* *(Lit.: 'in on/over take')* ***'surround'***	*BECOME**dær bær gereftæn´** (x, y)*

Table 2 (Cont.): LS of the Persian Prepositional/Light Verbal NJs

Preposition	**Verb Class**	**prepositional NJ (infinitive form)**	***Logical Structure (LS)***
dær + NP + LV	*Achiev.*	*31-dær dæst daštæn* *(Lit.: 'in hand have')* ***'have/exercise authority over'*** *32-dær extiyar daštæn* *(Lit.: 'in authority have')* ***'have/exercise authority over'*** *33-dær dæst gereftæn* *(Lit.: 'in hand take')* ***'take charge of'*** *34-dær extiyar gereftæn* *(Lit.: 'in authority take')* ***'take charge of'***	*INGR**dær dæst daštæn´** (x, y)* *INGR**dær extiyar daštæn´** (x, y)* *INGR**dær dæst gereftæn´** (x, y)* *INGR**dær extiyar gereftæn´** (x, y)*

Table 2 (Cont.): LS of the Persian Prepositional/Light Verbal NJs

In terms of aspectual properties, it should be stated that even though our study is not based on corpus-oriented generalizations and we do not intend to provide any frequency references, we sometimes refer to the number of occurrences as an indicator of the commonality of some construction types. With regard to the prepositional LVCs analyzed in this chapter it is observed that out of the thirty four adpositional NJs examined in this chapter twenty two belong to the Achievement verb class and twelve to the accomplishment type i.e. majority of the prepositional LVCs in our collected data are of achievement type bearing such features as [-static], [+telic], and [+punctual] with the logical structure INGR **predicate´** (x) or (x, y). In fact, no NJs were found in our data with state or activity verb class.

Also, by taking a careful look at Table (2) it becomes clear that the verb class of the prepositional light verbal constructions is not always dependent on the aspectual properties of the verbal elements. That is, as with other types of Persian LVCs discussed in Saeedi (2009a) the verb is not the only determining factor in characterizing the verb class of the adpositional or prepositional constructions. The following section provides a detailed discussion of the event attributes and structure of the prepositional nuclear junctures.

3. Event Structure of Prepositional NJs

Our investigation of the prepositional LVCs has revealed that the light verbs fusing with the prepositional phrases belong to the 'phase' class of verbs as shown in the following Table. As is clear from the Table, the light verbs occurring in the prepositional LVCs belong to the phase group of verbs, which is compatible with the adjectival type of Persian nuclear junctures (Saeedi 2009b). The only exception to the above list is the light verb *daštæn* 'have' which denotes state or attribute and is in fact a non-phase verb i.e. unlike the phase light verbs, does not refer to particular phases of an event demonstrated in Figure (3) below. In this Figure (3) some of Engerer's (2007) terminology (ingressive for start, continuative for process, and terminative for endpoint) has been used to schematize different internal phases of an event.

Light Verb		LVs' Phase Features
šodæn	'become'	Result
kærdæn	'make'	Process
dadæn	'give'	Result: x, y → z: endpoint, RRG 3 place PRED analysis
zædæn	'hit/strike'	Continue, process/start, process
gereftæn	'take/catch'	Endpoint
kešidæn	'pull'	Process
xordæn	'eat'	Process
amædæn	'come'	Process ←
ræftæn	'go'	Process →
aværdæn	'bring'	Process: 'Do' activity, RRG 3 place PRED analysis
bordæn	'take/carry'	Process
daštæn	'have'	Attribute/State: Non-phase

Table 3 Feature of LVs as 'phase' verbs in prepositional NJs

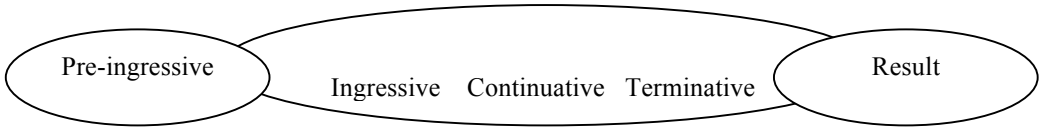


Figure 3: Phases of an event

The light verbs capable of fusing with the prepositional phrases in Persian refer to the continuative (process), terminative (endpoint), or result (resultative) phases of an event, as presented in Table (3). Interestingly, this parallels the findings with the nominal, adjectival and adverbial NJs (Saeedi 2009a). In general most of the verbs in Persian prepositional LVCs belong to the phase type and there are just a few non-phase verbs in these constructions. The same phenomenon takes place in Toratani's (2002) study on Japanese compound (complex) verb constructions, where majority of verbs occurring in these constructions belong to phase verbs and there are just a few non-phase verbs. In Toratani's (2002) study, only such verbs as *sugi* 'exceed' and *kane* 'combine something with' belong to the non-phase verb class while there are at least seven phase verbs appearing in the compound verb constructions in Japanese.

As mentioned above, with the exception noted, the light verbs in the prepositional LVCs refer to a particular phase of an event. Consider the examples in Table (4) where the verbal element is the same in each pair of the prepositional NJs and the first LVC in each pair is formed with the prepositional compound (two prepositions) while the second is made with a preposition and a noun. The light verb in the first (a, a´) pair i.e. *šodæn* 'become' refers to the result (resultative) phase of the events while the preposition-preposition combination (*æz bær* 'from on/over') in (a) with the source (directional) locative preposition *æz* 'from' and the state locative preposition *bær* 'on/over' implies the event type of *'memorizing'*. That is, the combination of these two prepositions indicates that something has caused an entity (e.g., the thing is to be memorized) to move from a 'source' implied by *æz* 'from' as a locative source directional preposition and be placed 'on' a location (e.g., one's memory) implied by *bær* 'on/over' as a locative stative location preposition. Additionally, the preposition-N combination (*ba xæbær* 'with news') in (a´) implies *'with information'* or *'being informed'*. In other words, the preposition *ba* 'with' shows that the 'state' of something

exists and that 'something' is the noun following this preposition. It is a logical justification to claim that this is the reason why such prepositions as *ba* 'with' are followed by an N in the prepositional NJs and not another preposition since semantically they need a noun whose stative location is characterized by such prepositions.

Prepositional NJ	LV's Phase F.	*Logical Structure*
(a) -æz bær šodæn (Lit.: 'from on/over become') **'memorize'** (a´) -ba xæbær šodæn (Lit.: 'with news become') **'become informed'**	Result	*BECOME**æz bær šodæn´** (x)* *INGR**ba xæbær šodæn´** (x)*
(b) -æz beyn ræftæn (Lit.: 'from between go') **'be wiped out'** (b´) -bær bad ræftæn (Lit.: 'on/over wind go') **'be squandered'**	Process	*BECOME**æz beyn ræftæn´** (x)* *BECOME**bær bad ræftæn´** (x)*
(c) -æz miyan bordæn (Lit.: 'from among take/carry') **'wipe out'** (c´) -æz yad bordæn (Lit.: 'from remembrance take/carry') **'forget'**	Process	*BECOME**æz miyan bordæn´** (x, y)* *INGR**æz yad bordæn´** (x, y)*
(d) -be miyan aværdæn (Lit.: 'to among bring') **'broach/bring up'** (d´) -be yad aværdæn (Lit.: 'to remembrance bring') **'remember'**	Process	*INGR**be miyan aværdæn´** (x, y)* *INGR**be yad aværdæn´** (x, y)*
(e) -dær bær gereftæn *(Lit.: 'in on/over take')* ***'surround'*** *(e´) -dær dæst gereftæn* *(Lit.: 'in hand take')* ***'take charge of'***	*Endpoint*	*BECOME**dær bær gereftæn´** (x, y)* *INGR**dær dæst gereftæn´** (x, y)*

Table 4: LV's phase features as process, endpoint, & result in Persian prepositional NJs

In the second (b, b´) (*ræftæn* 'go'), the third (c, c´) (*bordæn* 'take/carry), and the fourth (d, d´) (*aværdæn* 'bring') pairs the light verbs refer to the continuative or process phase of events and the preverbal prepositional constructions provide the actual event type or attribute. In the second pair, for instance, the prepositional NJ in (b) with the locative source (directional) preposition *æz* 'from' and the locative path (directional) preposition *beyn* 'between' imply that something has been wiped from a source (denoted by the source preposition *æz* 'from') and the path *'beyn* 'between'. In fact, the whole juncture *æz beyn ræftæn* (using the gloss) means 'something goes from between' which means 'something is wiped out'. As clear here, the two prepositions provide the information regarding the event attribute and the LV refers to the process of the 'wiping out' event which takes place over a time span. As demonstrated in Table (4), the same story takes place in the examples in (b´), (c, c´), and (d, d´) where the LV refers to the process inherent nature of the event and the prepositional elements provide the event type or subtypes.

In the fifth pair, however, the LV refers to the endpoint or terminative phase of the event but the role of the preverbal element is the same as the other four examples mentioned above. That is, the preposition-preposition combination *dær bær* 'in on/over' (in (e)) with the two state locative prepositions *dær* 'in' and *bær* 'on/over' implies the *'surrounding'* event i.e. it indicates that *'something takes in and over something else*', which is the same meaning of *'surround'*. In addition, the preposition-N combination *dær dæst* 'in hand' in (e´) with the same state locative preposition (*dær* 'in') and the concrete noun (*dæst* 'hand') implies *'having (the control of something) in one's hand'* which shows the type of the main event of the whole prepositional LVC.

In conclusion, in all the examples presented in Table (2) above, the light verb provides the information regarding the phase of an event while the preverbal-prepositional elements play the role of determining the event type of the whole construction. As mentioned above, the combination of the two locative prepositions *æz bær* 'from on/over' in (a), for instance, implies the '*memorizing'* event type. By taking a careful look at the glossary of the prepositional LVCs in Table (2) it becomes clear that the same is true for all the prepositional nuclear junctures i.e. the preverbal-prepositional constituents determine the event type or attribute and the light verbs refer to particular phases of events and are in fact bleached with regard to the event type. Even though in such prepositional NJs as *æz bær daštæn* 'know by heart' (Lit.: 'from on/over have') (presented in Table (2)) with the non-phase verb *daštæn* 'have' the light verb denotes state or attribute and does not refer to a particular phase of an event, the prepositional elements provide the event type and the light verb is bleached in this respect. As a matter of fact, the findings of this paper are in close affinity with that of the adjectival NJs in Saeedi (2009b).

4. Constructional Schema of Prepositional NJs

According to RRG, if two nuclei share the same nuclear operator and are structurally independent, the nexus-juncture linkage type of the construction is nuclear co-subordination. The prepositional LVCs in Persian, as presented in (6) and Figure (4) below, belong to this linkage type.

(6) seyl hæme-ye šæhr-ra dær bær næ-gereft.
flood all/whole-Ez city-DOM in on/over Neg.Op.-take.Past.3rd.Sg.
'The flood did not surround the whole city.'

As demonstrated in the Figure (4), the two NUC nodes are structurally independent while sharing the negation nuclear operator *næ-* which is attached to the verbal element in Persian. This indicates that the linkage type of the prepositional LVCs is nuclear co-subordination.

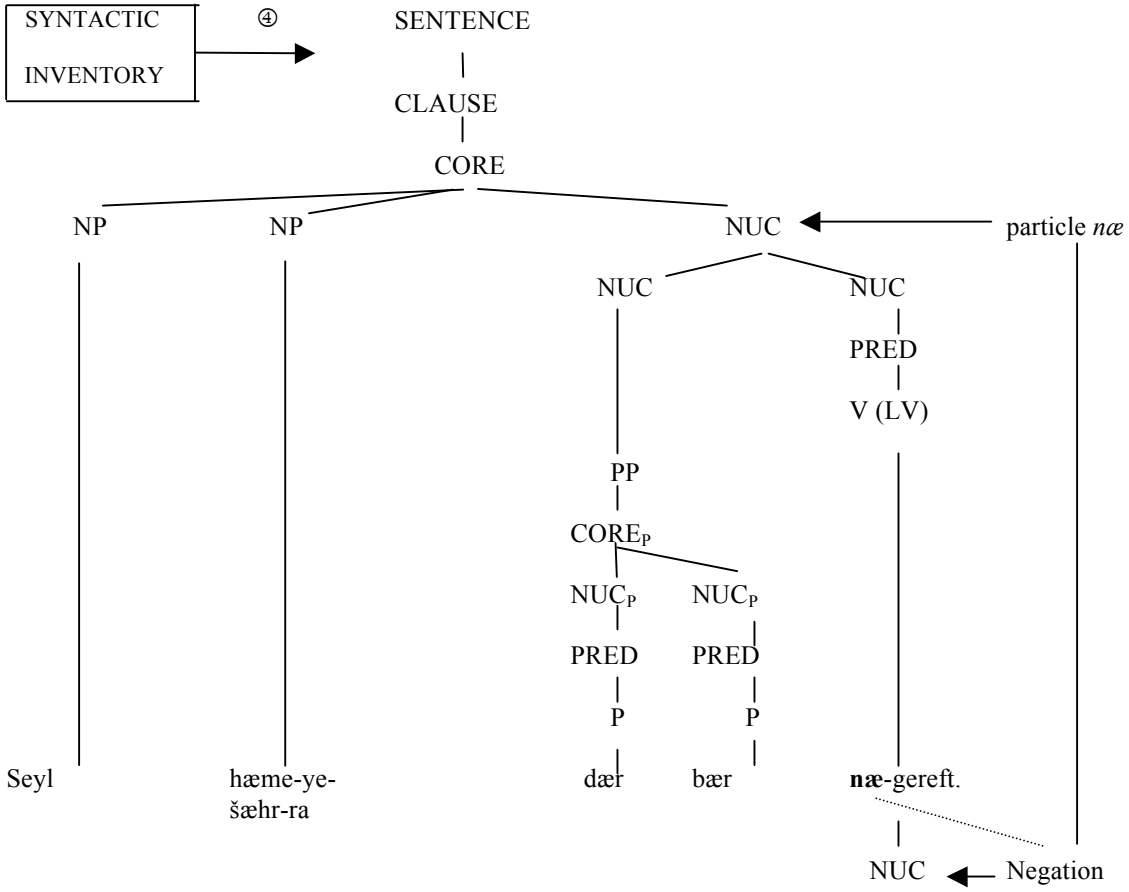


Figure 4: Operator sharing in Persian prepositional NJs

Now that we have determined the nexus-juncture linkage of these constructions, the constructional schema of the prepositional nuclear junctures can be schematized:

Construction: Persian prepositional nuclear juncture
SYNTAX:
Juncture: nuclear
Nexus: cosubordination
Construction type: light verbal (prepositional phrase + light verb)
[$_{CL}$ [$_{CORE}$ NP [$_{NUC}$ [$_{NUC}$ …Prep.phrase] [$_{NUC}$ …V(LV)]] NP …] …]
Unit template(s): (3.6) (see section (3.4.4.1) in chapter three)
PSA: none
Linking: default
MORPHOLOGY:
PRED$_{NUC1}$: Prepositional Elements: either (Prep. + Prep.) or (Prep. + NP)
PRED$_{NUC2}$: light verb: majority of phase verbs and one non-phase verb ('have')
[LV: [**predicate´** (x) or (x, y)] + ADV]
[LV: [**do´** (x, **predicate´** (x) or (x, y)] + ADV]
[LV: [INGR **predicate´** (x) or (x, y)] +PP]
[LV: [BECOME **predicate´** (x) or (x, y)] + PP]
SEMANTICS: [PRED$_{NUC1}$]… + … [PRED$_{NUC2}$]
PRAGMATICS:
Illocutionary force: unspecified
Focus structure: unspecified

Table 5: Constructional schema for Persian Prepositional nuclear junctures

According to RRG, such constructional schemas as the one presented above for Persian prepositional LVCs provide a detailed representation of the morphological, syntactic, semantic, and pragmatic features.

5. Conclusion

The findings of the present paper on the prepositional LVCs have revealed that the preverbal-prepositional elements occurring in these constructions belong to the stative and directional (source, path, and goal) locative prepositions and can be of two types i.e. the combination of two prepositions or a preposition and a noun. It also emerged that consistent with the adjectival NJs (Saeedi 2009b) the verbal elements in these LVCs belong to the 'phase' class of verbs referring to particular phases of events and that the prepositional elements provide the information regarding the locative stative and directional event type or attribute. In other words, the light verbs are bleached with regard to the event type i.e. they do not provide the information on what type of event the whole construction corresponds. We also found one example of a non-phase verb, the state/attribute verb *dæštæn* 'have', which is capable of forming nuclear junctures with the prepositional elements. The prepositional LVCs, as demonstrated in this paper correspond to the nuclear co-subordination linkage type.

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Storage of linguistic knowledge in the mental lexicon: An approach within Role and Reference Grammar

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Abstract[1]

This paper aims to give an account of a theory of a mental lexicon for German verbs of motion within the theory of Role and Reference Grammar [RRG] (cf. Van Valin 2005). The issue of how Aktionsarten in general and particularly verbs of motion, with their various alternations, are structured and how they are stored in an RRG-compatible lexicon is investigated. A time line model for RRG-Aktionsarten based on Reichenbach (1947) is developed to give a description of the structure of events assumed within RRG. Human knowledge is often represented in terms of inheritance networks. In this paper I use a model of inheritance networks to modify the present version of the lexicon in RRG. I will argue that we do not need basic Aktionsarten in the lexicon, if we analyze and decompose Aktionsarten and operators in terms of inheritance networks. I will show furthermore that we do not need multiple lexical entries for verbs like motion verbs that occur in a multitude of contexts with different Aktionsart readings (see example 2.1.1.a, b and 2.1.4), if we accept the idea of inheritance networks. Neither do we need a workshop module and lexical rules as suggested by Van Valin and LaPolla (1997) and Van Valin (2005).

1. Introduction

The meaning of the term lexicon in linguistics is not comparable with a dictionary, where definitions of words are listed in alphabetical order. Instead, behind the term lexicon in linguistics there is a complex theoretical construction with multilayered word descriptions (cf. Jackendoff 2002). Chomsky added the term lexicon in Aspects (1965). Based on Bloomfield (1933), he explains that all unusual and unpredictable word-features must be included in the lexicon (cf. Jackendoff 2002: 153). Even if the way of looking at the lexicon has changed in modern linguistics, as many of the productive processes of grammar have been moved into the lexicon, one thing has not changed: the lexicon does not contain an indefinite repertoire of all potential sentences a speaker could say, but rather individual entries of certain words that are somehow stored (cf. Koenig 1999: 1). The issue of how such a lexicon is structured within the theory of RRG will be explored in this paper.

This discussion will proceed as follows. In section 2, the basic notion of Aktionsart and its formal representations within RRG are discussed. Furthermore, the empirical problem underlying this paper will be presented and the architecture of an RRG lexicon theory will be outlined. In section 3.1 I present the basic concept of inheritance networks and the present version of the RRG lexicon. In section 3.2. I develop a decomposition of the operators into features based on which an inheritance network can be construed. Section 4 sheds light on the the connection between the Aktionsart inheritance network and the operator inheritance network I have developed. In section 5 finally I sketch an analysis of German motion verbs and construe an inheritance

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network for these verbs that will allow for simple lexical entries and dispense with the need for lexical rules to explain alternations.

2. Role and Reference Grammar

The theory of RRG is a functional grammatical theory that clearly differs from other theories in various ways. RRG is a monostratal syntactic theory, postulating one single syntactic representation for sentences. This is connected with the semantic representation of a sentence by linking rules. These rules will be summarized under the term *linking algorithm*. As RRG is a functional grammatical theory, discourse pragmatics also plays an important role. The basic theory of RRG can be found in Van Valin and LaPolla (1997) [VVLP] and Van Valin (2005) [VV].

The semantic representation of a sentence in RRG is based on the Aktionsart classification according to Vendler (1967), which divides sentences into states, achievements, accomplishments and activities. It makes use of a reworked and extended scheme of representation based on Dowty (1979) to describe differences among the Aktionsarten (cf. VV 2005: 31). However, there are several non-Vendlerian Aktionsarten in the RRG-framework. These are Semelfactives, Active accomplishments and all causative types of the Aktionsarten. Semelfactives were introduced in Smith (1997). They describe punctual occurrences which have no resulting condition (cf. VV 2005: 32). Examples are: *The light flashed, Max sneezed, The branch knocked against the window or Max spotted Claudius*. Between activities and Active accomplishments there is a derivational relationship. Active accomplishments describe the telic use of activities. While Vendler still describes sentences such as *Max has walked a mile* as being Accomplishments, Van Valin assigns the verb to the Active accomplishment in this morphosyntactic context, therefore presenting a derivational relationship to the activities. He draws a clear defining line between verbs which are telic and have dynamic elements, and thus are Active accomplishments, and verbs which are telic but not dynamic, and therefore are Accomplishments. However, there are verbs which are non-derived lexical active accomplishments. These typically are verbs which are telic and cannot alternate to Activites (cf. VV 2005). The causative types of the six RRG-Aktionsarten describe semantic differences in which a cause, for example a change in condition, can be identified. In the sentence *Max shattered the cup* the verb is a Causative Achievement. Van Valin characterizes the Aktionsarten with the help of four features:

(2.0.1)

State:	[+ static], [- dynamic], [- telic], [- punctual]
Activity:	[- static], [+ dynamic], [- telic], [- punctual]
Achievement:	[- static], [± dynamic], [+ telic], [+ punctual]
Semelfactive:	[- static], [± dynamic], [- telic], [+ punctual]
Process	[- static], [- dynamic], [- telic], [- punctual]
Accomplishment:	[- static], [- dynamic], [+ telic], [- punctual]
Active accomplishment:	[- static], [+ dynamic], [+ telic], [- punctual]

(cf VV 2005: 33)

RRG offers a number of syntactic and semantic tests which allow to determine the Aktionsarten of verbs. The lexical representation used in RRG, which was adapted by Dowty (1979), delivers an outline of the semantic processes described by the Aktionsarten. The verbs are analyzed via a decompositional lexical system, where

States and Activities form the basis. All other Aktionsarten are derived from them (cf. VV 2005: 42). In (2.0.2) an overview the logical structures [LSs] used in RRG is given:

(2.0.2)[2]		
	State	**predicate´** (x) or (x, y)
	Activity	**do´** (x, [**predicate´** (x) or (x, y)])
	Achievement	INGR **predicate´** (x) or (x, y) or INGR **do´** (x, [**predicate´** (x) or (x, y)])
	Semelfactive	SEML **predicate´** (x) or (x, y) or SEML **do´** (x, [**predicate´** (x) or (x, y)])
	Process	PROC **predicate´**(x) or (x, y)
	Accomplishment	PROC **predicate´** (x, (y)) & INGR **predicate´**((z), y)
	Active accomplishment	**do´**(x, [**predicate´**(x, (y))]) & INGR **predicate´**((z), y)
	Causative	α CAUSE β, where α, β, are LSs of any type Caus any type (cf. Van Valin 2005)

While accomplishment verbs like *melt* involve both a process taking place over time and an inherent endpoint of the process, which leads to a result state, achievement verbs like *pop* on the other hand do not have a process. They merely code a punctual event leading to a result state. It follows that an accomplishment can be analyzed as a process plus an achievement. This is true if the final moment of the process can be equated with the punctual event of an achievement. In some languages there are verbs coding processes directly without necessitating the implication of an endpoint or a result state. These verbs clearly differ from English verbs like *melt* and *dry*. The following examples are taken from Mparntwe Arrente (Wilkins 1989):

(2.0.3.)a.	Ayenge	irrente	ne-ke
	1sgNOM	cold	COP-PAST
	'I was cold.'		
b.	Ayenge	irrent-irre-ke.	
	1sgNOM	cold-PROC-PAST	
	'I got colder / cooler / *cold.'		
c.	Ayenge	irrente-arle-irre-ke.	
	1sgNOM	cold-RES-PROC-PAST	
	'I got cold.'		

The important contrast between (2.0.3b) and (2.0.3c) can be seen. The suffix *irr*e added to the stative stem *irrente* 'cold' means "become colder", but it does not mean "become cold". Accordingly, a change from less to more cold is coded, but it is not entailed that the process has reached its endpoint. In order to code the reaching of the endpoint, the suffix *arle* 'result' needs to be added. So in (2.0.3c) this suffix indicates that the process has reached its termination and yields a result state. The Mparntwe Arrente examples show that it is hence necessary to represent processes independently

[2] This representation of the LSs differs in various ways from the representations in VV(2005). Process is introduced as Aktionsart and the operator BECOME used in VV (2005) is erased as it decomposable into [PROC … INGR].

from a possible endpoint and result state. Therefore, the operator PROC for process is added. The decompositional representation is stated below:

(2.0.4)	a.	**cold´**(1sg)	*irrente*
	b.	PROC **cold´**(1sg)	*irrente* + *irre*
	c.	PROC **cold´**(1sg) & INGR **cold´**(1sg)	*irrente* + *arle* + *ire*

(Van Valin 2005: 44)

While INGR, SEML and [PROC ... INGR]can be used in connection with activity verbs, this is not possible with PROC. This is because PROC does not entail an event or transition, so it cannot be used to characterize some kind of pre-onset process. This however is possible with the other three operators.

2.1 One verb, many versions: the empirical problem

The empirical problem this paper deals with is described by Van Valin, Levin, Pinker etc. as follows: How is it possible that one single verb can occur in a multitude of morphosyntactic contexts (cf. VV in press). Here is an example:

(2.1.1)	a. The Cylons marched in Delphi.	atelic
	a'. The Cylons marched to Delphi.	telic
	b. President Roslin wrote	atelic
	b'. President Roslin wrote an e-mail.	telic
	c. Colonel Tigh ate.	atelic
	c'. Colonel Tigh ate a hamburger.	telic

If a motion-verb is being used atelically as an Activity, as in (2.1.2a), the locative PP is optional. If a Goal-PP is added, as in (2.1.2.), the same verb behaves like a telic verb and becomes an Active accomplishment. Here, the PP cannot be left out. The atelic creation-verb *write* behaves similarly to the motion verb *march*. Every time the object is specific or quantified it behaves telically, as in (2.1.2a). Thus an Activity-Active accomplishment alternation is presented. To the consumption-verb *eat* (2.1.2b) and (2.1.2c) the same pattern as to the creation-verb *write* applies. A further form of Alternation is the Causative-Alternation:

(2.1.2) a. The spacecraft blew up.
b. The missile blew up the spacecraft.

There are at least five possibilities of how the verbs in (2.1.2) are connected to each other. They could be listed separately as transitive or intransitive verbs in the lexicon. Or there could be a single entry in the lexicon for the verb, which underlies both forms and is specified for the transitive version of the verb. Pustejovsky (1995) holds this view. There could also be an alternating base-form which the transitive and intransitive form of the verb date back to. According to such a position, none of the verb-forms is a base form. This perspective goes back to Pinon (2001). The transitive form of the intransitives can also be derived from a causativation rule. Such phenomena occur in Huallaga Quechua (cf. VV 2005 : 41). On the contrary, the intransitive form can also be derived from the transitive. This would be analogous to Russian, French and Yagua. This connection can be read from the morphological form of the verbs (cf. VVLP 1997: 190, cf. Haspelmath 1993). I will not explain the various ideas of the construction of a mental lexicon as they have been constructed during the last decades of research in any

detail within this paper however the alternations mentioned can deliver four ways of reading a single verb:

(2.1.4)	a. The Cylons marched in Caprica.	Activity
	b. The Cylons marched Starbuck across Caprica.	Causative Activity
	c. The Cylons marched to Starbuck`s spacecraft.	Active accomplishment
	d. The Clyons marched Starbuck to her spacecraft.	Causative Active accomplishment

The empirical problem may be summarized in the following questions: How many entries in the lexicon does a verb have if many of such morphosyntactic alternations occur? How can it be explained that a verb can be realised with different PPs? Are all representations connected through lexical rules, or are there underspecified lexical representations plus the information from NPs and PPs? The aim of this lexicon theory is to show how a lexicon can be constructed with the help of one single lexical entry for per verb with the help of multilayered inheritance hierarchies.

2.2 Architecture of an RRG-compatible mental lexicon

Semantic hierarchies in which lexical information is inherited from one node to the other, are called inheritance networks. In processing-systems for natural languages, inheritance networks have been inserted as models of linguistic knowledge since the 1960s. This allows human knowledge to be coded in a flexible and efficient way. They also allowed to make inferences about the objects in a domain. A number of linguistic theories extensively use inheritance networks: construction grammar, Head-Driven-Phrase-Structure-Grammar [HPSG] as well as cognitive grammar (cf. Koenig 1999: 3).

As the lexicon is a part of human knowledge, therefore it can be expected that – like everything in human knowledge – even this is hierarchically structured (cf. Koenig 1999: 14). In an inheritance network, properties are assigned to a node. In this process, attributes are functionally represented as values. Qualities of node A can be inherited by node B if B is a successor of A. There are different types of inheritance. In simple inheritance, every node except for the root has exactly one predecessor. In multiple inheritances at least one node has more than one predecessor. In monotone inheritance every successor B has all of the qualities of A. The same values as A are assigned to all of the attributes of B. Non-monotonic inheritance functions just like monotonic inheritance via default. However, a successor of B may have other qualities than A. In this case, the attribute f will be assigned with a different value than A, or an attribute will be added that A does not have. In my account of an RRG lexicon I will make use of non-monotonic inheritance networks.

As a possible solution to the empirical problem described on the previous pages, the following working hypothesis will be explored: An inheritance network and lexical rules can be used to establish an RRG – lexicon theory. This working hypothesis entails a few basic assumptions: I assume that lexical knowledge is hierarchically structured by verbs in terms of *lexical fingerprints*. A fingerprint normally describes a non-redundant, underspecified functional assignment of values and attributes which are directly connected to the concepts of world ontologies and which determine the semantics of the verb. Constructing the fingerprints, it is necessary to find out the required reference points, but it should also be possible to define them with as much as less redundant information. So a fingerprint specifies the node's qualities in an inheritance network

and describes inheritance in the inheritance network. Another assumption is that verbs are contained in a specific lexical domain, following the example set by Marial and Faber (2005). I call these domains *district clusters*. District clusters spread out into semantic *neighborhood clusters,* which specify district clusters of verbs in more detail in their meaning. Verbs of the lexical domain MOVEMENT are diverse. They can be used to describe several kinds of motions from one place to another. It is possible to go by car, by train, by ship etc; it is also possible to move without technical aid on foot, to walk, to run or to go rambling. Furthermore, it is possible to crawl, to swim or to climb a mountain. All these verbs describe a movement from destination A to B and nevertheless they differ significantly. Therefore, they belong to different neighborhood clusters in one district cluster. In addition to the district cluster of motion verbs, plenty of other district clusters like emotion verbs, cognition verbs etc. exist (cf. Mairal and Faber 2005: 5).

One can look at the lexicon as being a pure warehouse of lexical knowledge, full of words and morphemes. Lexical rules are a phenomenon that, according to Van Valin, does not occur in the lexicon, but rather in a different module he calls *workshop*. The semantic representations are constructed from material stored within the lexicon (cf. VV 2005: 161). Actually, the lexicon is divided into two parts: the traditional lexicon, where morphemes and words are stored as in a storehouse and the workshop where, by using lexical rules and other lexical processes, new lexical forms are created which are not stored otherwise (cf. VV 205: 161). As I said in the introduction, modern linguistics postulates that many productive processes of grammar take place within the lexicon. One reason for this is the development of rules which form part of the processes within the lexicon. Based on these rules, it was possible to add important generalizations. These are called *lexical redundancy rules [LRRs]*. They are accepted in most generative theories. The adding of LRRs goes back to Chomsky (1970) and was extended in Jackendoff (1975). The question connected to so-called lexical rules (LRs) reads as follows: Are verb alternations best described as separate lexical entries, or can they be described with the help of LRs (cf. VVLP 1997: 178)? Van Valin and LaPolla propose the following LRs:

(2.2.2)

> Activity [motion] → active accomplishment: given an activity LS **do´** (x, [**pred´** (x)]), add '& INGR **be-LOC´** (x, y)' to form an active accomplishment LS.
> Activity [consumption] → active accomplishment: given an activity LS **do´** (x, [**pred´** (x, y)]), add '& INGR **consumed´** (y)' to form an active accomplishment LS.
> Activity [creation] → active accomplishment: given an activity LS **do´** (x, [**pred´** (x, y)]), add '& INGR **exist´** (y,)' to form an active accomplishment LS.
>
> (cf. VVLP 1997: 180)

In accordance with Van Valin and LaPollas' analysis regarding the structure of a mental lexicon, and with regard to Van Valins' notation of the workshop (cf. VV 2005: 161), the following illustration of the storage of linguistic knowledge in the mental RRG lexicon has been drawn:
1. Verbs that alternate only have one single lexicon entry, unless they are polysemous –
2. Verb Alternations can be described with the help of derivational lexical rules (cf.

VVLP 1997: 178ff). 3. The use of lexical rules is not a process that occurs in the lexicon; rather it happens in the workshop (cf. VV 2005: 161).

3. Time-line model for the RRG operator and the state of affairs network of supplies

Using Reichenbach's (1947) and Löbner's (1988) analysis, it is possible to claim all of the Aktionsarten to be arranged on one time-line. I hereby assume the ontology of the operators to be universally valid for all languages. This corresponds to the suppositions about operators in Dowty (1979), Foley and Van Valin (1984), VVLP (1997) and VV (2005). These time-lines are universally valid for all languages, since they illustrate physical progress in time independent of linguistic aspects. In this case one can assume universal validity. Here is a presentation of the lexical Operators **do´**, PROC, INGR and SEML as time-lines:

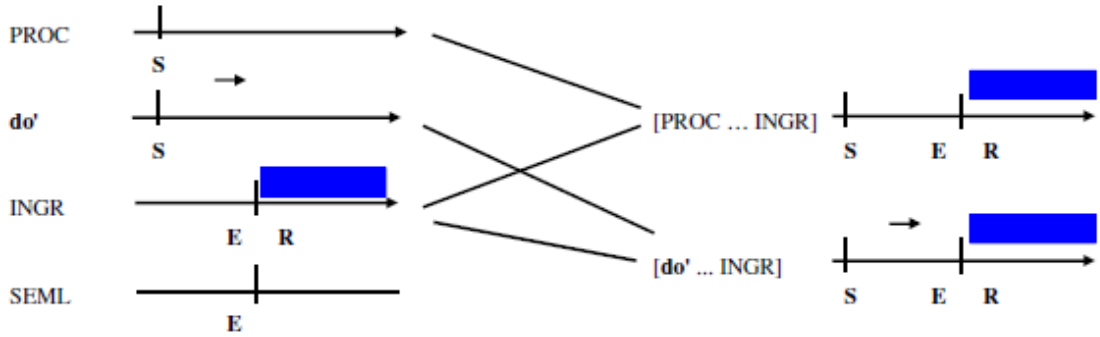

Figure 3.0.1: the lexical Operators **do´**, PROC, INGR and SEML as time-lines

With regards to notation, S marks the starting point or the beginning of a state of affairs [SOA]. An SOA shows a starting point or beginning if a process lies on the time-line. E stands for event and describes an occurrence on the time-line within the SOA. R describes the result of an event. This is additionally shown by a colored mark on the time-line. In principle the time-line is unlimited. Because of this, it cannot be terminated, which will be pointed out by an arrowhead.

In this model, a special position is assumed by the timeline for the operator SEML. In analogy to the other events with PROC, **do´** and INGR, SEML also describes an event on the time-line. However, this event does not result in a Result State. On the time-line, this is made clear by the lack of a colored marking for the result state. In addition, the time-line belonging to SEML does not have an arrowhead.

Besides, it becomes clear in figure 3.0.1. that the time-lines coded by operators [PROC ... INGR]and [**do´**… INGR] are both derived operators. [**do´**… INGR] is derived from the operators **do´** and INGR. BECOME is the operator used in the LS of Accomplishments. The operator hybrid [**do´** … INGR] is used in the presentation of Active accomplishments. For '[PROC ... INGR]', INGR and SEML the following relational correlations are valid - S ≠ E indicates that the starting condition of the SOA is not equal to the event E. This applies to the '[PROC ... INGR]'-Operator and to the hybrid [**do´** … INGR]. For the operator INGR, S = E is valid. Consequently, the event E is identical to the starting point S, in correspondence to the general definition of an

ingressive. According to Löbner, an ingressive event occurs if a transition to a completely new condition takes place. (cf. Löbner 1988: 185). The relation shown here reveals the moment when the ingressive takes its start. In doing so, the punctual components of the INGR-Operator are captured. However, as these relations should merely describe the relationship between starting condition and event, the relation S = E is also valid for the SEML-Operator.

In the following I will demonstrate that the time-line presentation of operators can also be presented as an inheritance network. Within this inheritance network, the operators are defined on basis of the nodes of the network's individual paths. Thereby, their semantics is determined.

To this end, binary features, which can be derived from the time-lines in figure 3.0.1, are readily available. The features are [± event], [± punctual]. [± dynamic] and [± result state]. They resemble the features of the Aktionsarten which Van Valin has presented (cf. VV 2005: 33). The root-node of the SOA-network is the abstract node SOA. The Aktionsart State cannot be represented by a separate operator in the logical structures of RRG. It is also permissible to view State as being an abstract node within the SOA-network, comparable to the root-nodes of SOA. The distinct feature of the Aktionsart State is that it does not describe an occurrence that could be described on a time-line. For this reason, States occur from the feature [- event] inside of the SOA-network. Vendler suggests a division of verbs into the groups State and Non-State (cf. Vendler 1967: 99).

In any case one fact is certain: apart from States, all other Aktionsarten are described by the feature [+ event]. From this it can be inferred that the nodes [+ event] and [- event] make up the first distinctive sister-node-pair. The [± punctual]-differentiation must of necessity follow the [± event]-node in the SOA-inheritance network. This is revealed in the time-lines-perspective of the definition of RRG-Operators already described above. If the feature [- punctual] is shown, the operator which is to be defined does not describe a punctual occurrence. Rather, it describes a somehow disposed process. Therefore, only operators like **do´**, PROC, [PROC ... INGR] and [**do´** ... INGR] can follow the tree-path to [-punctual]. These refer to Activity, Accomplishment and Active accomplishment. If the operator which is to be defined is followed by the node [+ punctual], then the relational correlation to the time-line is S = E.

This relationship is valid for the operator INGR as well as the operator SEML. Below the sister-nodes [+ punctual] and [- punctual] is a secondary pair of nodes, [+ dynamic] and [- dynamic]. Activities and active accomplishments involve such an action. Therefore, these verbs can be modified by adverbs such as *violently, vigorously, actively, strongly* and *energetically.* On the other hand, states, achievements and also accomplishments do not code dynamic action. This is why these verbs cannot co-occur with the adverbs mentioned. There are semelfactives which can co-occur with those adverbs, *e.g.* the sentence *Commander Adama coughed once violently* is grammatical, while other verbs cannot be used this way, *e.g.* **Colonel Tigh glimpsed the Cylon strongly* (cf. VV 2005: 33).

The final group of distinctive sister-nodes that forms a binary division of the RRG-operators, allowing for their definitive identification, is [+ result] and [- result]. This feature can be approximately equated to the feature [± telic] in the SOA-inheritance

network which is used in RRG. The operators' **do´** and PROC have no inherent point of termination. There is a starting point S, but there is no point E on the time-line that terminates in a Result R. This is why **do´** and PROC can be found under the node [- result] in the SOA-Network. The operator SEML contains the feature [- result].

Semelfactives are pure occurrences without any change of condition. In the sentence *The LED-lamp flashed once* the LED-lamp has the same condition before and after the occurrence of flashing. The operators presented at the end of a tree-path which contains the feature [+ result state] are INGR, [**do´** … INGR] and [PROC ... INGR]. Here it becomes clear that INGR is a kind of transitive function, which describes a change in condition.

The tree-paths which lead to these operators are analogous to the time-lines of [PROC ... INGR], INGR and [**do´**...INGR] already described above. Both time-lines show a point E, which transfers the starting condition S to the finishing-condition R. At this point it is insignificant if the relation S ≠ E or S = E is concerned in this case. The feature [+ result] describes the telic quality of a verb. Active accomplishments are therefore telic. This is why they terminate when their goal has been reached, and move on to a condition where the occurrence has been accomplished and has occurred on the time-line in its changed condition. The sentence *Max has eaten up the schnitzel* is telic because here the eating-occurrence of the schnitzel has terminated with the consumption. It is henceforth valid that Max has eaten the schnitzel. The situation is similar with *Claudius drove to the Paul-Janes-Stadium*. Here, the result has been achieved as soon as Claudius has reached Paul-Janes-Stadium since his journey to the stadium is terminated and as a result he can watch the football game. Achievements also have a Result. If a house blows up or a cup breaks, the Result follows the moment when the house blows up or the cup is broken. An Achievement describes a change from a condition, for example the not yet blown up house or the whole cup, to a new condition, namely the blown up house and the broken cup.

On the time-lines this is presented in figure 3.01. As a change is described, the operators describing these verbs, which are used in the LS of RRG, are represented in the SOA-Network by the feature [+ result]. For a sentence like *The ice in the motorway ramp melted,* this condition was the result of a melting process going on for some time (cf. VV 2005: 34). The feature [± telic] was not used here, because it points to the termination point of the verb more strongly, while [+ result] points towards the complete time-line after the Event E on the time ray. Therefore, the feature [± result] is a more adequate binary representation of the SOA described on the time-line of the operators than the feature [± telic], even though they only marginally differ in their power of description.

The network developed here looks like this:

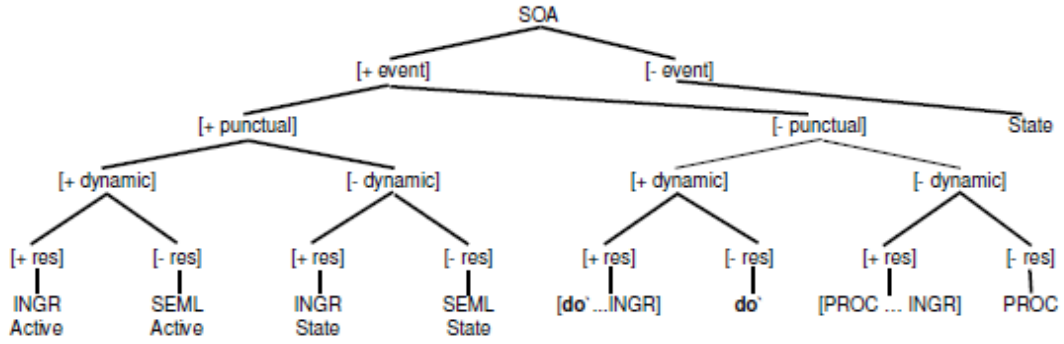

Figure 3.0.2: ***The SOA-Network***

Within the SOA-Network, the SEML-Operator surfaces on two paths – Both the path [+ event], [+ punctual], [- dynamic], [- result state], as well as the path [+ event], [+ punctual], [+ dynamic], [-result state] end in a SEML-Operator. The Operator INGR also occurs twice in the SOA-Network. Just like SEML, this operator can be derived from a State and also from an Activity. It can code a dynamic event, but at the same time it may also code a non-dynamic event. Therefore, it appears twice within the SOA-network. At one time, INRG inherits is properties from [- dynamic] and codes an INRG state and at the other it inherits its properties from [+dynamic] and codes an INGR activity.

4.0 The inheritance network of RRG-Aktionsarten

Van Valin gives clear implications as to what an inheritance network of RRG Aktionsarten looks like. He argues that State and Activity predicates are the basic Aktionsarten all other Aktionsarten can be derived from (cf. VV 2005: 42). On basis of the logical structures, which have already been described, and which are based on lexical decomposition, a hierarchical pattern among the Aktionsarten and their inheritance relationships can clearly be recognized (cf. VV 2005: 42). Based on table 2.0.2, State and Activity form basic Aktionsarten from which almost all other Aktionsarten can be derived.

Achievements, which describe a punctual change, for instance, can be represented either by a State LS or an Activity LS plus the INGR Operator. Semelfactives can also be represented either by a State LS or by an Activity LS plus SEML-Operator. Processes can be derived from States only. They cannot inherit their properties from Activities, as Processes do not code dynamic events. This is also shown in the SOA-Network. Active accomplishments are composed of an Activity LS and an Achievement LS.

The LS for the Activity component is linked with the LS of an Achievement, by a conjunction in Active accomplishments. The Achievement LS either describes a change in location or the result of a change in condition, arrived at by consumption on one side and by creation on the other. Examples of such representations are given in example (4.0.1):

(4.0.1) a. **do´** (Cylons, [**march´** (Cylons)]) & INGR **be-at´** (Pilgrim Bay, Cylons)
a'. The Cylons marched to Pilgrim Bay.

b. **do´** (Starbuck, [**eat´** (Starbuck, Jelly Beans) & INGR **consumed´** (Jelly Beans)
b'. Starbuck ate the Jelly Beans.
c. **do´** (the Chief, [**build´** (the Chief, spacecraft)]) & INGR **exist´** (spacecraft)
c. The Chief built a spacecraft

(cf. VV 2005: 44)

It becomes clear that if Active accomplishments are presented within an inheritance network of Aktionsarten, they have the qualities of both Activities and of the static Achievement derivation, so afterwards they are a hybrid of these Aktionsarten. In the SOA-Network this is shown for the combination of operators [**do´** … INGR], which defines Active accomplishments. As mentioned before, Accomplishments code an event which is decomposable as '[PROC ... INGR]'. So Accomplishments inherit from Processes on the one hand and static Achievements on the other. This kind of inheritance can be explained by the fact that they do not code any dynamic event. The causative forms of RRG Aktionsarten also have a special position.

The structure of causative verbs is complex. In this case an activity predicate is usually used and linked to a predicate which indicates the resulting state of affairs. Here the operator-connective CAUSE is used, e.g. [**do´**...] CAUSE [BECOME **pred´**...] (cf. VV 2005: 42). Fundamentally, every RRG-Aktionsart has a causative form. Effectively there is an inheritance network of causative forms. An inheritance relationship between every single Aktionsart and its causative form is retained. To simplify the presentation this second diverted inheritance network is presented in form of a single node CAUSE, which inherits the basic inheritance-network from every node. Based on this information, the inheritance network described in figure 4.0.1 can be constructed:

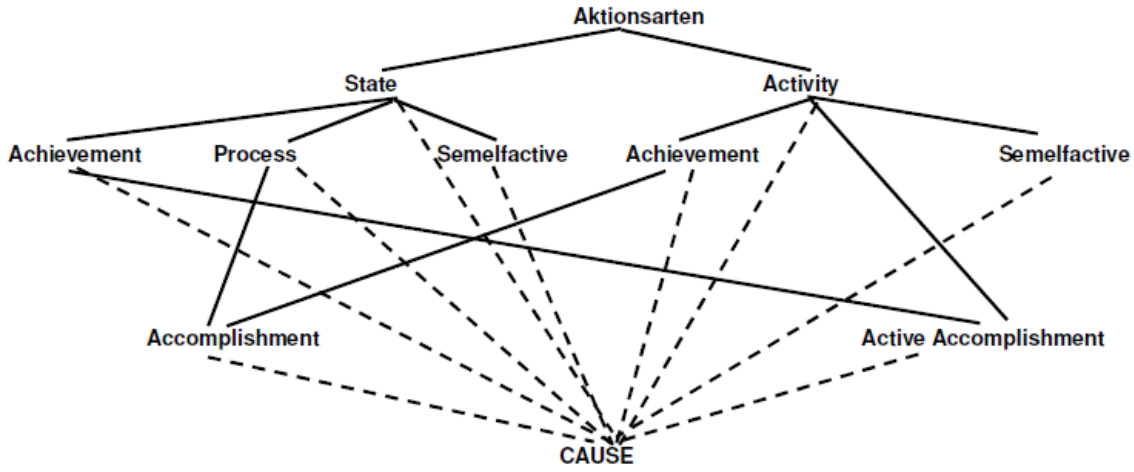

Figure 4.0.1: The inheritance network of Aktionsarten

It is crucial to be aware that the Aktionsart network is developed on an abstract level here. It describes all theoretical possibilities of inheritance relationships between the Aktionsarten. This is not to say that a language must have all of the Aktionsarten. An obvious example is Causatives. Mandarin for example has no lexical causative verbs. This does not mean no causal connections can be described in Mandarin. Rather, in Mandarin causatives are not lexicalised as single verbs, instead they are expressed by serial verb constructions (VV p.c.).

4.1 Connection of the SOA-network and the Aktionsart network

The inheritance relationship between the operators INGR, SEML, [**do´**... INGR], **do´**, [PROC ... INGR] and PROC and their semantic regulation is something completely different from the inheritance relationship between the Aktionsarten. The semantics of the operators is clearly determined in the SOA-Network. The LSs that are described in the Aktionsart network now inherit all of the qualities of the current operators in a monotone manner. In figure 4.2.1 the complete inheritance network of RRG Aktionsarten plus the SOA-Network is illustrated:

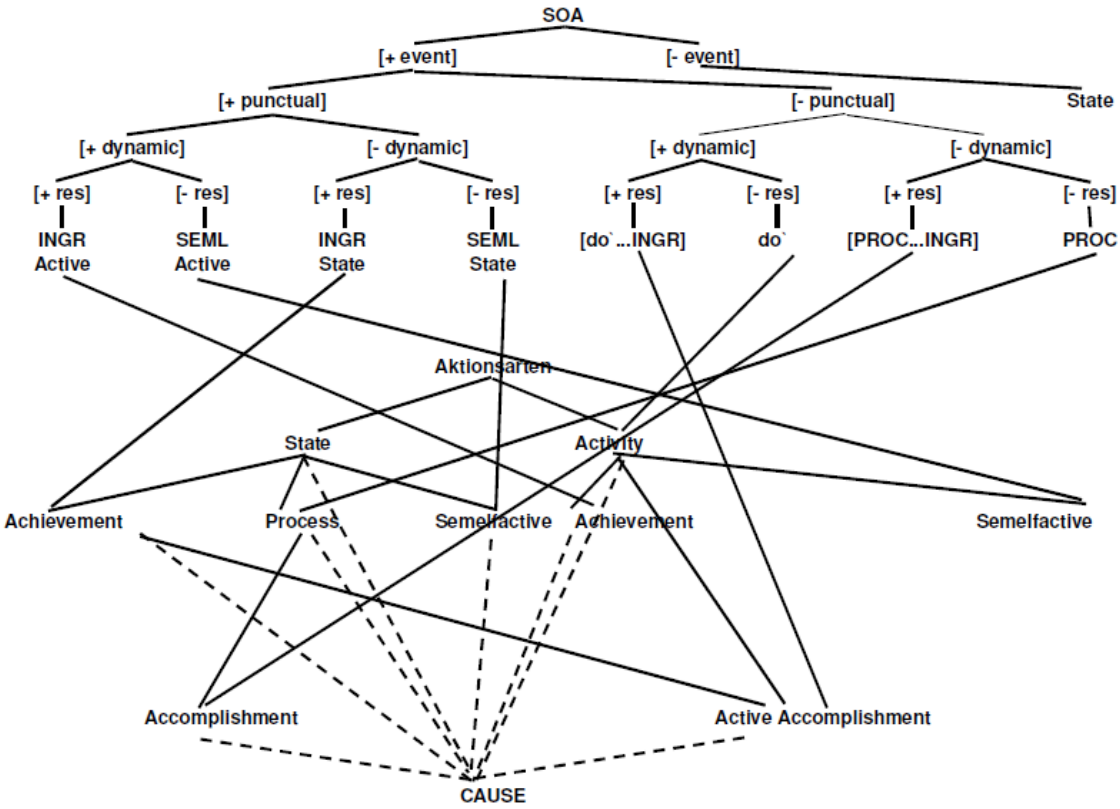

Figure 4.1.2: The SOA-network connected with the Aktionsart network

Figure 4.1.2 consists of the SOA-Network and the Aktionsart network with the CAUSE-dimension added. One can also regard this network as part of the semantic inventory of a language. The Aktionsarten completely inherit the semantic definition from the operators in the SOA-Network. The basic Aktionsarten Activity and State inherit one of the **do´**-Operator (Activity) and also from the abstract State-nodes (state). This node may not be equated with an operator. It is an abstract node which has the distinctive quality [- event].

In the Aktionsart network, States inherit from this node. As a result, State is semantically determined as being an Aktionsart which does not describe any occurrences on a time-line. Semelfactives which are derived from Activities in the Aktionsart Network inherit from the SEML-Operator in the SOA-Network, which defines the feature-bundle [+ event], [+ punctual], [+ dynamic], [- result]. Semelfactives which are build on States inherit from the SEML-Operator, which is semantically determined by the feature-bundle [+ event], [+ punctual], [- dynamic], [- result]. Achievements show a similar inheritance scheme. In their Activity-derivation, they inherit from the INGR Operator which has the feature-bundle [+ event], [+

punctual], [+ dynamic], [+ result]. In their State-derivation however, they inherit from the INGR-Operator in the SOA-Network which has the feature-bundle [+ event], [+ punctual], [- dynamic], [+ result]. Processes inherit properties from the PROC-node in the SOA-networks. As Accomplishments code events consisting of '[PROC ... INGR]', they inherit from both the static INGR-node and the PROC node.

There already is a semantic difference between the Activity and the State diversion of Semelfactives or also the SEML-Operator within the SOA-Network. This also holds true for Achievements or as the case may be the INGR-Operator. This can be explained simply by the structure of the SOA-Network, which is built up of the binary differentiation of [± event], [± punctual], [± dynamic] and [± result]. On basis of this binary characteristic it is already possible to classify the SEML and INGR-Operators into different diversions in the SOA-Network .

5. Analysis of a domain of German verbs

I will analyze the Aktionsarten of a domain of German motion verbs in this section. The verbs I will examine are *gehen* 'go', *spazieren* 'walk', *rennen* 'race', *sprinten* 'sprint', *schlendern* 'amble', *trotten* – 'jog', *laufen* 'run', *marschieren* 'march', *wandern* 'hike' and *wate* 'wade'.

With respect to these verbs there is one kind of alternation possible in German. The activity-active accomplishment alternation. Example (5.0.1) shows this alternation in German:

(5.0.1) a. Mulder wander-t.
Activity
Mulder hike-3sgPRES
'Mulder is hiking.'

a'. Mulder wander-t zur Area 51.
Active accomplishment
Mulder hike-3sgPRES to area 51.
'Mulder is hinking to the area 51.'

b. Scully spazier-t.
Activity
Scully walk-3sgPRES
'Scully is walking.'

b'. Scully spazier-t nach Black Mesa.
Active accomplishment
Scully walk-3sgPRES to Black Mesa.
'Scully is walking to Black Mesa.'

Van Valin and LaPolla state that alternating verbs, which are shown in (5.0.1), have alternated from an activity to an active accomplishment by adding a goal-PP. This means that these verbs have a basic Aktionsart, in this case activity. This alternation is possible with all the verbs under investigation. Van Valin and LaPolla explain these verb alternations by the use of lexical rules which apply in the workshop (cf. VV 2005: 47). Based on the networks which were constructed in section 4, another explanation for verb alternations is possible. In this analysis, no basic Aktionsarten are needed and no lexical rules apply.

Based on the results of section 4, another perspective on the realization of an RRG-lexicon is possible. For this reason I will have to correct my working hypothesis. It is thus possible to add inference rules to the inheritance hierarchies within the lexicon instead of using lexical rules. Here, the forms which are stored in the lexicon are connected directly in inheritance hierarchies. The indirect way via the workshop does not apply.

The architecture of this RRG-lexicon is geared to DATR, a programming language invented by Evans and Gazdar in the late eighties, used for the representation of lexical knowledge of various domains (mostly applied in morphology and phonology) (cf. Evans and Gazdar 1996). These inheritance hierarchies and inference rules apply within the lexicon. They connect individual elements in the networks as well as the various networks to each other. This is very similar to inference rules in DATR, which can be monotonic on the one hand and non-monotonic on the other. If such inheritance hierarchies and inference rules are used, it is not necessary to assume that a verb has a basic Aktionsart, due to the fact that each verb is directly connected with its alternating forms on the basis of inference hierarchies and inference rules.

Now it is possible to develop a *general logical structure [GLS]* for the domain of motion verbs under investigation. Following Van Valin and LaPolla it is possible to unite all verbs of a specific lexical domain in a single general logical structure. The differences among these verbs will fall out from the way the variables in the representation are interpreted (cf. VVLP 1997: 117). I adapt the model of GLSs developed by Van Valin and LaPolla (cf. VVLP 1997: 116-8). In constructing a GLS for motion verbs in German it is first necessary to analyze which arguments the motion verbs appear with as a rule.

This serves to determine which internal variables have to be realized in the GLS. It is necessary to know that the quantity of the internal variables depends on the concrete decomposition of the analyzed verb domain and that it is not determined (cf. Van Valin and Wilkins 1993, cf. Mairal und Faber 2002). For this development it is necessary to determine first which morphosyntacitc contexts the verbs can occur in.

I carry out this examination on basis of the motion verb *fliegen - to fly*. This verb does not belong to the specific verb domain in German which I examine in the context of this case study, but I will show that *fliegen* ‘fly’ provides some interesting implications for the construction of a GLS for motion verbs:

(5.0.4) a. Mulder segel-t.
Mulder sail-3sgPRES
'Mulder is sailing.'

b. Mulder segel-t mit der Jolle.
Mulder sail-3sgPRES with the.MsgDAT jolly-boat.
'Mulder is sailing with the jolly-boat.'

c. Mulder segel-t in der Jolle.
Mulder sail-3sgPRES in the.MsgDAT jolly-boat.
'Mulder is sailing in the jolly-boat.'

d. Mulder segel-t mit der Jolle nach BlackMesa.
Mulder sail-3sgPRES with the.MsgDAT jolly-boat to Black Mesa.
'Mulder is sailing with the jolly-boat to Black Mesa.'

e. Mulder segel-t in der Jolle nach BlackMesa.
Mulder sail-3sgPRES in the.MsgDAT jolly-boat to Black Mesa.
'Mulder is sailing to Black Mesa in the jolly-boat.'

As is shown, the verb *segeln* 'sail' does not need an argument (5.0.4a). However, the modality of motion is coded by Mulder. He is sailing. Sailing denotes a special kind of motion on water, namely by a boat or in this case by a jolly-boat. A jolly-boat is a non-motorized watercraft with masts, sails and a bottom. This means that the verb *segeln* 'sail' (if it does not entail any arguments) can be considered as a pure manner of motion verb, because it describes a special kind of motion. Furthermore, the verb can be used in connection to a special kind of water craft (5.0.4b, c). In this case, the relevance criteria according to Grice (1975) play a decisive role. The vehicle used when sailing is always included in the meaning of the verb. It is only possible to sail with a watercraft; however, it is unrealistic to fulfill that condition with a spacecraft or with a goods train. If the speaker wants to stress that Mulder used a specific kind of watercraft as in (5.0.4b-e), the vehicle is mentioned. Otherwise, speakers do not stress which kind of vehicle is used. It is possible without further ado to indicate a goal-PP, i.e. a new destination which will be arrived at after finishing the motion process. This has happened in sentence (5.0.4d, e). In this case, the Aktionsart of the verb has alternated, in (5.0.4d, e) the verb is an Active accomplishment. For Activities the following GLS for German motion verbs can be extracted first:

(5.0.5) **do´** (x, [**move.via (α).in (β).manner´** (x, (y)])

It is now necessary to explore how the internal variable (α) is realized by the motion verbs under investigation in the GLS and if this motion is realized at all. How the internal variable (α) is realized in the verbs is presented in (5.0.6):

(5.0.6) Lieutenant Agathon is-t zu Fuß gegangen
Lieutenant Agathon be-3SgPRES on foot walk-3sgPART
Lieutenant Agathon went on foot.

This sentence is absolutely grammatical in German. In this sentence, foot is used as a means of motion with whose aid it is possible to move from destination A to destination B. If a human being is walking, going, running or sprinting, in terms of motion: to move with their own physical strength from destination A to B, they are forced to apply their feet. This is inherent to the verb *gehen*'go'*;* just as with the verb *segeln* 'sail', i.e. an aircraft or spacecraft has to be applied for flying. Consequently, in regard to the Selectional Properties of the verb *gehen* 'go' and all motion verbs of this type, the

internal variable (α), which is realized by the y – variable, is equal to FOOT, while the α-variable of verbs such as *segeln* 'sail' is VEHICLE. This development is shown in examples (5.0.8) and (5.0.6 a – e). As a consequence, the Selectional Properties for the motion verbs *gehen* 'go' and *segeln* 'sail' look as follows:

(5.0.7) a. *segeln* 'sail' y = α α = VEHICLE
b. *gehen* 'go' y = α α = FOOT
(cf. VVLP 1997: 117)

Two questions remain at this point: First, how do the motion verbs realize the Active accomplishment reading, secondly, how do the α-variables VEHICLE and FOOT interrelate? In a sentence such as (5.0.6d), the internal variable (α) is represented by VEHICLE. On the other hand, the modality of motion which is achieved by the internal variable (β) is shown. An aim – PP, namely *nach Black Mesa* 'to Black Mesa' is indicated as well. However, this goal-PP does not have to be represented as an internal variable in the GLS. This can be administered by an Activity GLS and by accretion of the according Active accomplishment – component. It looks like this:

(5.0.8) **do´** (x, [**move.via(α).in(β).manner´** (x, (y)]) & INGR **be-at´** (z, x)

Since sentences like *Mulder segelt nach Black Mesa* 'Mulder is sailing to Black Mesa' can be used without the explicit application of a VEHICLE, the y – variable is optional for that variant of the GLS as well. In principle, all of the internal variables are inherently lexicalised with any verb. Apart from the motion verbs under investigation – the α-variables being represented by VEHICLE and FOOT respectively – there is a third group of motion verbs. Verbs such as *krabbeln* 'crawl', *schwimmen* 'swim' or *klettern* 'climb' are converted by a complex interaction of several parts of the body.

A precise semantic and ontological examination of these verbs cannot be achieved in the context of this paper and should be aimed at in future works. Therefore, I will apply the term OTHERS in this elaboration for the α-Variable in the GLS of these verbs. Concerning the GLS of motion verbs it is irrelevant if the α-variable be VEHICLE, FOOT or OTHERS. The conjunction between the α-variables VEHICLE, FOOT and OTHERS is remarked best in the following network:

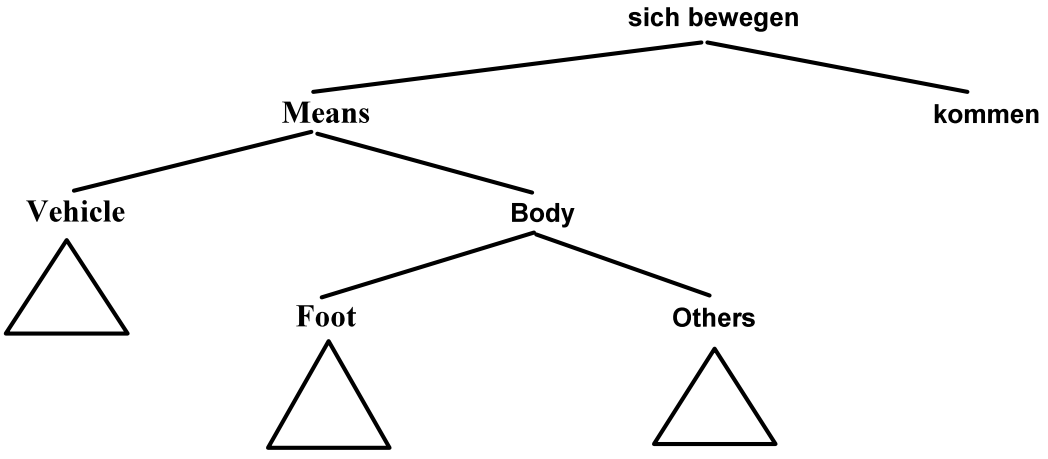

Figure 5.0.1: The Selectional-Property-Network

At first it is important to remark that the Selectional-Property-Network [SPN] is a superior network which is connected with the specific Neighborhood cluster. A neighborhood cluster is a cluster consisting of verbs which belong to a closed domain of very specific verbs. In the case of this study the verbs which belong to the domain of motion verbs which code motion on foot are a neighborhood cluster. The SPN is equal to the notion of district clusters which refer to verbs of a specific lexical category in this case to the motion verbs in general. There are lots of other district clusters for example the district cluster of emotion verbs or of cognition verbs.

District clusters normally contain a variety of neighborhood clusters. The rood node of the network *sich bewegen* 'move' is the abstract node hosting the main concept which is stored in the SPN and two daughter nodes originate from this abstract mental concept. On the right hand side there is the node *kommen* 'come', which diverts from the mother node *sich bewegen* 'move'. On the left hand side the node „means" diverts from the mother node. In the context of this draft, „means" stands for an instrument and describes the means of motion which is internally or externally lexicalized by the verb. This proposal goes back to Mairal's initiative (Mairal p.c.). Means can be realized either by an argument, which is internally and externally lexicalized by the α-variable VEHICLE, or lexicalized by an argument that is equal to the α-variables FOOT or rather OTHERS. As FOOT as well as OTHERS both constitute parts of the body, they inherit some qualities of the body. Thereby the conceptual difference of VEHICLE is revealed. The *kommen* – node in this case represents the most neutral motion verb in German.

Several tests conducted with English and German native speakers have suggested that the language has of verbs which differ from the Manner of Motion Verbs as well, because they are absolutely neutral with regard to the modality of the motion. This is especially present in external realization of the α – variable. In the following I will elaborate on the verb *to go / to come* in English and the verb *kommen* 'come' in German.

(5.0.9) a. Mulder went / came to Quantico by helicopter / on foot / by car.
a'. Mulder geht zu Fuß / *mit dem Helikopter / * mit dem Auto nach Quantico.
b. Mulder flew to Quantico by helicopter / *on foot / *by car
b'. Mulder kommt zu Fuß / mit dem Helikopter / mit dem Auto nach Quantico.
c. Mulder went /came to Quantico.
c'. Mulder geht nach Quantico.

The sentences in (5.0.9) represent the semantic differences between the verbs *to go / to come* and *gehen* 'go' / *kommen* 'come' in English and German respectively. Sentence (5.0.9a) proves that the verbs *to go* and *to come* are neutral enough to be applied in connection with the α-variable VEHICLE as well as with FOOT. Furthermore, they can be used without external realization of the internal variable α, for instance in (5.0.9c). The example in (5.0.9 b) on the other hand shows that the English verb *fly* can only be used with flying objects, e.g. helicopters or air planes. English Manner of Motion Verbs, such as *drive, sail* or *bike,* behave similarly. An external realization of the α-variable VEHICLE with the verb *fly* is possible in connection with a flying object only.

In German, *kommen* 'come' is the more neutral verb, as proven in sentence (5.0.9b'). The external realization of the internal variable α, which is represented by Means, can be chosen freely in connection with *kommen* 'come', similar to the English verb *to go /*

to come. But the term *gehen* 'go' in German is definitely a Manner of Motion Verb. Here, the α-variable can exclusively be realized with FOOT, as shown in sentence (5.0.9a'). Sentence (5.0.9c') presents another quality of the verb *gehen* 'go'. If the internal variable α, which is restricted in connection with FOOT, is not realized externally, the sentence becomes ambiguous. As a result, for a native speaker of German the sentence (5.0.9c') could mean that either Mulder really went to Quantico by foot even if he was before staying in his apartment in Washington D.C., which is almost 36 miles far away from Quantico, or it could mean that Mulder let himself be barracked in the Marine Corps Base Quantico. However, in English sentence (5.0.9c) is absolutely neutral. The sentence simply expresses that Mulder was somehow moving to Quantico. How he is able to do that is not lexicalized. With the aid of this GLS and the Selectional Properties developed above, it is now possible to create Lexical Fingerprints for the specific domain of German motion verbs.

It is worth mentioning that the SNP is not universally valid in all languages. There are lots of languages which do not show this pattern of realization. In Russian, Ukrainian, Polish and Czech for example there is no neutral verb like *kommen – to come* or *to go.* Rather all kinds of motion have to be realized with specific verbs of motion. However, this is no consistent pattern within Slavic languages, as Bulgarian follows the German pattern (Swirgun p.c., Bontcheva p.c).

5.1 Lexical Fingerprints of German motion verbs and the construction of an inheritance network of these verbs

The concept of semantic inheritance networks, which create a hierarchic structure, is based on the principle of hyponymy. Therefore, one can infer that general lexical units are no random amounts, but rather they form dimensions and sub-dimensions. With regard to motion verbs these can be described by parameters which are significant for that verb domain (cf. Mairal und Faber 2005: 9). I have analyzed the lexical definitions of the analyzed verbs using the definitions in the Brockhaus-Wahring. In addition I have asked several native speakers of German.

By assigning the FOOT-Domain, it has been explained at first how the α-variable of the GLS is internally lexicalized or externally realized. The internal lexicalization of the β-variable then results from this analysis. This means that the Manner of Motion is lexicalized by the β-variable of the GLS. As a consequence, the following paraphrasing of the β-variable as well as of the Manner of Motion results from the decompositional analysis of the verb domain:

(5.1.1)

a. *gehen* ‘go’: normales Tempo sich zu Fuß bewegen.
‘to move on foot with a normal speed.’

b. *rennen* ‘race’: schnelles Tempo sich zu Fuß bewegen & mit kurzen festen Schritten & kurz vor Sprint
‘to move on foot with a fast speed & to move with short firm steps & almost sprinting’

c. *laufen* ‘run’: schnelles Tempo sich zu Fuß bewegen & leicht springend.
‘to move on foot with a fast speed & slightly jumping.’

d. *marschieren* ‘march’: normales Tempo sich zu Fuß bewegen & über weite Entfernungen & gleichmäßig in geschlossenen Reihen.
‘to move on foot with a normal speed over far distances & to move regularly in closed alignments’

e. *schlendern* ‘amble’: langsames Tempo sich zu Fuß bewegen & behaglich
‘to move on foot slowly & on easy‘

f. *spazieren* ‘walk’: langsames Tempo sich zu Fuß bewegen & zur Entspannung
‘to move on foot in a slow speed & for relaxation’

g. *sprinten* ‘sprint’: sehr schnelles Tempo sich zu Fuß bewegen & mit höchstmöglichem Tempo & Grenze der Belastung
‘to move on foot in a very fast speed & with the most possible speed until the limit of the burden’

h. *wandern* ‘hike’: normales Tempo sich zu Fuß bewegen & über weite Entfernungen & mit Marschgepäck.
‘to move on foot with a normal speed & over far distances & with backpack’

i. *waten* ‘wade’: langsames Tempo sich zu Fuß bewegen & durch flüssige Umgebung.
‘to move on foot & through liquid surroundings & with a slow speed.’

j. trotten ‘plod’: sehr langsames Tempo sich zu Fuß bewegen & schwerfällig.
‘to move on foot slowly & with heavy footfalls

Based on these decompositional analyses of the β-variable, it can be recognized that German motion verbs have various conceptual dimensions (cf. Mairal und Faber 2005: 11). The most important dimension, which can be identified with the aid of the decompositions in (5.1.1), is: [± velocity]. Furthermore, the individual semantic qualities of each motion verb have to be added. If these dimensions are considered, the verbs can be divided into categories which assign them the current speed. With the verbs *trotten* ‘plod’, *schlendern* ‘amble’, *spazieren* ‘walk’, *laufen* ‘run’, *rennen* ‘race’, and *sprinten* ‘sprint’ the speed of motion increases, and the verbs are specified by additional qualities.

The verbs *wandern* ‘hike’ and *marschieren* ‘march’ are exceptions. Their speed is slow or neutral. The verb *waten* ‘wade’ cannot be classified easily. The motion is slow, but this has to do with the outer circumstances, namely it is necessary to move through a liquid surrounding; as a consequence, the person is forced to move slowly.

It is noticeable that the verb *gehen* ‘go’ is the semantically emptiest and most neutral verb. Neither does it have any further specific qualities. It can only be decomposed as in sentence (5.1.1a). Owing to the assignment of the binary feature, it is possible to establish the decompositionally different significance of the verbs.

(5.1.2)	a. *gehen* 'go'	[± velocity]
	b. *rennen* 'race'	[+ velocity]
	c. *laufen* 'run'	[+ velocity]
	d. *sprinten* 'sprint'	[+ velocity]
	e. *spazieren* 'walk'	[- velocity]
	f. *schlendern* 'amble'	[- velocity]
	g. *trotten* 'plod'	[- velocity]
	h. *wander* 'hike'	[- velocity]
	i. *marschieren* 'march'	[- velocity]
	j. *waten* 'wade'	[- velocity]

At this point it is necessary to emphasize that these binary features define a speed spectrum and a distance spectrum. With the aid of a binary decomposition a few semantic specifications can be explained, but the productivity of the binary feature semantics is very restricted. As a result, there is a ill-defined spot in the cognitive concepts of human beings which defines a transition between fast vs. slow on the one hand and far distance vs. short distance on the other hand. However, with the aid of the binary features a rough classification of the verbs can be carried out which makes it possible to divide the verbs into macro classes within their Neighbourhood – Cluster. It is noticeable that the verb *gehen* 'go' is not easily to be classified in terms of binary features, and therefore it has the feature [± velocity]. The verb *gehen* 'go' is able to define a relatively fast motion, in contrast to the verbs *laufen* 'run', *schlendern* 'amble' and *trotten* 'plod'. This is proven in the sentences *Max ist schnell gegangen* 'Max has gone fast' and *Max ist langsam gegangen* 'Max has gone slowly'.

Both are accepted by German native speakers, because *gehen* 'go' does not inform about the lexicalisation of the speed. However, the verb *gehen* 'go' is not the semantic primitive of the whole German motion verbs domain - this is namely *sich bewegen* 'move', but it can absolutely be considered as a primitive of the Neighborhood – Cluster FOOT. So there is a primitive of the district cluster, in this care *sich bewegen* 'move' and a primitive of a neighborhood cluster. This is due to the fact that it has the semantic [± velocity].This is the reason why, in comparison to *sich bewegen* 'move', it effectively is a primitive of the second order [PSO]. Owing to the fact that it is a semantic PSO, *gehen* 'go' creates the root node of German motion verbs of the FOOT – domain. It is also directly connected to the FOOT – node in the SPN. These feature results from the comparison to verbs like *wandern* 'hike' and *marschieren* 'march'. These node definitions are about Lexical Fingerprints.

At first, it is necessary to mention that primitives of Neighborhood – Clusters (therefore PSO's) do not have a Manner – Quality within the framework developed here. The Manner – Quality defines idiosyncratic verb qualities. Due to the fact that a PSO is semantically almost empty, it has no Manner – Qualities. This is the reason why a PSO always has the following reference point on its Manner – Qualities inside of the created framework: <manner of motion> = = PSO Ţ β = Ø. In this network, the PSO *gehen* 'go' instead inherits all relevant qualities from the FOOT – node, which on the other hand inherits from its mother node inside of the SPN, which is the primitive of the motion verb domain *sich bewegen* 'move'.

If a verb inherits all qualities of its predecessor node, this can be represented within a fingerprint by the expression < > = = predecessor.[3] In this case, the predecessor is a variable which can be replaced by the name of the relevant predecessor. As the root node of a specific verb network, the PSO contains in its fingerprint the basic information about the Selectional Properties [SPs] of the verb domain, which are thereby inherited by the daughter nodes. The SPs indicate content of the variables of the GLS. In case of the verb domain examined here, the SPs look as follows: y = α Ţ FOOT ʹn β = <manner of motion>. This means that the internal α-variable is equal to the external y variable. It is satisfied by FOOT and it can potentially be externally realized. The β-variable in the GLS is satisfied by the reference point <manner of motion> of the particular verb. Consequently, it is also a kind of variable, or in this case, it forms a reference point within the particular fingerprints. It is possible to refer to this behavior as local inheritance within a node, or rather a fingerprint.

I define verbs which are direct daughter nodes of the PSO in a network as basic verbs. Basic verbs at first inherit from the superior ontological description node. This node is called ontological description node as it is connected to a world ontology which describes its features in detail. Ontological description nodes have fingerprints, too, which describe their semantic features. As the ontology is based on binary features and in case of motion verbs the most relevant binary feature is [± velocity] there is only one ontological description node mentioned in this framework however if there was a more fine grained semantic description of these verbs there could in principle be more such nodes.

However the world ontology of the ontological description nodes is not part of the inheritance network developed in this paper. Basic verbs usually inherit all qualities from these nodes. In the case of this networks ontological description nodes are [+ velocity] and [- velocity]. Furthermore, basic verbs have second characteristic: They inherit the Selectional Properties from the root node, which is the semantic primitive of the particular domain and therefore the PSO. Since the semantic qualities of the PSO are not passed on to the ontological description node, the inheritance quality inside of this specific network is expressed by the reference point <selectional properties> = = gehen.

This can be understood as a global inheritance which is able to skip nodes, in this case the ontological description nodes. Furthermore, basic verbs contain the reference point <manner of motion>, where their idiosyncratic qualities are determined. The daughter nodes of basic verbs inherit all qualities from their mother nodes, but these sub verbs have their own idiosyncratic qualities as well. This is the reason why they require a <manner of motion> - reference point, where the qualities of these references, inherited from the basic verb, can be over-written.

At this point, the role of non-monotonic inheritance is made clear. The verbs with most idiosyncratic qualities are farthest below in the hierarchy of this network. It is possible to determine the following fingerprints for the examined verbs:

[3] The structure of the Lexical Fingerprints orientates itself to DATR (cf. Evans und Gazdar 1996). The terms global heritage and local heritage orientate themselves to DATR as well.

(5.0.3)

gehen ‘go’:
< > = = FOOT
<selectional properties> y = α Ţ FOOT ’n β = <manner of motion>
<manner of motion> = = PSO Ţβ = Ø

laufen ‘run’:
< > = = [+ velocity]
<selectional properties > = = *gehen* ‘go’
<manner of motion> = = a bit jumping

rennen ‘race’:
< > = = *laufen* ‘run’
<manner of motion> = = with short steps & short of sprinting

sprinten ‘sprint’:
< > = = *rennen* ‘run’
< manner of motion> = = fastest velocity possible & limit of capacity

spazieren ‘walk’
< > = = [- velocity]
<selectional properties> = = to go
<manner of motion> = = for recovery

wandern ‘hike’
< > = = [- velocity]
<selectional properties> = = to go
<manner of motion> = = with field kit

marschieren ‘march’
< > = = [- velocity]
<selectional properties> = = to go
<manner of motion> = = in a group & even in closed rows

schlendern ‘amble’:
< > = = *marschieren* ‘march’
<manner of motion> = = at ease & slow

trotten ‘plod’:
< > = = *schlendern* ‘amble’
<manner of motion> = = very slow & with heavy foodfalls

waten ‘wade’:
< > = = *trotten* ‘plod’
<manner of motion> = = in liquid environment

Based on these fingerprints, it is possible to identify the primitive *gehen* ‘go’ as well as the basic verbs *laufen* ‘race’ *spazieren* ‘walk’, *wandern* ‘hike*’ marschieren* ‘march’. The other verbs are sub verbs.

On basis of these fingerprints it is possible to create the following inheritance network:

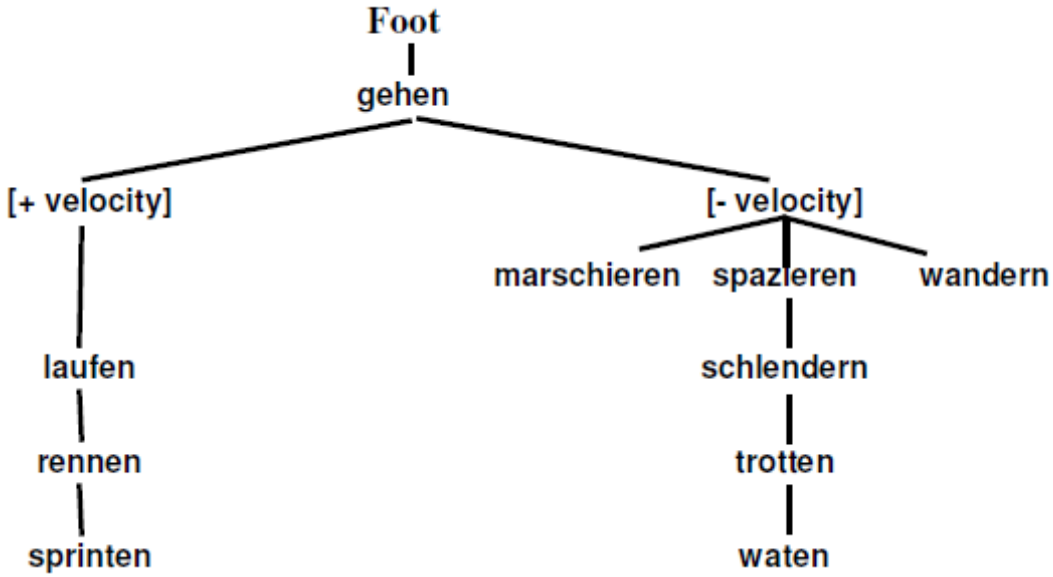

Figure 5.0.2: The inheritance network

5.1.1 Inheritance Network for German motion verbs

As can be seen figure 5.1.1, the feature [± velocity] is the relevant distinctive binary feature in the network. The nodes [+ velocity] and [- velocity] are daughter nodes of the PSO *gehen* 'go'. However, their status is different from the verb nodes. They are ontological inheritance nodes, connected to the conceptual world ontology mentioned before. As I have laid out before, the basic idea of basic verbs is that they inherit directly from the ontological description nodes. In addition, they have the least idiosyncratic qualities within their tree structure path. The verbs *spazieren* 'walk', *wandern* 'hike', *marschieren* 'march' and *laufen* 'run' and therefore are basic verbs according to the fingerprints shown. *Spazieren* 'walk' has been identified as a basic verb, because most German native speakers agree that *spazieren* 'walk' is a slower motion than *laufen* 'run' *rennen* 'race' or *sprinten* 'sprint'.

However, verbs which have the features [+ velocity] are graded in ascending order according to their speed. Accordingly, the basic verb describes the verb with features which define the slowest motion. A special quality is presented on the verbs which belong to the group of verbs inheriting from [- velocity]. Verbs that have these features are stored in a down-ward speed, i.e. the speed within this inheritance network gradually decreases from the basic verb to the final verb in a tree structure path. What is special with the verbs which follow the node [- velocity] is that the verbs *spazieren* 'walk', *wandern* 'hike' and *marschieren* 'march' have nearly the same velocity.

The difference between these verbs are their idiosyntatic features but in the case of velocity they have the same range. Therefore all of these verbs are basic verbs. However verbs like *schlendern* 'amble', *trotten* 'plod' and *waten* 'wade' inherit from *spazieren* 'walk' as they are semantically closer to this basic verb than to *wandern* 'hike' or *marschieren* 'march'.

It is now necessary to question how the networks developed are linked to the SOA – network and to the network of the Aktionsarten. It is also necessary to explore how the alternation of motion verbs can be explained without using the lexical rules which apply in the workshop, but in using the inheritance hierarchies which apply in the mental lexicon on their own. At first, the linking of the networks is shown in figure 5.1.2

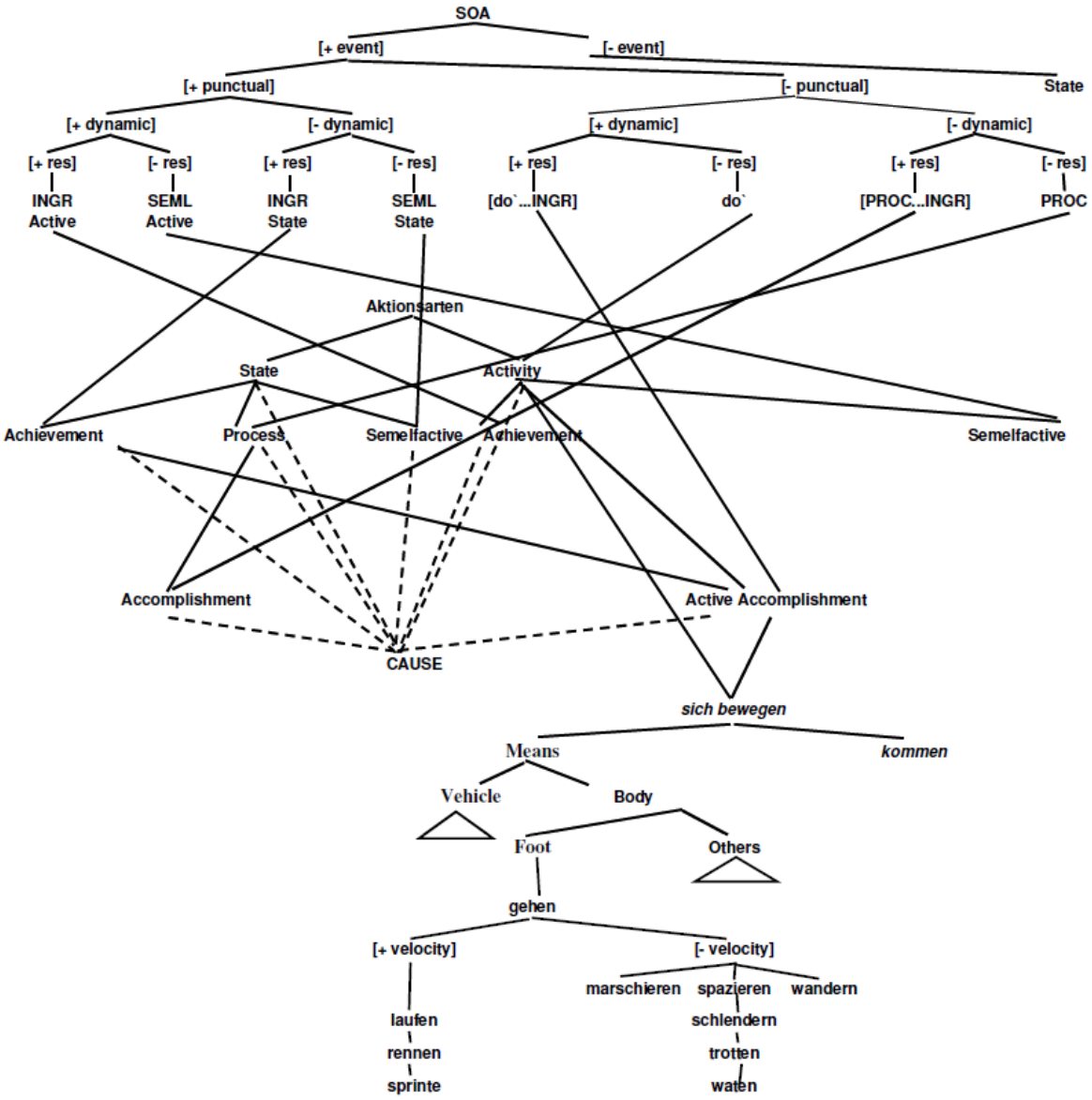

Figure 5.1.2 Complete Inheritance Network

Figure 5.1.2 allows for an overview of the whole architecture of the mental lexicon for RRG. It is important to emphasize that the SOA – network and the networks of the Aktionsarten are networks which are universally valid for all languages. It should be the aim of further research work to identify how the cross linguistic division of Aktionsarten is defined. It is determined for SPNs that they are language specific as well as that a great amount of these networks exist. For instance, Mairal and Faber indicate 10 lexical domains of verbs (cf. Mairal und Faber 2005: 5). The Neighborhood – Clusters which are connected with such SPNs are language specific as well. It is

currently neither possible to say how many and which SPNs and Neighborhood – Clusters a language has, nor if their structure is universally valid. However, with the construction of the SPN of German motion verbs it has been shown that it is possible to suppose that a SPN of English motion verbs disposes of a similar structure. The inheritance networks are all linked together. The *gehen* – node of the Neighborhood – Cluster of the FOOT – domain is connected with the FOOT – node.

The linking of the Aktionsart network plays a decisive role with the *sich bewegen*– node of the District-Cluster MOVEMENT. As is presented in figure 5.1.2, this node is directly linked with the nodes Activity and Active accomplishment in the Aktionsart network. This linking renders the use of lexical rules in the workshop unnecessary. If the sentence *Scully geht zu Fuß zum J. Edgar Hoover Building* 'Scully is going on foot to the J. Edgar Hoover – Building' should be pronounced, the LS in the Aktionsart network taken from the LS of an Active accomplishment is chosen in this framework. They look like this: **do´** [x, (**predicate$_1$´** (x, (y))] & INGR **predicate$_2$´** (z, x) or (y). The root node of the SPN also disposes of a fingerprint, similar to that of motion which I have described in this part of the paper. Nevertheless it is very complex, because it contains a semantic description of the concept of *sich bewegen* 'move', which I have not developed in this paper.

The concept of *sich bewegen* 'move' is displayed in the GLS of the District-Cluster MOVEMENT. The concept now disposes of a PP-Assignment-Principle [PPAP] in its fingerprint: "When occur as an Active accomplishment, substitute **be-at** for **predicate$_2$´".** The PPAP gives out the order to replace the variable **predicate$_2$´** by **be-at´**, if the verb which should be expressed in a fixed morphosyntactic context appears as an Active accomplishment. Because of the application of this principle it is unnecessary to assume a basic Aktionsart, as was argued for in VVLP (1997) und VV (in press).

The PPAP can be determined for other kinds of verb alternations as well. In a cluster where the consume verbs, e.g. *essen* 'eat' or *trinken* 'drink' would appear, the principle would be pleasantly assumed and would for instance read as follows: "When occur as an Active accomplishment, substitute **consumed´** for **predicate$_2$´**." In this framework, no lexical rules describe the alternation of the Aktionsarten in the workshop anymore. Instead, this is now a purely lexical process.

Processes taking place in the workshop are now merely such which cannot be motivated by the created networks owing to their networking. It should be the aim of future research work to create the internal structure of the workshop and to describe its interaction with the lexicon.

6. Conclusion

This account of a mental lexicon for RRG has shown how the internal structure of the lexicon module can be captured with the help of multilayered inheritance networks. It was exemplified that verbs in the lexicon have only one single lexical entry for each verb instead of basic Aktionsarten. It was further shown that lexical rules do not apply in this model of a mental lexicon and that many processes regarding verb alternations which have been sourced out to the workshop are actually lexical processes.

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The Beginnings of Phonetic and Phonological Coding in the Signs of Ireland Digital Corpus: The Representation of Handshapes

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1. Introduction

This paper discusses some of the research that has been done on phonetics and phonology in signed languages. We will discuss aspects of a few phonological models in relation to two of the parameters that have been proposed for signed languages, hand configuration and local movement.

We will also discuss a range of issues with respect to expanding the annotation of the Signs of Ireland (SOI) corpus to incorporate phonetic and phonological coding. This forms part of ongoing PHD research work that explores the phonology-morphology interface in Irish Sign Language (ISL).

The SOI corpus includes data from Deaf ISL users across Ireland in digital form (See Leeson et al. 2006). It consists of over 40 narratives that have already been highly annotated using ELAN[4]: it contains glossed lexical signs, classifier constructions[5] and non-manual features. Classifier handshapes have also been annotated. It is my intention to identify the phonemes and the allophones of ISL using the corpus and it is thus neccessary to incorporate a detailed annotation at the phonetic level.

I will outline here the factors influencing decisions regarding the coding and naming of handshapes at phonetic level. These include the question of whether already established naming conventions be maintained. Issues regarding handshape changes within signs will also be discussed.

2. Hand Configuration

Sign language researchers have established phonetic and phonological categories for signed languages, with Stokoe (1960) being the first to divide ASL signs into three main parameters, *handshape, movement* and *location*. Battison (1978) later added *orientation*. Researchers have since then remained true to these categories but not without dividing them even further. Below we will look at the handshape parameter.

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[4] ELAN is a software programme developed by the Max Planx Institute, Nijmegan. ELAN (EUDICO Linguistic Annotator) is an annotation tool that allows for creating, visualizing, editing and searching annotations for both video and audio data. It is widely used for establishing and maintaining signed language corpora. (Source: ECHO Project - http://www.let.ru.nl/sign- lang/echo/index.html?http&&&www.let.ru.nl/sign-lang/echo/data.html) (See also Leeson et al. 2006:1-2)

[5] Classifier constructions (classifier predicates) are a class of verbs that consist of a movement morpheme and a classifier handshape morpheme. The handshape stands for the referent while the movement and location of the verb represents the movement and location of the referent. They are thus somewhat isomorphic with the real world (Valli and Lucas 1992, Sutton-Spence & Woll 1999).

The Hand Configuration category is made up of the shape of the hand and its orientation. Many different possibilities exist; various combinations of the four fingers and the thumb may be executed, the fingers and thumb can take on different positions by bending of different finger joints and they can be abducted (spread) or adducted (non-spread). If an internal movement occurs within a sign, this results in a hand configuration change such as a change of the position of the fingers and/or a change of orientation.

In the literature, handshapes were first seen as holistic units, bearing names like V-hand, L-hand etc. (Stokoe 1960). However, representing handshapes as whole phonological units does not account for the fact that handshape changes within signs are restricted. Researchers debate on if a sign with handshape change should be represented as having one or two handshapes. In later publications, handshapes were seen as having internal structure that was possible to break down (Mandel 1981; Sandler 1989).

Mandel (1981) divided handshapes into *finger selection* and *finger configuration*. The finger selection determines which fingers and how many are salient in a sign. One or more of the four fingers may be selected and more salient in a handshape and other fingers consequently not selected and thus, backgrounded. Unselected fingers are either all extended or all folded into the palm while the selected fingers are all extended and in the same position, which is specified by the finger configuration. Mandel (1981) formulated a *Selected Finger constraint* to describe properties of handshapes: only one group of fingers may be selected in a sign. Sandler (1989) later applied the selected finger constraint to per mono-morphemic sign. This means that in signs where a handshape change occurs, the number of selected fingers will remain the same while other properties of the handshape may change.

We will discuss this in more detail below in relation to hand internal movement. Figure 2.1 below shows examples of selected fingers in combination with different position of the thumb.

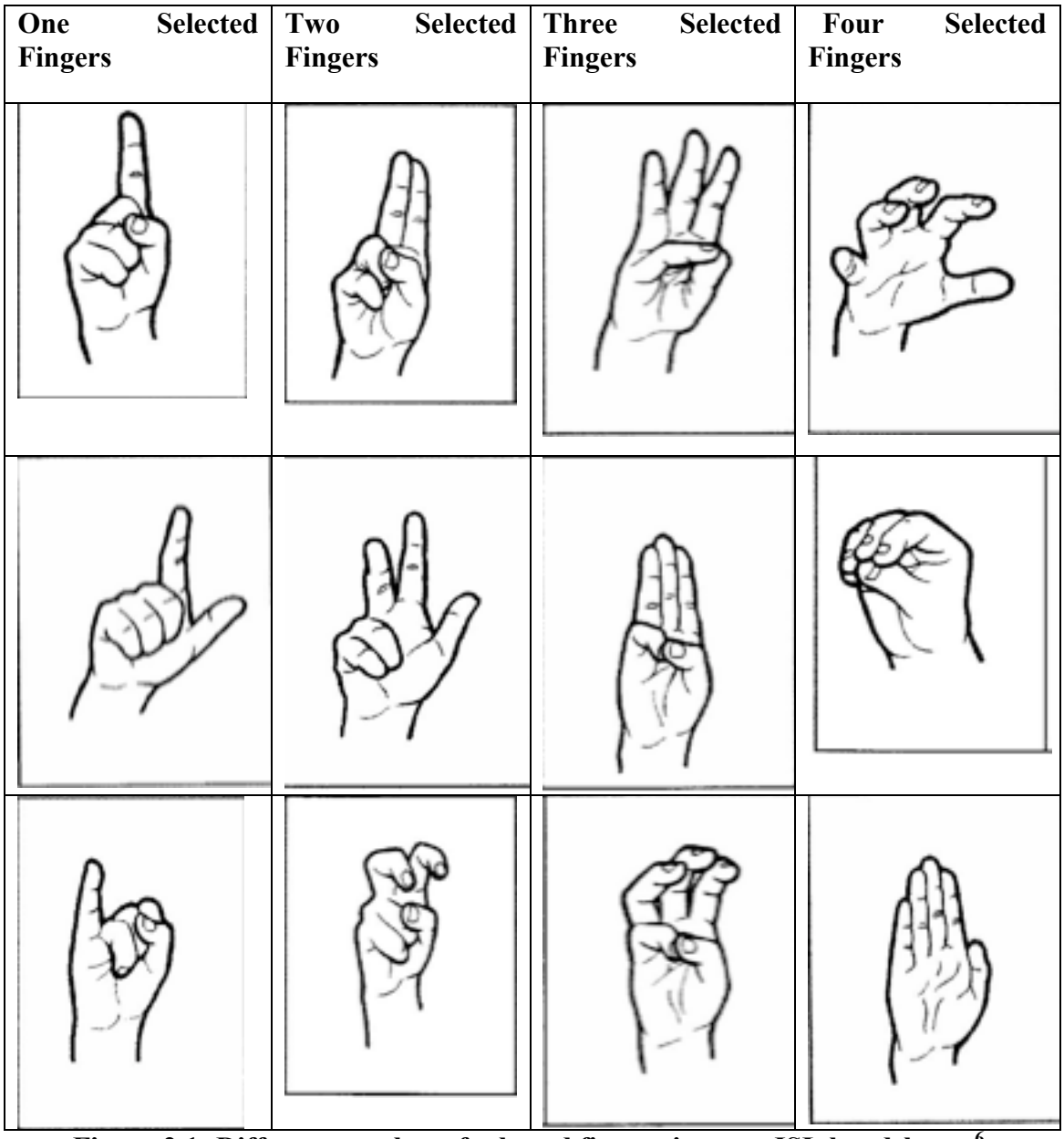


Figure 2.1: Different number of selected fingers in some ISL handshapes[6].

As noted above, the finger configuration determines the position of the selected fingers and it is divided into three groups:

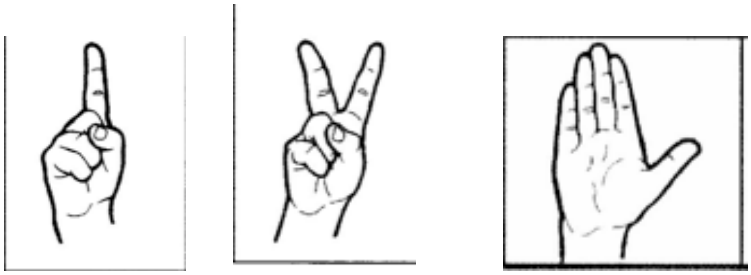
1) *Flexion*, at different finger joints:
MCP[7] (base) joints are flexed: fingers bent
PIP/DIP[8] (non base) joints are flexed: fingers clawed
All joints flexed: fingers curved

[6] Illustration copyright © Patrick Matthews (forthcoming), see also Matthews 2005.
[7] Metacarpophalangeal joint (MCP)
[8] Proximal interphalangeal joint (PIP), distal interphalangeal joint (DIP)

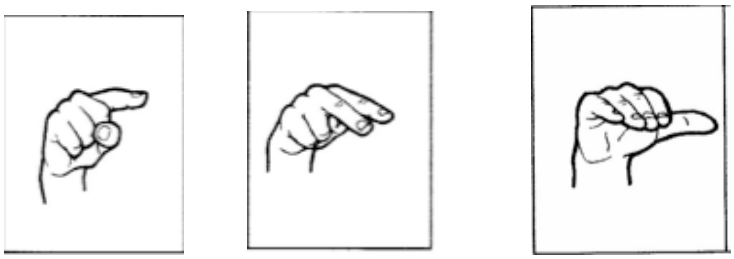
2) *Spreading*,
The adduction of the fingers: non-spread
The abduction of the fingers: spread
Fingers crossed

3) *Aperture*,
The selected fingers do not touch the thumb: open
The selected fingers touch the thumb: closed
(Taken from Crasborn 2001 and van der Kooij 2002)

Below we see examples of Flexion at different finger joints in some ISL handshapes.



a) Selected fingers are extended.



b) MPC (base) joints are flexed: fingers bent.

c) PIP/DIP (non base) joints are flexed: fingers clawed.

Figure 2.2 a-c: Different finger joints in some ISL handshapes

As noted above, dividing handshapes up further, can better account for handshape changes within signs. Seeing handshapes as whole phonological units predicts that any handshapes may occur in a sequence within one sign but handshape changes are restricted as claimed by the selected finger constraint, for example. We will discuss handshape changes in more detail below in relation to hand-internal movement, but first we will look at handshapes in ISL.

2.1 Handshapes in ISL

The discussion in this paper forms part of ongoing PHD research work that explores the phonology-morphology interface in ISL. The first part of the research is to identify the phonemes and the allophones of ISL, which entails establishing a list of phonetic features for the language. To date, no research has been done in this area apart from work describing phonetic handshapes in ISL. Thus far, there is no agreement on the phonetic alphabet inventory for ISL: Ó'Baoill and Matthews (2000) identified 66 handshapes while Matthews (2005) identified 78. The issue of allophonic variation has not yet been tackled for this language.

While currently we have a list of phonetic handshapes identified for ISL, we do not have any extended knowledge of their phonological status. Minimal pairs on the basis of handshapes have been identified but detailed phonological information does not exist. For example, we do not know which handshape sequences are allowed within signs in ISL and phonetic variation has never been identified although instances of these do occur as we see in figure 2.3a-b, which shows an example of variation in selected fingers articulated by the same signer within one narrative.

Figure 2.3a: The sign BOY, articulated with four selected fingers.

Figure 2.3b: Variation of the sign BOY, articulated with one selected finger.[9]

It is my intention to identify the phonemes and the allophones of ISL using the Signs of Ireland (SOI) corpus and it is thus neccessary to incorporate detailed annotation at the phonetic level. When attempting to transcribe or code phonetic features in a language with the aim of using the information in a phonological analysis, a problem arises as how to make the coding functional when doing different searches regarding phonology. Ideally then, one should know the phonology of the language and what kind of search will be neccessary *before* attempting the phonetic coding. However, this is seldom the case.

This problem has been referred to as the *database paradox* by Crasborn et al. (2001) and Van der Kooij (2002). In order to beat this paradox, it is neccessary to rely on research in other signed languages as well as preliminary observation of the language in question. The most extensive literature on sign language phonetics and phonology regards American Sign Language (ASL) and Sign Language of the Netherlands (NGT) and those will be consulted during the course of the research.

[9] Interestingly, the sign articulated *before* the variant of BOY is a two handed sign using a handshape with four selected fingers (the remnants of the sign can still be seen on the non-dominant hand), thus ruling out an instance of assimilation.

As noted above, the SOI corpus consists of over 40 narratives that have already been highly annotated: it contains glossed lexical signs, classifier constructions and non-manual features. Classifier handshapes have also been annotated. By adding phonetic annotations of handshapes in lexical signs, it will be possible to use the corpus to explore their phonological status in a systematic way. We will be able to detect, for example, what handshape changes occur within signs in ISL and explore occurrences of phonetic variation.

For annotation purposes, challenges arise in terms of how handshapes are recorded: for example, of the 66 handshapes identified in Ó'Baoill and Matthews (2000), 28 are established as occurring as classifier handshapes also. These are annotated following ECHO project annotation norms (Nonhebel et al. 2004) where possible, with additional handshapes drawn from a list of 48 classifier handshapes described for BSL in Brennan (1992) using names like CL-B, CL-ISL-K etc. within the framework of the SOI corpus. For this research, decisions have to be made regarding naming and coding handshapes at the phonetic level. These include the question of whether already established naming conventions be maintained when annotating lexical signs. Moving away from established protocols will result in inconsistencies within the annotations in the corpus. However, for the purposes of phonetic research a more elaborate coding might be necessary.

There is some inconsistency in the literature when it comes to handshape names. Researchers usually use names that refer to the alphabet in the sign language being discussed. Although some of these names are compatible between many signed languages, such as B (a flat hand) and A (a fist-handshape), we do find different naming conventions as well (e.g. W in NGT uses thumb, index and middle finger which is represented as 3 in ASL).

For transcription purposes, we have decided to incorporate the coding used in the SignPhon database.[10] These are coordinates into the table of handshapes in HamNoSys (see Prillwitz et al. 1989)[11], where the handshapes are organised according to articulatory properties and each handshape is given a code consisting of a letter and a number (A1, A2, B1, B2 etc., see van der Kooij 2002: 297-9).

Figure 2.5 below shows how a few ISL handshapes have been organised and given codes, corresponding to the system used in SignPhon. It would be very time consuming to have to describe a handshape in its full articulatory terms every time it occurs in the corpus. Thus, the use of codes will save some time when transcribing and is also useful if we later decide to use SignPhon to create a database for lexical signs in ISL. Also, deciding on names for all ISL handshapes is a time consuming process and redundant at this stage since we expect our current list of handshapes to change as the research proceeds. Some changes have already been made to our current list of handshapes as we see in figure 2.6 below.

[10] This is a database created to research the phonetics and phonology of NGT and includes lexical signs only (See Crasborn 2001; Crasborn et al. 2001; van der Kooij 2002).
[11] Thanks to Thomas Hanke for pointing this out to me.

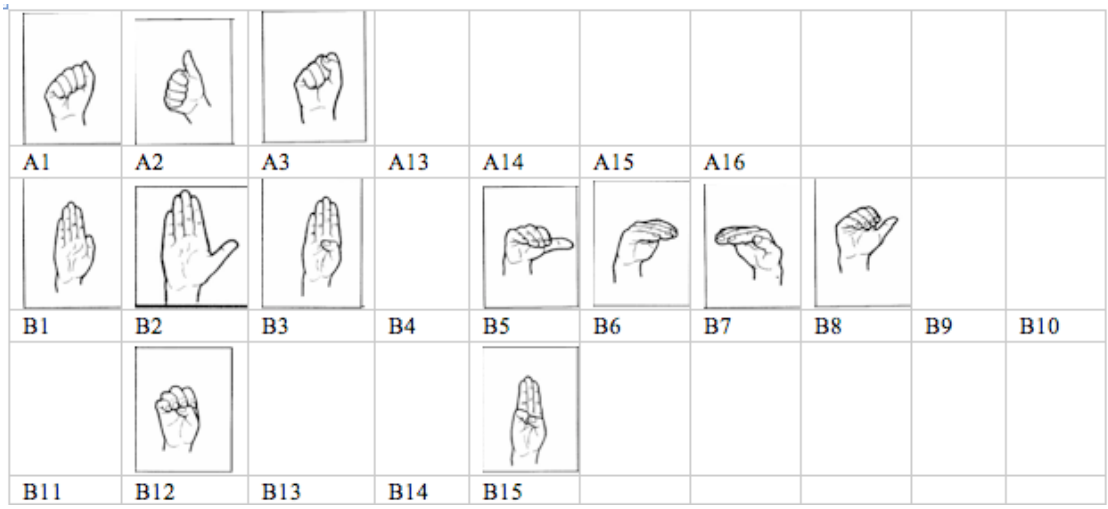


Figure 2.5: Part of the table of handshapes with codes corresponding to HamNoSys table of handshapes (Prillwitz et al. 1989)
(see also Van der Kooij 2002).

The empty boxes mean that a handshape that belongs in that box does not exist (or has not been identified so far) in ISL. New handshapes that we expect to be identified in the process of the annotations will be added in.

Figure 2.6: handshape not noted before in ISL (but used in signs like BOY).[12]

Thus, the naming conventions for classifier handshapes in the corpus have not been maintained for lexical signs. In order to facilitate search between handshapes in lexical signs and classifier constructions, information on the names of classifier handshapes is included in the notes tier already established within the SOI annotations. A subdatabase for handshapes, drawing on SignPhon, will be created where the exact articulation of the handshape and semantic information is included. This is still work in progress and will not be discussed further here. In the next section, we move on to talk about aspects of the movement parameter.

3. Movement

A large part of the sign language literature in phonology concerns the movement feature and the term *movement* has been used in different ways. Generally, movement features in lexical signs have been categorized as *path* movements, i.e. the movement of hands and arms in space that results in a change of place of articulation, and *internal*

[12] The handshape figure is from HamNoSys (Prillwitz et al. 1989)

or *local* movement, which consist of either a handshape change or an orientation change and these have been further categorized into hooking, flattening, releasing, wiggling, rubbing, twisting, nodding and circling to name a few. (See for example Liddell 1990; van der Hulst 1993). Local movements can occur on their own or in combination with path movements. The discussion here will be restricted to handshape change only. The different movement types are illustrated in figure 3.1.

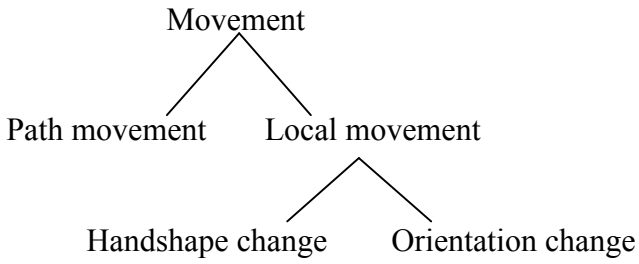


Figure 3.1: Movement types

3.1 Handshape Change

Stokoe (1960) analyzed signs as having three major compositional features, handshape, location and movement, and these were seen as occurring simultaneously within a sign. Later, the importance of acknowledging the sequential organization of signs became evident in order to account for different initial and final position of the hand in the production of a sign. Liddell and Johnson (The Movement Hold model 1989), and Sandler (The Hand Tier model 1989) and Perlmutter (The Moraic model 1992) all argued for sequentiality in signs. The three models all represent signs as being combinations of static elements (i.e. holds, locations or positions) and dynamic elements (i.e. movements). Below, we will discuss the Movement Hold model in relation to handshape change within signs.

The Movement Hold model (Liddell and Johnson 1989) includes two types of skeletal units, movements (M) and holds (H) and each of these units has a bundle of articulatory features associated with it (figure 3.2). In the articulatory bundles, features such as hand configuration, place, contact and non-manual features can be specified. When the hands move during a sign, this is associated with the M segment and when they are held stationary, they belong to the H segment. Signs are thus seen as sequences of the skeletal units. This model is based on autosegmental phonology (Goldsmith 1976), there is a temporal relationship between phonological elements.

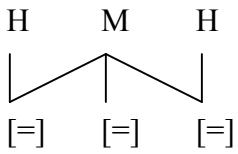


Figure 3.2: The Movement-Hold Model (Liddell and Johnson 1989)

In the MH-Model (Liddell & Johnson 1989), handshapes are represented in a sequence, i.e. in a separate segment cells with movement in between. The handshape is represented twice, for initial and final state regardless if handshape change occurs or not. The claim here is that in signs that include handshape change, the initial and final

handshape must be specified separately because the change is not predictable. In the ASL sign UNDERSTAND, for example, the initial handshape is an S-handshape (closed fist), which then opens into an INDEX-handshape instead of a predictable 5-handshape.

Thus, this model predicts that any sequence of handshape is allowed but other researchers claim that changes in handshapes are restricted and the relationship between the first and the second configuration are predictable in many signs (Sandler 1989; van der Kooij 2002). The Selected Finger constraint is one argument for this. As we have noted in the previous section, there can only be one set of selected fingers in a mono-morphemic sign (Sandler 1989). Hence, Liddell & Johnson's example of the sign UNDERSTAND, above seems to breach this constraint, as the initial handshape has no selected fingers while the final handshape has one selected finger. Liddell (1990) claims that the final handshape in such signs is not predictable based on the fact that ASL signs with an initial S-handshape open into several different handshapes; UNDERSTAND opens into an INDEX-handshape, THROW opens into an ASL h-handshape (only INDEX finger and middle finger selected) and GAMBLE opens into a 5-handshape. However, Sandler (1989) and van der Kooij (2001) claim that in such signs, the fingers are selected underlyingly. In signs where a closed fist handshape opens into an H-handshape, the two fingers are assumed to be underlyingly selected. According to this view then, handshape changes are predictable.

Van der Kooij (2002) refers to *static* handshapes when they remain the same throughout signs and *dynamic* handshapes when they change within signs. She finds that aperture change is the most common type of hand-internal movement in NGT and some handshapes only occur when there is a change in aperture and, thus, are dynamic handshapes. Thus, she represents signs with a handshape change as having one handshape as opposed to two, like in the Movement Hold model. The second restriction on hand-internal movement, apart from selected fingers, concerns aperture change. Van der Kooij (2002) claims for NGT that there are constraints on which handshape sequences may occur in a sign with handshape change based on the joints that are involved. She proposes the following generalization:

1. There is one joint selection per mono-morphemic sign (Van der Kooij 2002: 64)

This captures the generalization that finger configuration does not change within a sign in signs involving aperture changes in NGT as we see in figure 3.3 below (this has also been reported for ASL, see Uyechi 1996):

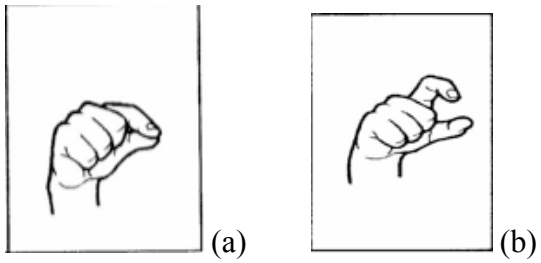

(a) (b)

Figure 3.3: A closed handshape

A closed handshape that involves bending of the base joints only (a) does not open to a handshape with the non-base joints curved (b), i.e. a flat shape does not become a round shape and vice versa (adapted from van der Kooij 2002: 64).

3.2 Handshape Changes in ISL

Information on hand-internal movements in ISL is very limited. Although we might assume that there are restrictions on handshape changes within signs in ISL as reported for other signed languages, this has never been formally researched in the language as far as I know. Thus, we still do not have evidence regarding the constraints on handshape change that where discussed above for selected fingers and joint selection. Hand-internal movements that are found in other signed languages also exist in ISL as we see in figure 3.4, which shows a part of an inventory of hand-internal movements based on van der Kooij (2002)[13]. According to van der Kooij (ibid.) these movements may occur both on a path movement and without a path movement. We will initially assume that this is the case in ISL as well, although further research will have to confirm this.

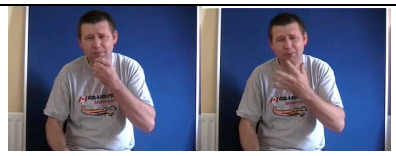
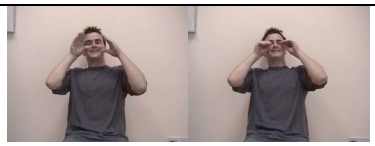
Hand-internal movement	Description	Example, ISL
Opening/ Releasing	The hand changes from a closed to an open position. (closed: in a fist or the thumb touching or restraining the fingers)	 BEAUTIFUL
Closing	The hand changes from an open position to a closed one.	 SLEEP
Rubbing	Thumb rubs one or more of the finger pads or sides of the selected fingers.	 SOON
Hooking/ Clawing	The selected fingers flex at the base joint only and there is no opposition relation with the thumb.	 TOPIC

Figure 3.4: ISL signs that include hand-internal movements (Text adopted from Van der Kooij 2002: 61)

[13] Note that van der Kooij's inventory is based on Liddell (1984), Wilbur (1993) and Stack (1988).

We see here that the signs that include a closing or opening movements, SLEEP and BEAUTIFUL, follow the selected finger constraint discussed in the previous section. The number of selected fingers remains the same so the handshape might be interpreted as one (dynamic) handshape as opposed to two different handshapes. The joint selection constraint is adhered to in these signs as well. The flat open handshape in SLEEP becomes a closed flat handshape and the round curved closed handshape in BEAUTIFUL opens into an extended 5-handshape, and not flat open handshape, which would break the constraint. To conclude, the above examples could be seen as preliminary evidence that the selected finger constraint and the joint selection constraint apply to ISL as well as NGT, but this can be confirmed by further research within the SOI corpus.

4. Summary

We have now discussed some of the literature on phonetics and phonology in signed languages, focusing in particular on handshapes and handshape changes that occur within signs. This was discussed with respect to expanding the annotation of the SOI corpus to incorporate phonetic and phonological coding with the aim to identify the phonemes and the allophones of ISL.

It has been noted by other researchers in this field that preferably one should know the phonology of a language before annotating corpus data in order to facilitate searches regarding phonology. Since this is not the case here, we rely on research that has been done on other signed languages and make assumptions about ISL based on that and preliminary observation.

We outlined decisions regarding the coding of ISL handhapes at phonetic level, reporting that the coding system from SignPhon will be incorporated into our corpus. By adding phonetic annotations of handshapes in lexical signs, it will be possible to use the corpus to explore their phonological status and phonetic variation, but currently all that has been established in the language is a list of phonetic handshapes.

In discussing handshape changes within signs we find that knowledge of this is very limited in ISL, although preliminary evidence suggests that handshape changes within signs adhere to two constraints: the selected finger constraint and joint selection constraint. Further research within the SOI corpus will be able to establish this.

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Exploring the differences in emotional competency across subject domains for Irish first year undergraduate students

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Abstract

This study generated composite emotional competency profiles for Irish first year undergraduate students in four separate subject areas and tested for statistical significance between student groups. A total sample of 307 participants took part in this research as follows; n = 119 social care, n = 108 business, n = 42 computing, n = 38 engineering. Results revealed significant differences between Social Care and all other student groups for the interpersonal skills composite scale and for two of the three sub-scales from which it is computed, empathy and social responsibility. With respect to the third sub-scale from which the interpersonal skills composite scale is computed, interpersonal relationships, social care students had statistically higher scores than computing and engineering students and business students also had statistically higher scores than computing students. Results are discussed with reference to curriculum design, student support services and the design of interventions for at-risk students.

1. Introduction

The world's first psychological laboratory was opened by Wilhelm Wundt in 1879 and one of the first challenges faced by researchers in this area was to establish psychology as a credible science. In order for this to occur, human experience and thought needed to be quantified and the development of rigorous measurement techniques (psychometrics) became an important focus of early psychological research. Specific to the study of human intelligence, the psychometric movement, allowed for the first time, for intelligence to be measured and this naturally led to the development of standardised tests of intelligence. Traditionally, intelligence was considered a unitary, cognitive construct and intelligence tests focused on cognitive abilities, as these were the aspects of human thought which were most amenable to measurement. The study and measurement of cognitive intelligence has yielded robust and practical results and a number of studies have found that higher levels of cognitive intelligence confers advantages across a number of social, health and academic domains (Gottfredson 1998, Neisser, Boodoo, Bouchard, Boykin, Brody, Ceci, Halpern, Loehlin, Perloff, Sternberg and Urbina 1996, Batty, Shipley, Gale, Mortensen and Deary 2008).

The psychometric approach has also been criticised on a number of grounds, principally with respect to its focus on cognitive abilities and the assumption that intelligence is a unitary construct. Recently several theorists have argued that rather than being a singular construct, intelligence is in fact comprised of a number of separate but related constructs and that we should speak not of intelligence in the singular, but of multiple intelligences and focus on both cognitive and non-cognitive aspects of human reasoning (Bar-On 2000, Gardner 1983, Sternberg 1985). Recent developments with respect to the design, measurement and application of tests of non-cognitive intelligence have also led their proponents to argue that non-cognitive aspects of human intelligence such as emotional or social intelligence can now be measured as readily as cognitive aspects can.

2. Emotional intelligence

There is a growing body of evidence which suggests that although IQ tests do measure skills which are important to learning in school, they do not predict general life outcomes. Specifically, as IQ tests were originally designed to predict academic success, many critics argue that they measure fixed intelligence and this renders them unsuitable for application beyond the confines of academia i.e. in social or 'real-world' situations (Bar-On 1997, 2006, Cherniss 2000, Ciarrochi, Forgas and Mayer 2006, Emmerling and Goleman 2003, Gardner 1983, 1993, Goleman 1995, Parker, Summerfeldt, Hogan and Majeski 2004, Parker, Creque, Barnhart, Harris, Majeski, Wood, Bond. and Hogan 2004, Petrides, Frederickson, and Furnham 2004, Roeser, Van Der Wolf and Strobel 2001, Zigler and Seitz 1982). In today's global economy, employers are also seeking graduates who possess not only academic knowledge but inter and intrapersonal skills.

Both educationalists and industrialists alike have therefore come to realise the value of devising predictive tests aimed at assessing and predicting life skills and emotional awareness as there is a growing body of evidence that beyond a certain minimal requisite level of cognitive intelligence, emotional intelligence (EI) [14]is a stronger predictor of life success, business acumen and indeed personal satisfaction (Goleman 2000, Parker, Hogan, Eastabrook, Oke and Wood 2006, Schutte and Malouf 2002, Mestre, Guil, Lopes, Salovey and Gil-Olarte 2006, Schutte, Malouff, Thorsteinsson, Bhuliar, and Rooke 2007, Swart 1996 and Yost and Tucker 2000).

2.1 Emotional intelligence and education

Within the educational arena, researchers have begun to speak of 'Social and Emotional Learning' (SEL), which is essentially an applied field of study within the area of EI and specifically pertains to the development and examination of educational strategies for the promotion of emotional intelligence and positive developmental outcomes. Zins, Payton, Weissberg and O'Brien (2007), provide a good overview of research in this area and list a number of studies which have found positive associations between EI and academic attainment in children.

In the USA, the 'Committee for Children', and the 'Collaborative for Academic Social and Emotional Learning' (CASEL), are both non-profit making organisations which are dedicated to the promotion of SEL in the classroom. The committee for children in particular, have developed a number of programmes for school children that teach various aspects of SEL in regular class sessions throughout the school year. Their programmes have been successfully running for a number of years in twenty one countries worldwide.

One particular programme, 'Second Step' for example is designed to teach empathy and anger management and in this regard, Elias, Kress and Hunter (2004) claim that, the real challenge for an educator is that as the classroom is a complex social environment, children are emotionally distracted in many ways from learning. They

[14] Theorists in this area employ the terms emotional competency and emotional intelligence interchangeably, therefore the same convention shall be adopted throughout this article and both terms shall also be used synonymously.

believe that this obstacle to learning can be overcome by simultaneously incorporating aspects of social-emotional learning into the standard curricula taught to students and also fostering school environments that encourage the development of healthy and mature social interactions. In fact a range of research studies have found a positive relationship between academic attainment and EI (Austin, Evans, Goldwater and Potter 2005, Myers and Tucker 2005, Roeser, Van Der Wolf and Strobel 2001, Schutte and Malouf 2002, Swart 1996, Yost and Tucker 2000, Zeidner, Shani-Zinovich, Matthews, and Roberts 2005). A number of researchers have also studied potential mechanisms to help students increase their level of EI and examined the costs and benefits of doing so. Edwards, Mumford and Serra-Roldan (2007) argue for example that the provision of positive personal attention can be a simple way of countering some of the disadvantages that may pertain to at-risk students.

Petrides, Frederickson and Furnham (2004) have argued that the relationship between EI and IQ may not be directly linear and that there may in fact be a stronger advantage for students who have lower IQ scores but who have higher EI scores. In other words, students with fewer cognitive resources are more likely to feel stressed and having higher levels of emotional resources may help them to cope. Research has also specifically examined the impact of non-cognitive factors on academic attainment for students from socially disadvantaged families. In this regard, Izard, Fine, Schultz, Mostow, Ackerman and Youngstrom (2001) found that for children as young as five years old from socially disadvantaged families, levels of emotional intelligence, strongly predicted higher levels of social skills in third grade (approximately five years later). This research suggests that providing EI coaching at the earliest opportunity can serve a preventative function and have a positive and lasting impact for at risk students.

Specific to higher education, Kingston (2008) found an inverse relationship between drop-out rates and coping skills. Boyatzis, Cowan and Kolb (1995), delivered an EI instructional programme to a group of MBA students in the United States and found that improvements in EI competencies were sustained over a five year period post graduation. More recently, Boyatzis (2008), conducted a twenty year review of attempts to embed aspects of emotional competency in the curricula taught to students on the same MBA programme and concluded that not only do such efforts impact positively on the development of emotional competencies but in fact have a knock-on positive impact on the development of cognitive abilities.

2.2 Irish Perspectives on Emotional Intelligence

Aspects of emotional competencies are incorporated into the core curricula of Irish students at both primary and secondary level through the teaching of 'Relationship and Sexuality Education' (RSE) at primary level and 'Social, Personal and Health Education' (SPHE) at secondary level. A recent review of the implementation of the SPHE curriculum was conducted by the SPHE support service in 2008. Findings suggest that both teachers and students find this subject worthwhile and valuable but that due to it being non-examinable, insufficient classroom time is devoted to it. Specifically the report found that *'students express the view that SPHE is helpful to them in dealing with difficult situations'* (p7) and that this curriculum promotes self-esteem and contributes to students' emotional health. The review further found that although as stated above, the syllabus is taught only to junior certificate students, that parents, teachers and students all supported the continuation of SPHE to senior cycle.

There is some evidence to suggest that the discontinuation of the SPHE syllabus to senior cycle coincides with a decrease in young adults levels of emotional competencies. The 'State of the Nations Children' report produced by the Irish Department of Health and Children in 2008, found for example that the percentage of children who reported feeling 'happy always or very often with the way I am' was 74.8% for 9 year olds but dropped to 49.3% for 15-17 year olds. The percentage of surveyed children who reported being 'happy with my life at present' also dropped from 95% for 9 year olds to 88.5% for 15-17 year olds. One cannot conclude from these findings that there is a causative relationship between the two however this research does seem to suggest that young adults experience some difficulty with respect to emotional management and self concept and continued focus on the development of emotional competencies may therefore be of benefit in this regard.

With respect to third level students, Parker and Broderick (2008) conducted an international comparative study of the relationship between emotional competency and academic attainment for college students in America, Canada and Ireland. Students had their emotional competencies tested at the beginning of their first year of study and again at the end of their studies, just prior to graduation. When students were grouped according to GPA, in all three countries students with higher GPA's (i.e. more academically successful students) had statistically significant higher EI scores than those with lower GPA's.

Although, there has not been much research conducted in an Irish context with respect to emotional competency and academic attainment, available evidence does suggest that incorporating aspects of emotional competency coaching in the curricula that are taught to younger students gleans positive results and that there is value in continuing such coaching to senior cycle and beyond. Further research is also required to investigate more fully from an Irish perspective the relationship between emotional competency and academic attainment at third level.

3. Methodology

3.1 Participants

All incoming first year students aged eighteen years of age or older who registered for courses beginning in September 2009 at the Institute of Technology Blanchardstown (ITB) in four distinct subject areas (Social Care, Business, Engineering and Computing) were eligible for participation in this research. A total of 307 students chose to participate (n = 119 Social Care, n = 108 Business, n = 42 Computing, n = 38 Engineering).

3.2 Materials

The Bar-On EQ-i has been chosen for use in this research as although it has not been extensively employed in an Irish context, it has been employed internationally and has been found to have strong internal reliability and predictive validity.

Further details pertaining to the construction and validity of the test are now provided. The EQ-i is a self report measure with 133 items, consisting of short sentences to which respondents indicate the level to which they believe each sentence describes them on a five point scale, ranging from 'Very seldom or not true of me' (1), to 'Very often true of me or true of me'(5). Once the test has been completed, a total EQ score is

generated as well as composite scores in five principle domains (Intrapersonal, Interpersonal, Stress-Management, Adaptability and General Mood). Each of the principle domains are further comprised of scores in a range of sub-categories and the following table lists the categories associated with each domain.

Composite scale	Sub-scale
Interpersonal	Empathy Social Responsibility Interpersonal Relationships
Intrapersonal	Self-Regard Emotional Self Awareness Assertiveness Self Actualisation Independence
Stress Management	Stress Tolerance Impulse Control
Adaptability	Reality Testing Flexibility Problem Solving
General Mood	Optimism Happiness

Table 1: Composite scales and sub-scales of the Bar-On EQ-i.

Bar-On 2004, found the sub-scales of the EQ-i to have strong internal reliability, yielding alpha coefficients of consistently greater than .90 and test-retest coefficients were also reasonable across a six month interval. The test was also shown to have good predictive validity in a number of domains and the EQ-i has been employed in a number of areas to successfully predict social ability and performance in a range of settings. Bar-On (2006) provides a good summary of both his own research in this regard and also summarises findings from other researchers worldwide who have confirmed the validity of this measure in a range of settings over the past number of years.

One of the principle debates which is central to the development of measures of EI, is whether as the name suggests emotional intelligence is in fact a form of intelligence, an ability which may have a strong genetic component and may as a result therefore be difficult to improve or change, or whether EI is a trait, similar to personality, which may arguably be more amenable to social learning and more readily changed through experiential learning. The Bar-On model adopts a trait approach to the study of emotional intelligence and considers EI to be largely skill based.

3.3 Procedure

A short presentation was given to students in participating courses at induction during the first week of term, where the rationale and objectives of the study were explained to them and they were given the opportunity to ask any questions they had pertaining to the study or their involvement in this research. Students were also presented with an information sheet outlining in writing the information delivered in the presentation and

consent was received in writing from all participants. Students were clearly informed that participation was on a voluntary basis. Once consent was received from students, they were given an online version of the EQ-i and all participants completed the test. In line with both best practise and institute policy, ethical clearance was sought and granted prior to the commencement of this research.

4. Results

Descriptive statistics are provided in table 2 for all composite scales and sub-scales of the EQ-i for each subject group. Average total EQ scores are highest for social care students and lowest for computing students.

With respect to specific composite scale and sub-scale scores, average scores are highest for social care students in all composite scales and sub-scales, with the exception of independence and self regard, for which business students have highest average scores, stress management and flexibility for which engineering students have highest average scores and stress tolerance for which computing students have highest average scores.

There is more variability with respect to lowest average scores, with computing students achieving lowest average scores for three composite scales (intrapersonal, interpersonal and general mood) and six sub-scales (self actualisation, social responsibility, interpersonal relationships, flexibility, optimism and happiness). Engineering students achieved lowest average scores in emotional self awareness, assertiveness, empathy, reality testing and problem solving, business students achieved lowest scores in stress tolerance and impulse control and social care students for self regard and independence.

This data is summarised in Table 3 and has been presented pictorially in Figure 1.

To analyse these scores for statistical significance across subject areas, a series of one-way ANOVA's was conducted for total EQ and for each composite scale. Where significance was found for any composite scale, further ANOVA's were conducted for each of the sub-scales associated with it. Significance was not found for total EQ $F(3, 303) = 2.499$, $p = .06$, or for four of the five composite scales, intrapersonal $F(3,303) = .63$, $p = .596$, stress management $F(3,303) = .421$, $p = .738$, adaptability $F(3,303) = 1.032$, $p = .375$ or general mood $F(3,303) = .73$, $p = .535$.

For the composite interpersonal scale, scores differed significantly across subject areas $F(3,303) = 19.99$, $p = .000$. Tukey post hoc comparisons of the four groups indicated that social care students (M 103.82 95%CI [101.6, 106.05]) had statistically higher scores than students in all other groups, computing (M 87.4 95%CI [81.81, 93]) $p = .000$, engineering (M 88.53 95%CI [82.78, 94.27]) $p = .000$ and business (M 93.94 95%CI [91.14, 96.75]) $p = .000$. No significant differences were found between any other groups at the .05 level.

Table 2: Averages, standard deviations and standard errors for all students in each EQ domain and sub-category for all subject areas.

DOMAIN	MEASUREMENT	TOTAL (N =307)	SOCIAL CARE (N = 119)	BUSINESS (N = 108)	COMPUTING (N = 42)	ENGINEERING (N = 38)
Total EQ	Average Score	91.93	94.43	91.2	88.14	89.92
	Standard Deviation	14.24	12.97	13.46	15.91	16.69
	Standard Error	.81	1.18	1.3	2.43	2.67
Intrapersonal	Average Score	**93.54**	**93.85**	**94.47**	**91.37**	**91.61**
	Standard Deviation	14.61	14.14	13.63	16.15	16.66
	Standard Error	.83	1.29	1.3	2.46	2.67
Self Regard	Average Score	97.6	94.93	99.95	96.19	99.43
	Standard Deviation	16.11	16.54	15.84	16.98	13.51
	Standard Error	.92	1.51	1.52	2.59	2.16
Emotional Self Awareness	Average Score	95.4	97.77	95.31	92.7	90.38
	Standard Deviation	15.05	14.06	14.22	15.73	17.84
	Standard Error	.86	1.28	1.36	2.4	2.86
Assertiveness	Average Score	96.41	97.1	96.2	96.63	95.46
	Standard Deviation	13.5	13.3	12.48	15.13	15.08
	Standard Error	.77	1.22	1.2	2.31	2.41
Independence	Average Score	90.86	89.8	91.95	89.98	90.79
	Standard Deviation	15.57	16.4	14.02	16.82	16.09
	Standard Error	.89	1.5	1.34	2.56	2.58
Self Actualisation	Average Score	93.17	95.83	92.56	89.39	90.33
	Standard Deviation	15.85	15.51	15.92	16.19	14.88
	Standard Error	.9	1.42	1.52	2.47	2.38
Interpersonal	Average Score	**96.21**	**103.82**	**94.01**	**87.72**	**88.85**
	Standard Deviation	16	12.27	14.66	17.85	17.36
	Standard Error	.91	1.12	1.4	2.72	2.78
Empathy	Average Score	94.29	103.1	90.57	87.79	86.61
	Standard Deviation	18.37	15.6	17.37	19.97	17.65
	Standard Error	1.05	1.43	1.66	3.04	2.83
Social Responsibility	Average Score	91.79	101.79	86.59	83.35	86.18
	Standard Deviation	17.4	12.7	16.4	19.41	16.35
	Standard Error	.99	1.16	1.57	2.96	2.62
Interpersonal Relationships	Average Score	99.98	103.42	101.03	92.86	94
	Standard Deviation	16.24	15.2	14.85	17.62	17.45
	Standard Error	.93	1.4	1.42	2.69	2.79
Stress Management	Average Score	**92.55**	**93.29**	**91.26**	**92.19**	**93.61**
	Standard Deviation	15.22	14.7	14.62	17.9	15.31
	Standard Error	.87	1.35	1.4	2.73	2.45
Stress Tolerance	Average Score	93.95	93.2	93.1	96.77	95.61
	Standard Deviation	16.34	1.38	17.82	16.68	14.99
	Standard Error	.93	15.01	1.71	2.54	2.4
Impulse Control	Average Score	92.91	95.98	89.23	91.84	93.79
	Standard Deviation	16.69	14.93	17.9	18.45	14.64
	Standard Error	.95	1.37	1.71	2.81	2.34
Adaptability	Average Score	**88.98**	**90.8**	**87.51**	**87.56**	**88.49**
	Standard Deviation	14.65	13.67	14.59	15	16.78
	Standard Error	.84	1.25	1.4	2.29	2.69
Reality Testing	Average Score	89.59	91.3	88.61	88.95	88.54
	Standard Deviation	15.35	14.44	15.07	14.77	18.81
	Standard Error	.88	1.32	1.44	2.25	3.01
Flexibility	Average Score	95	95.63	94	92.7	96.85
	Standard Deviation	14.8	13.4	14.68	16.4	17.45
	Standard Error	.84	1.23	1.4	2.5	2.79
Problem Solving	Average Score	88.55	90.6	86.96	87.98	86.26
	Standard Deviation	15.32	14.23	15.79	15.77	16.36
	Standard Error	.87	1.3	1.51	2.4	2.62
General Mood	Average Score	**96.15**	**97**	**96.22**	**92.56**	**96.49**
	Standard Deviation	16.71	14.34	18.92	18.16	14.76
	Standard Error	.95	1.31	1.81	2.77	2.36
Optimism	Average Score	93.05	92.39	94.4	91.6	92.33
	Standard Deviation	15.66	15.47	14.55	19.55	14.16
	Standard Error	.89	1.42	1.39	2.98	2.27
Happiness	Average Score	100.5	101.72	101.2	94.72	100.38
	Standard Deviation	15.83	14.82	16.5	16.58	14.95
	Standard Error	.90	1.36	1.58	2.53	2.39

Table 3: Highest and Lowest scores for each domain and sub-category of the EQ-i.

DOMAIN	SOCIAL CARE	BUSINESS	COMPUTING	ENGINEERING
Total EQ	Highest		Lowest	
Intrapersonal		**Highest**	**Lowest**	
Self Regard	Lowest	Highest		
Emotional Self Awareness	Highest			Lowest
Assertiveness	Highest	Lowest		
Independence	Lowest	Highest		
Self Actualisation	Highest		Lowest	
Interpersonal	**Highest**		**Lowest**	
Empathy	Highest			Lowest
Social Responsibility	Highest		Lowest	
Interpersonal Relationships	Highest		Lowest	
Stress Management		**Lowest**		**Highest**
Stress Tolerance		Lowest	Highest	
Impulse Control	Highest	Lowest		
Adaptability	**Highest**			**Lowest**
Reality Testing	Highest			Lowest
Flexibility	Highest		Lowest	
Problem Solving	Highest			Lowest
General Mood	**Highest**		**Lowest**	
Optimism		Highest	Lowest	
Happiness	Highest		Lowest	

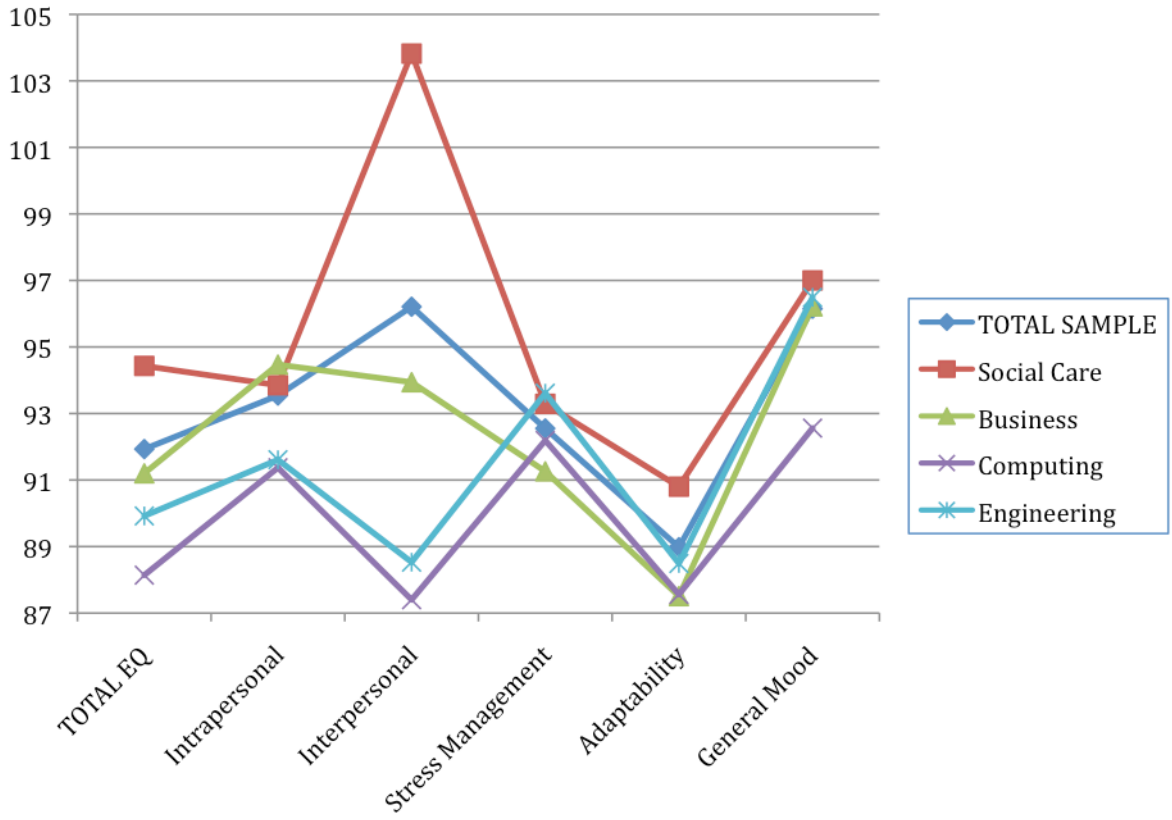

Figure 1: Scores for each principle domain for all student groups.

For the empathy sub-scale, scores also differed significantly across subject areas $F(3,303) = 18.262$, $p = .000$. Post hoc comparisons for this sub-scale also revealed that social care students (M 103.11 95%CI [100.28, 105.94]) had statistically higher scores than students in all other groups, computing (M 87.12 95%CI [80.98, 93.26]) $p = .000$, engineering (M 85.84 95%CI [80.19, 91.5]) $p = .000$ and business (M 90.33 95%CI [87.04, 93.63]) $p = .000$. No significant differences were found between any other groups at the .05 level.

The same pattern was repeated with respect to the social responsibility sub-scale with scores again differing significantly across subject areas $F(3,303) = 27.502$, $p = .000$. Post hoc comparisons again indicated that social care students (M 101.79 95%CI [99.49, 104.09]) had statistically higher scores that students in all other groups, computing (M 82.83 95%CI [76.8, 88.86]) $p = .000$, engineering (M 85.68 95%CI [80.33, 91.03]) $p = .000$ and business (M 86.4 95%CI [83.57, 89.53]) $p = .000$. Again no significant differences were found between any other groups at the .05 level.

For the interpersonal relationships sub-scale a slightly different pattern emerged. Scores differed significantly across subject areas $F(3,303) = 27.502$, $p = .000$ and post hoc comparisons revealed that social care students (M 103.42. 95%CI [100.66, 106.18]) had significantly higher scores than computing (M 92.81. 95%CI [87.25, 98.36]) $p = .001$ and engineering (M 93.97 95%CI [88.16, 99.78]) $p = .008$ students. For this sub-scale however, business students (M 101.08. 95%CI [98.24, 103.93]) were also found to have significantly higher scores than computing students $p = .022$.

4.1 Summary of findings

There are some significant differences between the emotional competency profiles for the student groups that were included in this study. Social Care students have the highest overall levels of emotional intelligence (although statistical significance was not found) and the highest scores for three of the five composite scales and twelve of the fifteen sub-scales. Social Care students have significantly higher levels of interpersonal skills than students in other subject areas. Computing students had lowest overall scores and were also lowest in three of the five composite scales and nine of the fifteen sub-scales. Computing students also had the highest scores for one of the sub-scales. Engineering students had the lowest scores for one composite and for four sub-scales and the highest scores for one of the composite scales. For business students, a varied pattern emerged. These students had highest scores in one composite and three sub-scales and had lowest scores for one composite and three sub-scales.

5. Discussion

The results outlined above support the need for emotional competency coaching for first year undergraduate students in all subject areas as although significant differences were found across groups, the profile for every student group included both higher and lower scores. It is important to reiterate therefore that as per the literature review above, research suggests that emotional competencies are not absolute and can be improved through coaching i.e. that they are at least partly ability based. Group profiles should also be considered in context, as in some instances even higher scores can be misleading and may in fact denote poorer as opposed to higher emotional competencies. Engineering students for example have the highest levels of stress management which, on the surface, appears positive however, they also possess the

lowest levels of adaptability, reality testing and problem solving. This may mean that at times, stress may appear to be managed effectively when it is not in fact *perceived* i.e. in some instances stressors or problems may be ignored.

These findings have important implications for curriculum design, for student support services and for the design of interventions aimed specifically at supporting at risk students. Arguably, one of the most useful aspects of research of this kind is that whilst emotional competency profiling draws attention to student's emotional weaknesses, it also highlights their emotional strengths. In this regard, Edwards, Mumford and Serra-Roldan (2007) argue that in the past, the emphasis has been on delineating the negative predictors of school related outcomes and therefore

> "*Determining which variables 'positively' influence the trajectories of these students' school-related outcomes has important implications for developing successful intervention and prevention programs in all countries and among all cultures."* (p30).

In recent years, educators and psychologists have begun to speak about the education of the 'whole' child and argue that it is only when social-emotional and academic factors are combined that this can occur (Elias and Harriett, 2006). This argument pertains as much to third-level students and adult learners as to younger students and based on these current findings, there appears to be a strong argument in favour of including learning outcomes on all third level programmes aimed at encouraging emotional and social development.

It is important to note prior to doing so however that one of the principle difficulties which educationalists encounter is in fact clarifying what exactly education is and what it should entail. Sharp, Ward and Hankin (2006), ask for example, whether formal education should focus solely on the development of cognitive abilities, or should educators encourage the development of democratic thought, morality or self-awareness and if so, to what extent? There is clearly both a need for and a benefit from encouraging student's emotional and social development however what is not clear is where the responsibility lies for the provision of such skills and how such development should best be achieved? There are for example a number of ways in which interventions aimed at encouraging emotional development can be delivered; via the provision of emotional competency coaching, through the infusion of aspects of emotional competencies in the curricula that are taught to students or perhaps through offering stand alone modules in this area either on a mandatory or an optional basis. Boyatzis (2009) argues that where attempts are made to foster emotional competency in educational settings it is important to adopt a holistic approach. Coaching for example may be important particularly where self-assessment of emotional intelligence occurs, as students may not believe that they possess particular competencies until they have the opportunity to put them into practise, therefore developing *and* demonstrating such competencies may be important.

As a majority of the principle tests of emotional intelligence and a majority of the research that has been conducted with respect to the application of such tests has involved western populations, some researchers have recently begun to question whether such tests and such research may be culturally biased. Researchers have established some time ago that the basic range of human emotions are experienced

universally (Izard 1971), however there are considerable intercultural differences with respect to the manner in which emotions are labelled and expressed (Elfenbein and Ambady 2003). Elfenbein and Ambady also found that people can more accurately label the emotions of those from members of their own culture than of those from other cultures. This may mean that in multicultural classroom settings both students and teachers may experience some difficulty expressing emotion and labelling the emotions of others. Whilst reviewing current trends in social emotional learning Hoffman (2009) notes in this regard that given such cultural differences, it may be important to assess the extent to which current tests of emotional intelligence and current interventions may need to be adapted to become less culturally biased.

In conclusion, there is merit in further investigating this area as a number of important questions and issues are yet to be resolved. As very little research has been conducted in an Irish context with respect to better understanding the relationship between emotional competency and academic attainment, this study will hopefully help to build a foundation from which further research may be conducted.

5.1 Limitations and directions for further research

A dearth of research has been conducted with respect to emotional competency and academic attainment in Ireland. Although this study appears therefore to support the need for emotional competency coaching for undergraduate students, it contains a number of limitations which may limit its generalisability. Most importantly, this research has been conducted in one specific third level institution and similar research will need to be conducted with other student cohorts to ensure these findings are not specific to this particular group.

The Bar-On model has received some criticism as a self-report measure and future research may seek to corroborate the findings from this study with objectively rated measures of EI. As mentioned above, there is also some debate as to whether emotional intelligence is trait or ability based and researchers are not fully in agreement as to which approach should be adopted. Future research may also seek to employ alternative models of EI to substantiate the findings from this study. It is important however to point out that a majority of theorists do recognise that to some extent both genetic and social factors will impact the development and expression of emotional intelligence and that when both personality and IQ are controlled for, research shows that emotional intelligence does emerge as a unique construct (Van Rooy and Viswesvaran 2004). Finally, this study has been conducted as part of an ongoing research project. Now that students EI competencies have been profiled, ongoing research will test the assertion that providing emotional competency coaching can improve student's EI scores. What seems certain is that future research in this area is of great value and will benefit students, educationalists and researchers alike.

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Mobile Phone Game Localisation

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Abstract

Often, mobile phone games are developed over a short time span. Because of the additional work and complexity that localisation requires, such games are frequently produced without localisation in mind. In recent years automation and standardisation of localisation has been developed and promoted by the Localisation Industry Standard Association (LISA) and Oasis. Mobile phone game localisation involves various types of language transfer on a small scale, which challenges the localisation process carried out on a game. Our work investigated the workflow for the localisation of a mobile phone game into Spanish and German using a LISA Standard TMX (Term Base Memory Exchange) and the Oasis standard XLIFF (XML Localisation Interchange File Format). Using Unicode the game was also localised into one Altaic language (Korean) and one Semitic language (Arabic). The localisation results have been compared and contrasted using software and statistical analysis carried out on a range of methods.

1. Introduction

Many games are produced without localisation in mind due to cost, time to market and competition from other companies. This paper describes our work to help overcome the problems that may be associated with localising a mobile phone game. We aim to find a low cost, low risk approach to achieve this goal, using localisation industry standards and technologies. We will develop a workflow to localise a legacy mobile phone game in four different languages - Spanish, German, Korean and Arabic.

2. Review of Literature

This section of the paper will review localisation in general, internationalisation and localisation for mobile phone games. It will also give a brief outline of the mobile phone game Monster Madness.

2.1 Localisation

Two terms that are used when looking at localisation are: “Localisation” and “Internationalisation”. The terms Internationalisation and Localisation are similar in meaning and need to be differentiated. Sam [22] states “Internationalization involves writing and designing an application so that it can be used with different languages, date, time, currency and other values without software modification”. Chandler [5] states “Localisation is the translation and adaptation of a software or web product which includes the software application itself and all related product documentation”. Hoft [9] also states that localisation is: “the process of creating or adapting an information product for use in a specific target market”. Localisation is the adaptation of a system for a particular locale (country) which usually takes place at the level of program design and document development. It is also the process of translating a software product into other languages. It involves taking a product and making it linguistically and culturally appropriate to the target locale (country, region, language) where it will be sold. A well-localised product is one which enables users to interact with a software product in their native language. They should be able to read all interface components such as error messages or on screen text in their own language

and enter information with all accented characters i.e. characters that are distinct to their own language for example the '˜n' in Spanish.

The above are important factors to consider for localisation. When many people think about localisation they only think about the translation of one language into another. However, this may not be the case as localisation issues can also arise between countries that have a common language. For example in two English speaking countries America and Ireland, the date format in America is mm/dd/yy and in Ireland it is dd/mm/yy; the currencies and time formats are also different as well as paper sizes. When creating software projects for both countries these are some of the problematic areas that need to be addressed.

2.2 Mobile Phone Game Localisation

The localisation of games is more complex than localisation of other software or merchandise [13]. This is because games not only have text but also animations, voice over, sounds, graphics etc. that need to be localized. According to Quan [19] localisation-friendly code is code that is developed with localisation in mind. In order to achieve this there are many parameters that need to be looked at when localising a mobile phone game. The literature (for example see [5] and [19]) yields a number of different sets of parameters that need to be considered. According to Chandler [5] some of the features that need to be looked at when localisaing a software product are:

- Game code
- Display text
- Device being used

Other areas that are important for the localisation of mobile phone games are:

1. Displaying of international characters

If the displaying of international characters was not taken into consideration then special characters outside the source language (the language being translated) such as the '˜n' in Spanish would have problems displaying correctly or may not display at all.

2. Text in user Interaction

Concatenation is used to connect or link words or phrases in a series or chain. In Computer Science the term is used to arrange strings of characters into a chained list. When displaying text concatenation should be avoided as it may lead to text displaying incorrectly e.g. running off the screen. Concatenation may be created in a game by pulling two separate text strings from the game code and displaying them as a single sentence in the game. This can cause a lot of problems in localisation with verbs, tenses and genders. However, they may display grammatically correctly in the English language but their translation may mean something completely different. [5]. An example of concatenation would be two separate words such as 'Shalom' and 'Ofam'. When they are pulled together/concatenated they would produce the string 'Shalom Ofam'.

This can be seen in Figure 1.

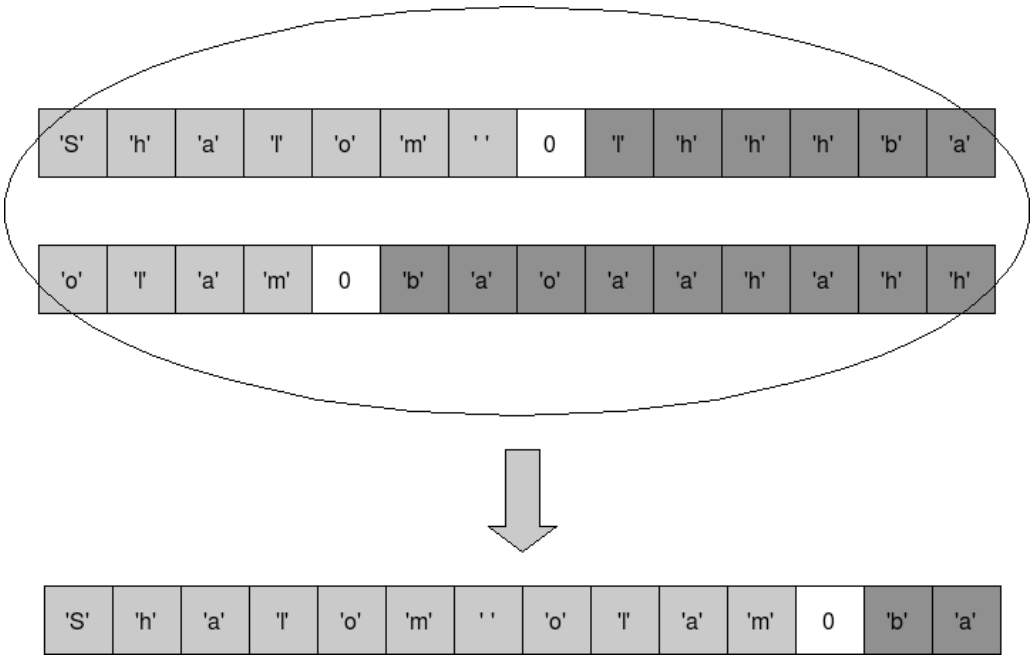

Figure 1: Example of Concatenation [25]

3. Font Properties

The type of font selected is very important in localisation as text and graphics are the main interactive elements between the user and the game. Texts that are too large or too small may cause the text to overlap or be difficult to read. "Translated words are usually 25% to 30% larger than their English spelling" [5], [10], meaning that the English word is small compared to the translated word. This is due to the fact that English is a compact language compared to other languages.

The font where circumstances allow should be scaled down to accommodate the increase without making the text difficult to read. If the translated word was transferred back to English then the text would shrink by the same amount (about 25% to 30%). Some languages need a larger font nthan others. Take Japanese and English fonts for example. If the font size was small in Japanese it would make it almost impossible to read as each Japanese character is very detailed but the English version would be legible and easy to read.

4. User Interface (UI) Design

There are many factors to consider when designing a localisation-friendly UI. One of the main factors is to design the UI to cope with the localised text. If a button used to display the word "exit" has to be translated into German then "ausgang" would be displayed on the button which has three characters more than the English text. It can clearly be seen that the German word is longer and will cause problems when trying to place it on a button that contains the English text. Where possible it would be a lot more efficient to use buttons where the UI's can be scalable, such as drop-down boxes, text boxes and other elements that can be modified up or down depending on the information it is holding. Using icons where possible is a lot more programmer-friendly

than translating text on a box as described above. Icons cut down on the amount of localised text to be used and reduce the amount of linguistic bugs such as truncation and concatenation. An example of this is using a silhouette of a single player to indicate a single player and a silhouette of two players can be used to indicate a two player game. Alternatively numbers could be used in much the same way, to depict for example the number of players. Cluttered UI screens should always be avoided. In the case of a mobile phone game this can be a difficult concept to overcome as not all mobile phone screens are the same size [5].

The international date and currency formats need to be supported as the dates are displayed as dd/mm/yy in Europe and mm/dd/yy in America. The currency is Dollars in America and Euro in Europe. Special characters must be available on the input screen for mobile devices. Sometimes there is a UI screen depicting a keyboard to save the highest score. To allow the user to input data that keyboard must have special characters and numbers in the localised version.

5. Audio and Video Graphics that contain text

The decision to localise audio and video graphics is another important factor to consider when localising a mobile phone game. For example if the game was developed in England and it contained audio that many English or European people were familiar with (e.g. chart music) this may have to be changed in order to facilitate localisation in another country. If the game was going to be localised for the Korean market then the programmer should change the audio to music,that would be recognised by that country. The use of video graphics is another issue that has to be taken into consideration when localisation a game. For example the Monster Madness logo that can be seen in Figure 2. The game has a title screen which depicts the game logo in English. If it were to be localised into Korean, Spanish etc. the programmer or company has to decide if the logo has to be localised into the relevant language or does it stay as it is as a way of recognising the game in any country worldwide.

Figure 2: Monster Madness Title Screen [24]

When games are localised not only has the text to be taken into consideration but in some cases the graphics, depending on the country [6]. For example in Germany strict censoring laws ban games that depict scenes containing blood. When localising the

game the graphics are changed to a green substance instead of blood. Also in some cases were roadsigns or directions are used, these graphics would have to be localised in order for the end user to be able to engage with the game. This concept also applies to mobile phone games where the graphics would have to be tailored to suit a certain locale.

3. Monster Madness Game Localisation

In this research the mobile phone game that was used is called Monster Madness. This is a legacy game from Eirplay Games [8]. It is a simple shooting game and in order to get an idea of the game a screen shot of it can be seen in Figure 3.

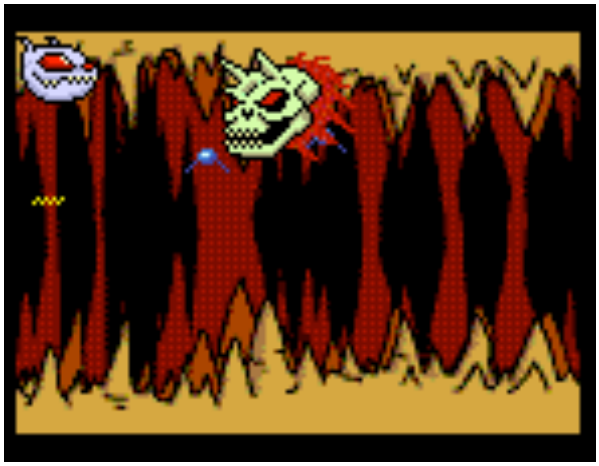

Figure 3: Monster Madness Screen Shot

When localising the Monster Madness Game the main factor that will need to be taken into consideration is the displaying of international characters. A lot of localisation factors that have been discussed do not apply to this game because user interaction takes place through text and not audio or graphics. Examples of these are the graphics (no icons need to be changed) and audio (there is no audio in this game). However, when designing all of these issues would have to be considered from the early development stage.

Localisation should be considered from the onset when creating a game [4]. There are two main types of situations for localising a game. The first is the localisation of a legacy game and the second is the localisation of a new game which is been designed with localisation in mind from the start. One of the most important aspects in localisation in a new game is the separation of text and audio files etc. From the software source code, as this makes it much easier to localise. If this was not considered (as in the case of a legacy game) then the text and audio are embedded in the source code files. If the text were scattered in different source code files it would be difficult to locate and translate. The programmer would then have to go through the code line by line, in which case it could be thousands of lines, and extract all of the translatable text and place them into a separate source code file in order to facilitate localisation. On big projects this could take up to a number of weeks. It is much more efficient to place the translatable text into a separate folder away from the source code.

When developing a game the life cycle of the game has to be taken into consideration. Today many games are created from start to finish in about three months. When localisation is involved this may take longer. [13]

4. Methodology

The Monster Madness game was written in J2ME (Java Platform Micro Edition). J2ME is a Java platform aimed at developing software for small applications such as mobile devices [3]. The IDE (Integrated Development Environment) that was used to develop the software was Netbeans 5.5.1 as it is one of the IDE's that contain a mobile phone emulator to test the code [1].

4.1 Background to the Monster Madness Game

The Monster Madness mobile game was designed by Eirplay Games [8]. This game was used in the SECASE (Software Engineering CASE studies) [2] project by the Institute of Technology Blanchardstown (ITB).

The Monster Madness game is a legacy game and was built without localisation in mind. Due to this all of the strings that contain the text or languages are found throughout all the classes in the code. This influenced a workflow for the localisation of the game.

4.2 Approach Adopted

To create a workflow to localise the game, the first step was to decide what content of the game needed to be localised. The following is a list of the components of the game that required localisation:

- text strings appearing on line during the game play
- text for control menus
- images in the game that contain text
- sound (none)
- video (none)
- game play content (any violence or cultural issues that could be offensive, illegal or inappropriate in other locales)

After the localisation aspects of the game were defined the next stage was to look at the source code of the game. The components of the game that had to be localised had to be located in the Java source code and multimedia content of the game. The following were the aspects of the source code that needed to be localised:

- 13 Java classes in the source code contained text.
- Only the title screen contained text and a decision was made to keep it in English (as with most branded games).
- 5 menu screens contained text.

The next phase was to compose a list of options to modify the source code of the game in order to localise it. Some of these options included:

- Structure 1 - do a search and replace all of the hard coded strings, leaving the code unchanged
- Structure 2 - extract all UI text to a separate class [11]
- Structure 3 - at run time detect the locale (the language it is running in) and make the game read in the translation for the current locale from an external file

- Structure 4 - at run time detect the locale and choose the correct string embedded in the Utils.java class

The option to extract all UI text to a separate class was chosen to localise the game as it was the efficient way to handle multiple languages in one class. The next stage was to design the workflow for localisation. The workflow consisted of the following prototypes and versions of the game:

1. Prototype 1 - Version 1 - Original version of the game with unstructured code and a single language. The English text was hardcoded throughout different classes in the source code.

2. Prototype 2 - Version 2 - This version of the game had structured code and a single language. All of the UI text (English words and phrases) from the original source code was put into a new class called Utils.java.

3. Prototype 3 - Version 3 - This version of the game had structured code and multiple languages. A multi-dimensional array and index were created in the Utils.java class (hand coded) allowing for more then one language to be held in the code. The indexes allowed the user choose what language they wanted the game to run in. This version contained English, German and Spanish hardcoded into the code.

4. Prototype 4 - Version 3 - This was a variation of Version 3 using a XLIFF file (see Section 3.3).

A code generator was designed to read from the XLIFF file and output the source and target languages into a Utils.java class. This reduced the file size and download speeds of the game. If the XLIFF file was read into the game code and not a code generator the file to be downloaded to a device would increase in size and run a lot slower. The Utils.java class would have almost doubled the file size, but by keeping them in a separate class this problem was avoided. The XLIFF file was created by the use of Swordfish Translation Editor software [15]. This took in a XML document, asked the user to translate the text and outputted the XLIFF document. The XLIFF document was also hand coded, but this led to relevant information and "id" tags being omitted, therefore the use of Swordfish produced higher quality and validated documentation that the programmer could not achieve by hand coding.

5. Prototype 5 - Version 2 - This was a variation of Version 2 using a TMX file [20], [23], (see Section 3.4). A code generator and the Swordfish Translation Editor software was used in the same manner as Prototype 4.

6. Prototype 6 - Version 2 - This was a variation of Version 3 using Unicode (hand coded) to translate the game into Korean and Arabic. The operating system that was on the PC was Windows 2000.

This platform does not facilitate the input of such languages. The only solution to this problem was to install a Linux operating system (as this recognises Arabic and Korean languages) or to use Unicode. This version of the Monster Madness game used Unicode. In order to translate from English to Arabic or Korean, translate.google.com

was used. To translate from Arabic or Korean to Unicode Babelpad software was used. This encrypted each line or symbol in the target languages into a unique Unicode hexadeciamel number.
An example of Korean and Arabic phrases and their Unicode equivalent can be seen in Figure 4.

Figure 4: Example of Unicode displaying the Korean phrase "Exit" and the Arabic phrase "OK"

4.3 XLIFF (XML Localisation Interchange File Format)

XLIFF is a localisation technology standardised by Oasis in 2002. It is used as a format to exchange localisation data between many people who are involved in a localisation project such as translators and localisation Engineers [17]. XLIFF is an XML based format that allows translators to concentrate on the translation of text and for localisation Engineers to be able to intemperate that text and use it in a software project. The XLIFF document consists of two sections - a header and a body.

The header section contains relevant data such as - contact information, project phases, pointers to reference material, and information on the skeleton file. When a file is converted to XLIFF, the structural formatting is extracted and stored in a skeleton file. The skeleton file indicates where the text from any given trans-unit should be placed.

The format of this file is not defined by the XLIFF specification, so conversion tools can use any format they choose. The conversion tools should be able to recover the original source file, given the skeleton file and the XLIFF file. [17]. The body section contains trans-unit elements. These are the main elements in an XLIFF file that contain the source and target languages i.e. the localizable text and its translations. The trans-unit elements contain source, target, alt-trans, and a handful of other elements. The example of my work below shows a simple Xliff programme:

```
<?xml version = ‘ ‘1.0’ ’ encoding = ‘ ‘UTF□8”?>
<xliff version = ‘ ‘1.2’ ’ >
<? encoding UTF□8?>
<file datatype = ‘ ‘xml’ ’ original =C: Documents
and Settings n b00000652 nDesktop n Swordfish
Projects n ES Swordfish n Spanish
Translations.xml’ ’
source□language = ‘ ‘en□GB’ ’
target□language = ‘ ‘es□ES”>
<header>
<skl>
<external□file href =
‘ ‘C: n Program Files n Swordfish n skl n Spanish
Translations.xml.61214.skl’ ’/ >
</skl>
</header>
<body>
<trans□unit>
<source xml : lang = ‘ ‘en□GB’ ’>Get ready for
next level </source>
<target xml : lang = ‘ ‘es□ES’ ’>Consiga listo
para el Nivel siguiente </target>
</trans□unit>
<trans□unit>
<source xml : lang = ‘ ‘en□GB’ ’>
Game not functioning correctly. </source>
<target xml : lang = ‘ ‘es□ES’ ’>Juego que
no funciona correctamente. </target>
</trans□unit>
</body>
</file>
</xliff>
```

In the code above the trans-unit element contains an id attribute which is used determine where the segment goes in the original document. The trans-unit element contains the source and target elements. The target element holds the translated source element after linguistic review has taken place. Alt-trans elements are used to hold attributes associated with the XLIFF file such as match-quality and the tool used to produce the file. According to Raya [21] Figure 5 depicts the translation process from the original document to the XLIFF document.

The steps involved in this process are:
1. Text extraction: Separation of translatable text from layout data.
2. Pre-translation: Addition of existing translation to the XLIFF file generated in the previous step.
3. Translation: Performed by a professional translator.
4. Reverse conversion: Generation of a translated document from the translated XLIFF file.
5. Translation memory improvement: Storage of new translations in a translation memory (TM) database for later reuse.

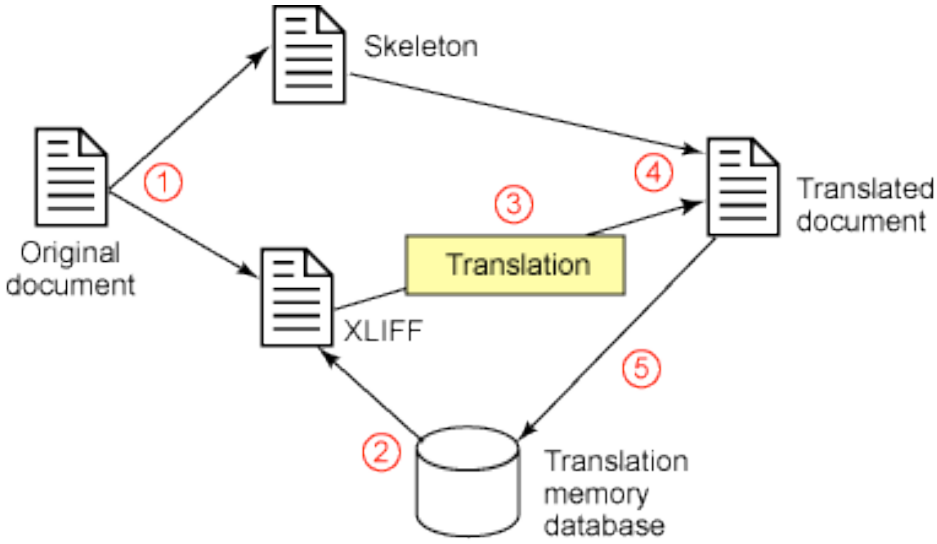

Figure 5: XLIFF Process [21]

Maxprograms Swordfish Translation Editor software was used to produce the XLIFF files. An XML document was written that contained the English (source) text to be translated. The XML document was opened in Swordfish to be converted to XLIFF. During conversion from XML to XLIFF a translator is required to translate the source language. These translations are then stored in a database in Swordfish and can be used again in the future, reducing translation times on further projects.

Some of the benefits of using XLIFF are that translators and Engineers do not have to learn many different programming languages to translate text and use these translations in various different projects. XLIFF allows for the text to be translated, extracted and used in any programming style that the user requires. This leads to a document that is structurally formatted and supports a localisation processes in almost any project or task.

4.4 TMX (Term Base eXchange)

TMX has existed since 1998 and is a certified standard format. TMX is developed and maintained by OSCAR (Open Standards for Container/Content Allowing Re-use), a LISA (Localisation Industry Standard Association) Special Interest Group. TMX is the open, XML-based standard for exchanging structured terminological data. A formal definition of TMX from the LISA website states:

"TMX (Translation Memory eXchange) is the vendor-neutral open XML standard for the exchange of Translation Memory (TM) data created by Computer Aided Translation (CAT) and localization tools. The purpose of TMX is to allow easier exchange of translation memory data between tools and/or translation vendors with little or no loss of critical data during the process. " [12]

Like XLIFF, a TMX document is divided into two sections - a header and a body. The information about the document is described in the header and the main context is described in the body. In the body there are translation unit elements <tu> that contain a collection of translations. Each translation unit contains text in one or more languages in translation unit variant elements <tuv>. The text of a translation unit variant is enclosed in a <seg> element. [12]

An example of a TMX file that was converted from XML to TMX through the use of the Swordfish Translation Editor can be seen below.

```
<?xml v e r s i o n = ‘ ‘1.0 ’ ’? >
<tmx v e r s i o n = ‘ ‘1.4 ’ ’ >
<h e a d e r c r e a t i o n t o o l v e r s i o n = ‘ ‘ 1 . 0 . 0 ’ ’
d a t a t y p e = ‘ ‘ winr e s ’ ’ s e g t y p e = ‘ ‘ s e n t e n c e ’ ’
adminl ang = ‘ ‘EN□US’ ’ s r c l a n g = ‘ ‘EN□US’ ’
o□tmf = ‘ ‘ abc ’ ’ c r e a t i o n t o o l = ‘ ‘XYZTool ’ ’ >
</ he ade r>
<body>
<tu>
<t u v xml : l a n g = ‘ ‘ en ”><seg>Winner
</ seg></ tuv>
<t u v xml : l a n g = ‘ ‘ es□es ”><seg>Gandor
</ seg></ tuv>
</ tu>
<tu>
<t u v xml : l a n g = ‘ ‘ en ”><seg>Auto F i r e
</ seg></ tuv>
<t u v xml : l a n g = ‘ ‘ es□es ”><seg>Fuego Auto
</ seg></ tuv>
</ tu>
<tu>
<t u v xml : l a n g = ‘ ‘ en ”><seg>New Game
</ seg></ tuv>
<t u v xml : l a n g = ‘ ‘ es□es ”><seg>Neuvo Juego
<seg></ tuv>
</ tu>
</body>
</tmx>
```

Some of the advantages of using TMX are that it gives the user control over the translation of the language that it is representing. It keeps consistency and quality by allowing the user to control the terminology which leads to the localized text being more likely to represent what the user wants it to. This also improves the quality of the text. It reduces the time spent on localising a product. By using TMX it allows for flexibility of the tool being used.

An example of the game running in English, German and Spanish through the use of XLIFF and TMX can be seen below.

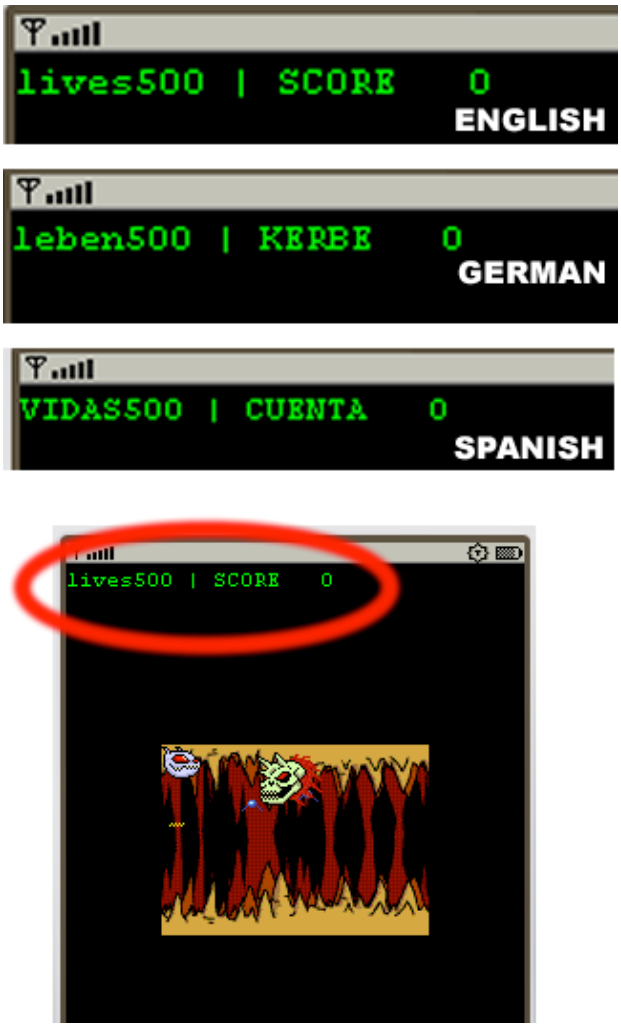

Figure 6: Monster Madness Screen Shot in English, Spanish and German

4.5 Unicode

As has been stated before, one very important factor in localisation is the displaying of international characters. If this was not taken into consideration then special characters outside the source language would have problems displaying correctly or may not display at all. Languages such as Korean and Arabic, are not recognised by Windows operating systems. To overcome this problem, one option was to use a Linux operating system (which recognises these languages) or the other is to use Unicode.

Unicode is the standard for representing text characters. Unicode provides a unique number for every character of a keyboard so for example the letter ‘a’ corresponds to the number 97 in the decimal system and 0061 in the hexadecimal system. The advantage of this system is that no matter what the platform, program, or language being used, the device will recognise the Unicode characters and be able to translate them into the required language. This is due to the fact that each language has its own Unicode.

It also enables a software product or a website to be targeted across multiple platforms, languages and countries without re-engineering. [18]. Unicode is a system that uses two bytes (16 bits) and provides a unique number for every character regardless of the programming language etc. This gives the game code the capability to display more than sixty five thousand characters in many languages including Spanish, German, Arabic and Korean. Some languages such as Arabic are referred to as bidirectional text. This text is read from right to left (RTL) instead of left to right (LTR), therefore, the device must support the capability to display text in the correct manner and accept text inputs in both directions. A screen shot of the game running in Arabic and Korean TMX can be seen in Figure 7.

Figure 7: Monster Madness Screen Shot in Arabic and Korean

5. Results

The research into the results of the localisation of the game is still ongoing. However, we have primilary results on the following:

1. Software Testing - Junit/JMUint
2. Game Testing
3. Comparison of file size and download time.

5.1 Software Testing

After the game was localised into four different languages, the first test that was applied to it was unit testing. This ensured that the code still functioned correctly after the game was localised successfully. With unit testing every class that is written by a programmer should have a corresponding unit test to test the functionality of the code [7], [14]. JUnit testing is a toolkit used for performing unit testing on Java programs. With JUnit testing there are two types of tests that can be written. One is to test a source file (a pre-written class) and the other is to write a class test for a class that has not been written (a post-written class) [16]. In the Netbeans IDE 5.5.1 JUnit examines the source file and file and generates sample test code for each method in a class. For applications, Netbeans has the capability to allow the programmer to automatically create a JUnit test for any method or class. When the test is created the programmer can modify the parameters and values to test the piece of code. For example if a calculator class was written to take in two numbers to be added together, the programmer would have create a test stub in JUnit, input two numbers into the test, run the test and check to see if it passed or failed. However, this is not the case for mobile applications.

Using JUnit for mobile applications requires a different approach. The testing principals are the same but the mobile phone application is run on an emulator and will need to be tested on various mobile phones. JUnit testing on mobile applications is conducted through JMUnit. This allows for fully automated regression testing of mobile application on an emulator and on a mobile phone. [7].

The Monster Madness game was not designed for testing with JMUnit. If every method and class were to be tested in the game, the code would have to be rewritten to facilitate the testing, which is time consuming. Due to this only one class was tested - the SmallEnemyMonsterSprite class which contains fourteen methods. The test stubs are created in the same way as Junit but a testing approach has to be decided upon for each method. This was achieved by testing each valid input to ensure that it does not throw an exception. Then the inputs were changed to force it to throw an exception. This proved that the code would run correctly under the correct conditions. In order to run JMUnit, the main programme needs to be ran and then the test-suite needs to be activated. This allows the tests to be run.

The test for the SmallEnemyMonsterSprite class can be seen below. It shows that the outcome of the test suites when all of the methods have passed successfully and also when they have failed. To rectify the fail, the JUnit test result window in the IDE shows exactly where in the code the failure occurred. This failure in the test could be due to one of the following reasons [7]:

1. An incorrect test specification
2. An incorrect design of code implement the test specification
3. A coding error in the code under test
4. A failure of other classes or methods
5. Some other reason

Once the problem is fixed the testing code should then pass successfully.

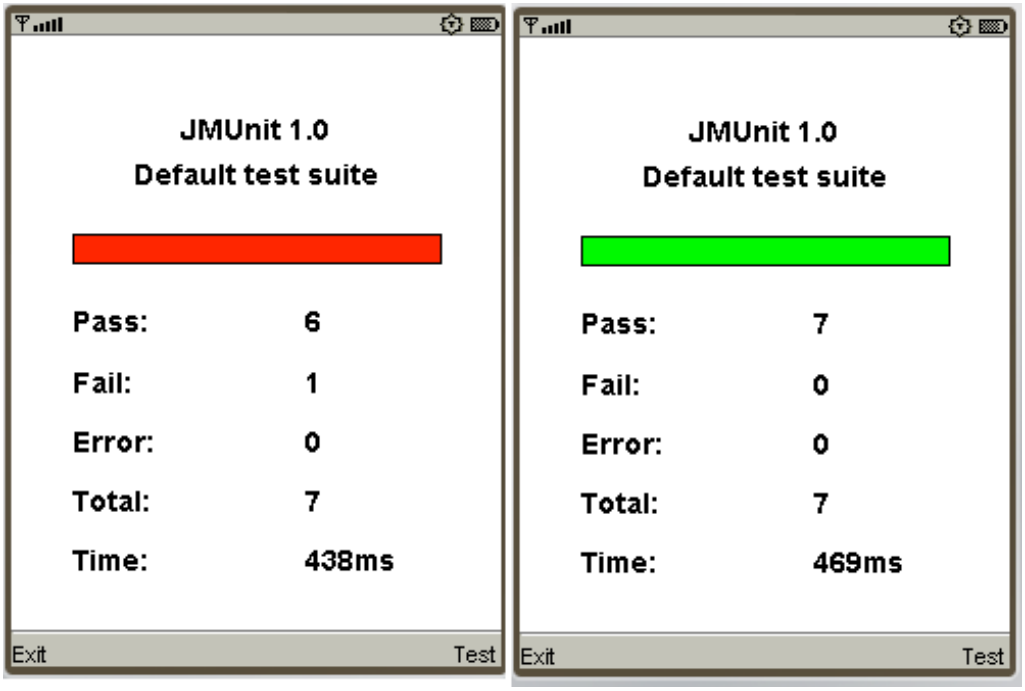

Figure 8: SmallEnemyMonsterSprite class test - Pass and Fail

5.2 Monster Madness Game Play Testing

Game Play Testing was the second test carried out on the localised versions of the Monster Madness game. This stage of testing is usually carried out by a native speaker of the language that the game is running in. Game Testing ensures that the game has been played and ran through every possible scenario that could take place in the game. The Monster Madness game was tested on the emulator and on two mobile devices - Palm Treo and Sony Ericcson W5801. All of the bugs and errors that were encountered during game play are then logged and sent to the programmer. The following conditions outline the tests that the game went through at this stage.

1. Run all version of the game to the very end.
2. Terminate all versions of the game after each level is completed.
3. Terminate all versions of the game during each level.
4. Check all sub menus of the game. E.g. Settings, High Score, About, Settings. game play tests were carried out for the German and Spanish version of the game.

Some of the problems that were encountered in the Spanish and German games are listed below. The majority of errors were untranslated text, therefore, when running the game in Spanish or German, some of the text was still in English.

1. “Back” in English
2. “New Score” in English
3. “Winner” in English
4. Monster MIDP 2 - Spelling Error
5. Help and About menus were still in English

There were also problems with the text running off the screen (concatenation). This problem was resolved by changing the phrase or text into a shorter one. Another problem that was encountered when running the game on a mobile phone and not on

the emulator was during the deploying stage. When the Spanish version of the game was deployed and ran it functioned correctly. When the German version was then deployed and ran, the High Score menu was still in Spanish. This problem was solved by changing the file name to be deployed and changing some of the code.

5.3 Files sizes and speeds

In order to deploy the game onto a mobile phone, the .jar and .jad files are sent to the device via bluetooth, infra-red, OTA (Over the Air) or USB cable. Therefore, for efficient download speeds and execution time of the game, the .jar and .jad files need to be small. One way of achieving this was to keep the XLIFF and TMX files out of the game code so when the game was compiled and ran in Netbeans these files did not get encapsulated into the .jar file, reducing it in size. This stage has not been completed and is the next phase to be tested.

6. Conclusions

This paper looked at localisation and in particular, localisation of a mobile phone game. It describes our work to help overcome the problems that may be associated with localising a mobile phone game. We found a low cost, low risk approach to achieve this goal, using localisation industry standards and technologies. We created a workflow that was developed to localise a legacy mobile phone game into four different languages - Spanish, German, Korean and Arabic.

The methodology section gave a clear and concise description of the steps that were taken to localise a mobile phone game. It also described the two industry technologies and standards that were used to achieve this - TMX and XLIFF and showed example code for both. This section also displayed the strengths associated with the use of Unicode to localise a mobile phone game into an Altaic language (Korean) and a Semitic language (Arabic). The results section of this paper outlined the software testing that was carried out on the game and the main problems that were encountered when test playing the game. It also provided solutions to fix any bugs or errors that were found in different versions of the game.

6.1 Future Work

Our aim is to expand on the work that we have done to date by increasing the capabilities of the game. This will be achieved by adding audio and graphics. The graphics will cut down on the amount of localised text to be used and reduce the amount of linguistic bugs. An arbitrary example of this would be to use a silhouette of a single player to indicate a single player and a silhouette of two players can be used to indicate a two player game. As part of the research, one of the aims is to develop a project lifecycle that mobile phone game companies can follow when developing games for localisation. This will be achieved by going back to industry (Eirplay Games) and getting feedback and recommendations on the prototypes that have been developed. This will also be achieved by evaluating the workflow of that was used for this project.

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Voice Enabled Indoor Localisation

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Abstract

The ability to track objects in real time offers a wide range of beneficial applications that include safety, security and the supply chain. The problem with location based systems is that they can be inconvenient and time-consuming to locate an object. A user has to access a computer and log onto a location system to locate an object. There are several problems with current location determination interfaces. Firstly a user has to log on to a computer; this can be inconvenient and time consuming as the user may have to locate a computer (which may be in another area of a building) and then log onto the system. The user has to look at a map that is displayed on screen to see where the object is located; the problem with this is that the user could make a mistake by looking at the wrong object or the wrong area of the building. Incorporating a voice control function into the system can solve interaction problems with some location based systems. This paper provides an overview of integrating voiceXML with an indoor location positioning system to locate objects through voice commands.

1. Introduction

Positioning is a process to obtain the spatial position of a target (Küpper, 2005). Any positioning system has at its core the measurement of a number of observable parameters. These include angles, velocity, ranges and range differences. These parameters usually measure the spatial relationship between some fixed point and the target whose position is to be determined. These measurements utilise the fundamentals of Radio, Infrared (IR) or Ultrasound signals. The positioning systems can be classified as radio-location or non-radiolocation, e.g. acoustic, optical. Position is determined by various mathematical methods including Angulation, Lateration, Dead Reckoning and Pattern Matching. For a positioning system to be implemented, various hardware and software components are needed. These physical infrastructures contain components such as Base Stations (BS) and Terminal Devices (TD). The base stations could be Satellites, GSM towers or Wi-Fi Access points. The terminals are usually small mobile pieces of hardware like a mobile phone, Wi-Fi enabled tag, laptop, PDA or a handheld GPS receiver. Other important elements of positioning systems include a Geographical Information System (GIS) database, some sort of server and/or control unit and various protocols applied between the control units and the BS and the BS and terminal devices (Curran and Hubrich, 2009).

Mobile devices are associated with network technologies that have the potential to provide user location and context cues to the services they offer. Location data alone has little value, but when it is used to expand the variety of mobile applications through timely, personalised content reactive to dynamic environments, it offers great return for very little additional bandwidth use. Integrated positioning infrastructures are those whose primary function is not positioning. This is usually some form of wireless network whose main purpose is communication. The positioning software runs on top of the standard communications hardware. A cellular network is an example of this.

The base stations (cell towers) and terminal devices (mobile phones) can facilitate positioning even though it is not their primary function. An advantage of this type of approach is that roll-out and operating costs are manageable. A disadvantage is the extra traffic produced by the positioning network. A second disadvantage is because the hardware and software protocols used for communication were not originally designed for positioning so it can be difficult to integrate a positioning system with them. Standalone positioning infrastructures operate independently of the communications networks. They use their own base stations and terminal devices. Examples include GPS satellites which are only used for positioning. In an indoor environment, systems using ultrasound or infrared are sometimes set up in locations such as airports. These systems have a number of disadvantages including high roll-out and operating costs and the need for non-standard mobile devices. In addition, communication between the positioning systems and the communications network requires separate interfaces to be designed. Advantages include more straightforward design and less competition for bandwidth from the communications network (Curran and Furey, 2007).

Positioning infrastructures may also be classified as terminal or network based. This refers to where the actual position fix is carried out. In terminal based positioning systems, all the positioning (measurement, calculations and mapping) is conducted on the mobile device. For network based positioning systems, all the measurements and calculations are conducted by the network. For both of these options, the "fix" may be sent on to the network or back to the mobile device. A third option exists where the measurements are taken by the terminal device and then uploaded to the network for processing which is known as *terminal assisted*. The type of positioning infrastructure used depends on the type of location based service to be used. If further processing of the data is to be carried out at the target location, e.g. on a laptop, then the terminal-based approach may make most sense. However, with the network based approach, upgrades to the system can be carried out without the need for new terminal devices such as phones. This can assist cellular companies with "smooth migration".

Current indoor location based systems can be prone to human error as a human has to look at a map and work out the position of an object. With a voice controlled location base system many of the disadvantages of location based systems could be addressed. The overall objective of this research is to have a voice controlled location based system. This would allow scenarios such as a user lifting a phone and 'speaking out' what object they would like to locate. The system should send the user back the location information via voice. For instance, if a user wanted to locate their laptop bag (which contained a tag) then they would lift a phone and dial a specific number to put them through to the system. Once the user is connected a voice will ask the user to state the object that they would like to locate. The system will send the location information to the user in voice output.

2. Location Determination Technologies

Radio Frequency Identification is a tracking technology that is used to track people, animals and objects. Radio Frequency Identification has three main components these are a "scanning antenna, a transceiver with a decoder (to interpret the data) and a transponder (RFIG tag) that has been programmed with information". Radio Frequency Identification works by the scanning antenna sending out radio frequency signals. These signals are used as a mean of communicating with the transponder (RFID tag).

When an RFID tag receives the Radio Frequency signals sent out from the scanning antenna it transmits its information stored on the chip so that information like tag number can be checked with a database to identify who or what has entered a particular area. Tags are a fundamental element of any location position system. There are two main types of tags, passive tags and active tags. A passive tag is one that seldom moves. A passive tag has no batteries so it relies on radio waves from an access point to power it up. This works because there is a coiled antenna inside the tag that generates a magnetic field that powers the circuits when it receives a signal. Passive tags have their disadvantages which include very short reading distances. However passive tags have lots of advantages including the absence of batteries, long tag life, cheap to manufacture and very small size. An active tag is used for tracking objects. An active tag is equipped with a battery that is used as its main source of power. It is possible to connect a tag to an external power source. Active tags are regularly used as they can be read at great distances and can improve the utility of a device. However the active tag has a lot of draw backs such as a short lifetime as the tag relies on a battery for power, cost (active tags are quite expensive to buy), the active tag is much larger than the passive tag this may limit some applications, long term maintenance costs as batteries have to be replaced, the possibility of misreads due to battery failures.

Bluetooth is a short range technology that is used to connect two devices together wirelessly (Open Wireless Protocol). Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up data being sent and transmits chunks of it on up to 79 frequencies (Ali et al., 2008). Nowadays all mobile phones and laptops have Bluetooth capabilities, which enable the transfer of files from one device to another device as well as a range of other uses. It is fundamental that devices wishing to be connected both have Bluetooth capabilities or else connection is not possible. Infrared radiation (IR) is commonly used in remote controls for TVs and other consumer electronic products (Kolodziej et al., 2006). IR-based positioning systems use short-range transmissions of modulated IR light to transmit the identity of a mobile device (tagged object) to a fixed receiver in a particular known location. Ultrasound technology is mostly used in positioning systems for improving the accuracy, as it provides the finest granularity (Kolodziej et al., 2006).

Wi-Fi works by a computers wireless adaptor transferring data into radio waves which then get transmitted by an antenna (Marshall et al., 2001). The signal is then sent to a router which then decodes the signal and sends information to the internet using a physical connection. Ultra-Wide-Band is a communication method used in wireless networking to achieve high bandwidth connections with low power utilization. UWB operates by emitting a series of extremely short pulses across a very high broad of frequencies simultaneously. The accuracy of time measurements for time-of-flight range estimations is a direct function of signal bandwidth. Particularly in the case of indoor location and short range systems in general, range, and position accuracy on the order of 1m demand pulse widths or rise times of several nanoseconds, and bandwidths of several hundred megahertz, with equivalent clock rates (Bensky, 2008).

Finally, cellular networks are a major platform for wireless location-based services (LBS). This is natural considering the widespread distribution of handsets. Position accuracy demands and the methods used for positioning are dependent on the nature of these services (Bensky, 2008). The main reason for adding location determination to cellular communication was the physical security for users. Some of the most common

location based services are navigation, identification of nearby commercial institutions, tracking objects and fleet manager and intelligent transport systems. There are two main categories that describe location based systems: Network based and Handset based. A Network-based system determines the position of a handset by cellular base system measurements. In a Handset-based location system, special software and hardware may be built into the handset to allow position determination to take place.

2.1 Location Determination Applications

There are a number of location determination applications available which often can be classified as applications for users who do not want to disclose their position to anyone else, applications for users who display their position to a selected group, or applications for users who want disclose their position to everyone.

Mappoint[15] is an example of an application for users who do not disclose their position to anyone else. It displays the user's position on a map and nearby points of interest. Dodgeball[16] is an example of an application for users who display their position to a selected group. It is used by mobile users and works by users telling dodgeball who their friends are. Then when a user is out and about they sent a text message to dodgeball with their location; dodgeball then send a text message to all their friends and reports back if there are any of their friends in the vicinity. LocateMobiles.com[17] is a service for people wishing to find the current location of their family or friends. Average accuracy of the location determination is about fifty meters albeit depending on the number of towers within the cell at the location and other factors such as interference from large buildings and the terrain.

The Skyhook hybrid positioning system (XPS) is a hybrid location determination system that uses the location data from GPS, mobile cellular masts and nearby Wi-Fi access points to calculate the position of a mobile device, such as a dual-mode mobile phone, laptop or PDA. When calculating the position using Wi-Fi, a Skyhook database is utilised that contains millions of access point records from across Asia, Europe and North America. The records are collected by a fleet of vehicles that drive around the roads detecting the signal from access points. From an access point the Media Access Control (MAC) address is read, recorded and time stamped along with the vehicle's location at the time of detection. This means that the actual physical location of an access point is not recorded but rather a signal fingerprint from the access point. Then later when required to calculate a location it is the fingerprint that is actually used not the actual access point location[18]. The use of Wi-Fi location determination technology could be utilised in a number of applications namely:

- **Prisoner Monitoring -** A system using tamper-proof Wi-Fi tags can be worn by prisoners for instance to restrict prisoners to certain areas of the prison by notifying prison wardens if prisoners enter restricted areas. This will also help to prevent escape attempts and allow prison guards to monitor prisoner whereabouts at all times.

[15] www.mappoint.com
[16] www.dodgeball.com
[17] www.LocateMobiles.com
[18] www.skyhookwireless.com

- **Child Safety -** A Wi-Fi based system could be used by children in a school, crèche or theme park environment, some of the Ekahau tags have a call-button which a child could activate if they were distressed or in need of help. The system could be configured to notify the nearest teacher, carer or park staff about the issue.
- **Indoor gaming -** A large scale version of Pac-man could be played with people equipped with tags playing the roles of Pac-man and the Ghosts.
- **Security -** If valuable equipment is no longer detected in its normal area this action could activate an alarm for the security staff and then allow them to track and find it while it is in the range of the WLAN.
- **Supply Chain -** Wi-Fi tags could be attached to product in a warehouse to enable stock or inventory level tracking.
- **Healthcare -** Patients could wear wristband tags that allow them to be tracked throughout the hospital. If a patient tries to leave without being discharged, nurses are alerted to the situation and are able to get them and return them to their ward. This would be particularly useful for patients suffering from dementia or Alzheimer's disease. Additionally, important staff may wear tags so that in an emergency situation they can be quickly located (Stantchev, 2007).

2.2 Location-based Systems

Cricket is an indoor location system for pervasive and sensor-based computing environments. Cricket provides the hardware, software based algorithms, and a software API for location-aware application running on handhelds, laptops and sensor nodes (Hjelm 2006). MIT Cricket uses both radio frequency and ultrasound signals to provide location information to both mobile devices and static nodes in a decentralized, uncoordinated architecture. Active beacons are placed on walls and ceilings throughout a building sending out Radio Frequency location information. A device such as a laptop and PDA would have passive listeners attached to them that run application software.

Place Lab uses map-based pinpointing approach. In Place Lab, each wireless access point transmits an ID which can be used to uniquely identify a particular location. Place Lab uses a device's embedded 802.11 interface, but does not rely on precalibrated fingerprints. It determines its position by using the location of access points that a device has detected.

AeroScout provide unified asset visibility solutions for healthcare, manufacturing, logistics and other industries. AeroScout's Wi-Fi positioning technologies use the wireless infrastructure to locate any standard 802.1b and g mobile station, including laptops, PDAs, bar code scanners, and RFID readers, in addition to battery-powered AeroScout tags attached to people or any other assets and equipment. AeroScout have many different products including, AeroScout MobileView and AeroScout tags. Aeroscout uses two different algorithms to determine the location of an object. These algorithms are known as TDOA and RSSI. AeroScout's Wi-Fi based active RFID tags and/or Wi-Fi devices send a brief signal at a regular interval, adding status or sensor data. The signal is received by standard wireless access points (or AeroScout Location Receivers), without any infrastructure changes needed, and is sent to a processing "engine". The engine uses signal strength and/or time of arrival algorithms to determine location coordinates, and sends location and status data to AeroScout MobileView.

2.3 Ekahau

Ekahau is a leading indoor positioning system. Their solution tracks 802.11 (Laptops, Mobile Phones, Wi-Fi tags) enabled devices. The Ekahau Positioning Engine provides a software-based system that enables location-based applications for wireless LANs. The complete positioning system includes the Ekahau Client, Ekahau Positioning Engine and Ekahau Manager. Each user device that the system tracks, such as a laptop or PDA, must be running the client software. The Ekahau Positioning Engine is Java-based server software that calculates the user device locations, and the Ekahau Manager is a platform for creating positioning models, tracking devices, and analyzing positioning accuracy (Geier, 2002). Ekahau achieves accuracy of 1 to 3 m, and calibration that requires up to 1 h/12000m^2.

Ekahau Vision is an end-user software application enabling a full asset and process visibility by turning location of assets into valuable information. It delivers the data required to streamline business processes and optimize asset utilization. Ekahau Vision application is web based and is a gateway to critical data. The Ekahau Positioning Client is a software tool for tracking mobile devices with Ekahau RTLS. The software runs as a system service. It is by default started automatically at system start-up and runs in the background. The Ekahau Positioning Client works by scanning compatible Wi-Fi-devices for RSSI-data and transmitting this data over the wireless network to an Ekahau Positioning Engine (EPE) running on a remote server. Ekahau API is a web service that can merge with enterprise systems. The tag configuration, management and locating functions can be embedded into an external application. So the users of enterprise applications do not have to learn a new system. The Ekahau Manager is a stand-alone application tool that is used for creating models of an area. It can perform site calibration, drawing and editing of rails. Site calibration is used to increase accuracy. Basically it works by walking around the area you wish to calibrate stopping every few feet so that the system can compare against the server to find out the accuracy of the system (See

Figure 1 1).

Figure 1: Calibration on Block MG Second Floor @ University of Ulster, Magee

The Ekahau planner can be used to intelligently simulate the initial access point placement settings, walls, and thus predict the expected network performance, prior to installing any Wi-Fi infrastructure (Ekahau, Planner data sheet). It provides a drag-

and-drop GUI for access point and wall placement on a facility floor map (Ekahau, Planner data sheet). The Ekahau Planner provides real-time visualizations for displaying RF coverage shown in Figure 2 and a variety of performance parameters. The software supports multiple different wall material types and antenna types for the best possible calculation of RF signal propagation (Ekahau, Planner data sheet).

Figure 2: Shows RF coverage

The Ekahau planner presents an innovative approach that streamlines Wi-Fi network design and deployment (Ekahau, Planner data sheet). It can be used to intelligently simulate the initial access point placement settings, walls, and thus predict the expected network performance, prior to installing any Wi-Fi infrastructure (Ekahau, Planner data sheet). An easy to use drag-and-drop GUI is included for access point and wall placement on a facility floor map (Ekahau, Planner data sheet). The Ekahau Planner provides real-time visualizations for displaying RF coverage and a variety of performance parameters. The Ekahau Software Development Kit (SDK) is an application that contains Java package, Javadoc, and code example for quickly connecting to the Positioning Engine (Kolodziej, 2006).

3. Voice Technologies

Interactive Voice Response (IVR) is a term for automated telephony applications. There are a lot of systems that use IVR. When someone rings an insurance company or a mobile phone company there is usually a voice asking a question. IVR applications are created by VXML. For example if a user lifted a phone and dialled a number, the application would pick up and say "Please tell me what you are looking for" The user would then say what they were looking for (e.g. Laptop Bag) The system would then go to the back end database, look up the location of the "Laptop Bag" and send the location back to the VXML application: The VXML application would then use that information to plays back "The Lap Top is located in MF124".

As shown above the system has to go to the back end of the database. The proposed system will be different in that it will be working alongside the Ekahau system and will be in real time, therefore if an object is moved it will still be possible for the user to receive a very accurate location of their requested object. A Spoken User Interface is one in which both machine presentation and user input take the form of human speech. Speech replaces the video display, indicator lights, buttons and knobs of the more traditional user interfaces. The machine presents output through digitized or synthesized speech – in effect, "reciting" information to the user-and accepts and

interprets spoken user input through the use of speech recognition technology (Becchetti and Ricotti, 1999).

When a machine speaks to a user, the spoken machine output serves five functions.

- Prompts – Indicates User must provide input.
- Feedback – Returns result of users input.
- Instructions – Help user understand task.
- Help – Instructions that will coach the user.
- Application Data – e.g., weather, stock information – that the machine states to the user as part of the application task itself (Balentine et al., 2001).

ASR technology allows an application to identify human speech. The aim of ASR research is to allow an application to recognise human speech with 100% accuracy regardless of pitch, accents and noise. Despite several decades of research in this area, accuracy greater than 90% is only attained when the task is constrained in some way. Depending on how the task is constrained, different levels of performance can be attained; for example, recognition of continuous digits over a microphone channel (small vocabulary, no noise) can be greater than 99%.

VXML technology allows a user to interact with the internet through voice recognition. Instead of a traditional browser that relies on a combination of HTML and keyboard and mouse, VXML relies on a voice browser and/or the telephone. Using VXML, the user interacts with voice browser by listening to audio output that is either pre-recorded or computer-synthesized and submitting audio input through the user's natural speaking voice or through a keypad, such as a telephone. There are a lot of similarities between VXML and HTML, for example a user would write VXML to describe to a VXML browser (or interpreter) on what to say to the caller and what to expect in response from the caller in the same way that a user would write a HTML page that IE or Firefox uses to display information to the user.

SSML is one of three types of mark-up language used to create voice enabled functionality with Internet browsers and email programs.. Sometimes used as a standalone approach, SSML is also sometimes used in tandem with Spoken Text Mark-up Language (STML) and Java Speech Mark-up Language (JSML). The ultimate goal of SSML is to provide applications that allow persons to use voice commands with various online tasks such as searching the Internet, receiving and responding to emails, and enjoying the content of various web sites. SSML applications are mainly used in conjunction with telephony applications, this type of XML mark-up provides exceptional sound clarity. Spoken Text Mark-up Language (STML) is a set of mark-up codes and symbols for text-to-speech (TTS) synthesis for voice-enabled Web browsers and voice enabled e-mail. STML provides text description tags that describe the structure of the document, and speaker directive tags that control the emphasis, pitch, rate, and pronunciation of the text (Balentine & Morgan, 2001).

The Java Speech Mark-up Language (JSML) is a text format used by applications to annotate text input to speech synthesizers. JSML elements provide a speech synthesizer with detailed information on how to speak text and thus enable improvements in the quality, naturalness and understandability of synthesized speech output (Hunt, 2000). JSML defines elements which in turn define the structure of a document,

pronunciations of words and phrases, speaking rate, speaking pitch and word emphasis. JSML is portable across different platforms, supports lots of languages throughout the world and was designed to be straight forward to learn.

4. Voice Enabled Location Determination Prototype

This system aimed at allowing users to request the location of a tagged object on campus through telephony. The first phase of this project involved creating a list of key words (e.g. laptop, Keys, MF124 etc) and linking each keyword with speech. The next phase would involve mapping the area that objects will be placed in; this will be done using Ekahau Manager. The final phase involved linking the voice keywords with corresponding tags, so that whenever a user asks where a certain object is, the response will be correct accurate. The system works as follows:

- The user makes a request to the application
- The application translate the request so it's understood by the main system
- The main system queries the database.
- The database returns the query result.
- If object does not exist the main system translates message back into voice form to the voice application
- If the object does exist then the main requests information from the location engine.
- The location engine returns requested information
- The voice application then responds to the user with relevant message

The system allows a user to not only find the location of an object but also the user can find out specific data of the object such as the charging status, the battery life, the map ID, the tag number and the MAC number of an object using VoIP calls anywhere in the world. In addition the user can connect to the application via an instant messenger client that will allow the user to interact with the application and receive the desired results effectively and efficiently; this is a great addition for user with speech problems and also allows users with mobile phones to connect to their instant messenger client and communicate with the application, anywhere and at anytime.

VoiceXML was integrated with the Ekahau SDK (Software Development Kit) for retrieving the data of objects and parsing that data to a text file. To get the real time data of the tags, the following command was run *"example –h 193.61.190.42 stream ALL >laptopinfo.txt*". This placed the real time information of the tags into a text file called "laptopinfo.txt" as shown in Figure 3.

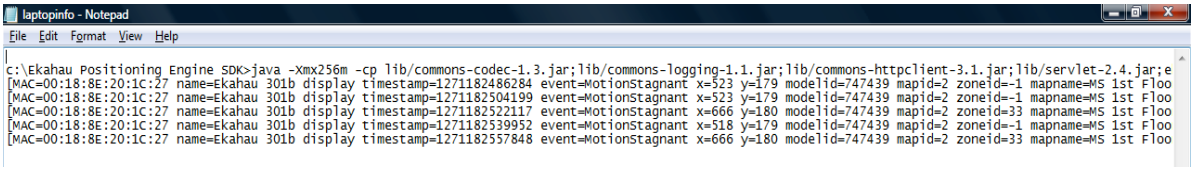

Figure 3: Data output

Now that the real time data has been saved, it must be uploaded to a hosting account before the application can utilise the data. Another way of obtaining tag data is to run a query in the browser that will produce the tag stream data such as

"*http://193.61.190.42:8550/epe/pos/tagstream?tagid=105463684135"*. This query will get the tag stream data for tag number *"105463684135"*. The output is in xml so no parsing is required. This provides all the data that the application needs, in order to produce accurate results. If the user says laptop, and then asks for the battery life, the application will read the text between <batterylevel>26</batterylevel> which is 26 and produce an output for the user.

Voxeo provide platforms and tools for developers specialising in voice and IVR applications. This application and all the files required to run it can be stored in a Voxeo developer account. The application has an instant messaging feature as well as voice interaction. We show the interaction between the application and the instant messenger client.

Figure 4: Communicating via messenger client

Figure 5: Requesting laptop battery life

Figure 4 shows the user calling the application by typing "main into the chat box". The application responds and asks the user what object they would like information on. Figure 5 shows the user requesting for the details of the battery life. The application returns the details and takes user back to the main menu.

The voice location system underwent performance evaluation as a way of testing accuracy of words. Skype was quite useful as testing could be performed for free. In summary, users found the speed of the system was acceptable. The response and interaction with the system was reasonable. A problem however was found with the accuracy of the system as some users had to repeat their input several times before the system recognised what they said. It is important to remember that speech recognition systems still have fundamental errors. Recognition errors and ungraceful error handling is currently hindering the progress of systems such a proposed here.

5 Conclusion

Common approaches to determining location were discussed in this section. GPS (Global Positioning System) is able to show ones position on the Earth mainly in

outdoor locations. GPS satellites, 24 in all, orbit at 11,000 nautical miles and float in geosynchronous orbit above the Earth. They are continuously monitored by ground stations located worldwide. GPS Receivers are cheap but the downside is that you need a line of sight to a satellite hence you need to be outdoors. Cellular Triangulation is a process by which the location of a radio transmitter can be determined by measuring either the radial distance, or the direction, of the received signal from 2 or 3 different points. The distance is determined by measuring the relative time delays in signals from the mobile set to 3 base stations. Most people carry mobile phones, however in reality most readings are quite coarse and can only be relied on to roughly pinpoint one to a geographical region. Wireless location determination systems consist of radio beacons, databases holding beacon location information and clients which estimate their location from the signal strength measurements. Leaders in the field include Ekahau, Trapeze Networks and Ubisense. It is a useful method as access points now exist in many residential and public buildings but it can be difficult to achieve accurate readings and intense planning/fingerprinting needs to be performed. RFID has seen widespread use across many different applications with the vast majority of these applications only using the data contained in tags within the reader's zone, rather than the location of the tag at any given time. Tags are quite cheap but it is relatively new and the distance for measurements can be quite restrictive. Ultra Wide Band (UWB) is precisely timed by short bursts of RF energy to provide accurate triangulation of the position of the transmitting tag. Since the short time UWB signal is very broad in frequency spread (typically 1 to 2 GHz wide) the system can operate on a very low power output and is robust against interference. It can be accurate to centimetres but deployment can be expensive and many systems only work in limited wide area spaces.

The system presented here which integrates voice and location positioning however was able to recognise interactions such as which object we wished to locate e.g. laptop or phone. It also allowed us to then speak which function (e.g. location, battery level). There is merit indeed in systems such as proposed here.

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Effective Teaching and Learning in Higher Education: A United Kingdom Perspective

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Abstract

This paper explores the current teaching and learning environment in higher education in the UK, concentrating on England. We ask: Is there a positive and supportive environment for learning and teaching in the UK? The conceptual and theoretical foundations underpinning practice in higher education teaching and learning are examined as is the support and impetus provided by government and policy. The nature of academic identities and the structure and engagement in academic development is also assessed. We pose a series of important questions within this paper, of significance to the Irish Higher Education sector.

1. Introduction

The background to this paper is based on my personal experience as a teacher and academic in the further and higher education sector in Ireland for the last 25 years. Since becoming involved in the higher education sector in Ireland in 2001 it has been apparent to me that there is little or no coherent attempt to encourage and support engagement in the study of teaching and learning or pedagogy in higher education. That is not to say there is none, however there is no sector wide body with responsibility or oversight for learning and teaching or academic development. This is in contrast to the UK where there has been a series of initiatives, developments and investment in teaching and learning that can be traced back in part to the The National Committee of Enquiry into Higher Education in the Learning Society (1997), generally referred to as the Dearing report. There is also a robust and widely recognised body of literature underpinning current policy and funding in the U.K. and finally there is an established system for academic development that underpins and supports the professional development of academics and teaching in higher education. This paper attempts to explore the linkages between these three main areas and to identify and develop possible areas for further research.

2. Method

My research into this area has been broad as I initially found it difficult to refine my ideas with regard to teaching and learning in higher education. This was in part due to the differences between the higher education systems in Ireland and the UK however there have been many relatively recent developments in this area and there is a significant body of literature to examine.

I have made use of the John Rylands Library at the University of Manchester and have also used the electronic journals link to access material through the Internet extensively. I have also been fortunate to have access to the libraries of Dublin University, Trinity College and have made use of the facilities in the Lecky, Berkeley and Ussher libraries in my search for material and information for this paper. I also had access to electronic journals in the Berkeley library however this was limited and I would have welcomed more flexible access to the Internet whilst researching there. I found the Stella

catalogue was an excellent tool in carrying out searches. In addition to my use of the libraries and electronic journals I made use of the Internet and had access to the library in the Institute of Technology Blanchardstown.

3. Guides to Effective Teaching

There are a wide range of books available to individual lecturers who wish to improve or validate their teaching and teaching practices. This type of book appears at regular intervals, for example 'Preparing to Teach', Gibb and Habeshaw (1989) from the eighties, 'Learning to Teach in Higher Education', Wilkin (1995) from the nineties, and 'The Lecturer's Toolkit', Race (2007) a more recent publication. The focus of these books is on sound, realistic and practical advice on how to teach in higher education. There is little or no attempt to venture beyond the hints and tips of classroom/lecture theatre/laboratory practices. This focus on basic hints and tips is acknowledged by Morss and Murray (2005) who maintain that some aspirant teachers in higher education don't want to explore beyond the practical nuts and bolts to consider the research and theory of learning and teaching in higher education. But to understand and reflect on what teaching in higher education means and how to improve and build on positive experiences and practice a reference point is needed. What is needed in order to embed good practice and to achieve effectiveness in teaching in higher education is a theory or theories of education. The next section examines the theoretical background of teaching in higher education in the UK today.

4. Teaching, Learning and Understanding

The main conceptual framework or theories of learning underpinning UK higher education at present are referred to by Haggis (2003); Marshall and Case (2004) as 'approaches to learning'. This framework has its roots in research carried out by Marton and Säljö in the 1970s. The approaches to learning research is now widely accepted in the UK and farther afield especially in Australia, but is not without its critics. This section of the paper looks at the main features and ideas that characterise approaches to learning research and also considers some of the criticisms of these approaches.

4.1 Outcomes and process of learning

In the past number of decades research into teaching has focused on understanding learning and understanding understanding. Research has also focused on the student and can be said to be student focused. An important study into learning was taken by Marton and Säljö (1976a). This study examined the link between the quality of the learning outcome and the process of learning. This study brought into focus and use the terms surface-level learning and deep-level learning or simply surface learning and deep learning. Much of the research into learning outcomes prior to this period was based on, or described learning in quantitative terms, for example the total number of correct answers in a test. Research has since focused on the qualitative nature of learning. The study by Marton and Säljö (1976a) of university students found basically two different levels of processing (learning), surface-level and deep-level that correspond to different aspects of the learning material on which the learner focused. A second study, Marton and Säljö (1976b) highlights the link between the level of learning adopted by the student and the level of understanding reached. Deep learning shows a greater level of long-term retention. Marton and Säljö (1976b) conclude that

learning can be 'technified' (their emphasis) when task demands become predictable. Learning in these circumstances risks being reduced to a search for the type of knowledge expected on the test. These findings have implications for teachers when designing, delivering and assessing academic programmes as the delivery and assessment of students may be interpreted as requiring mainly the recall of factual information (surface-level) to the detriment of a deeper level of understanding.

Lindsay (2004) questions the validity of the research into deep and surface learning by Marton and Säljö drawing attention to the use of unstandardised interviews, a lack of clear criteria for classifying students as deep or surface learners, classifications being made by the interviewer/investigator, and no information at all about other relevant variables such as the intellectual ability of participants, or their competence with the narrative techniques that allow meaning to be communicated to interviewers. Webb (1997) draws attention to a lack of rigour and scientific research in studies on deep and surface learning and questions its applicability in non western cultural contexts.

However it is perhaps the qualities of the deep/surface metaphor that make it appealing and practical and explain why it has achieved its foundational status within higher education research, practice and development. What is undeniable is that these studies and their findings are significant and form the basis of approaches to learning research in higher education that have achieved such widespread acceptance in the UK.

4.2 Illustrating the learners approach

To illustrate the distinction between two different types of learners, both Prosser and Trigwell (1999) and Biggs and Tang (2007) present mini-situational case studies. The approaches adopted by students are divided into two contrasting approaches to learning, deep and surface. In a deep approach to learning, students aim to understand ideas and seek meanings. They have an intrinsic interest in the tasks and an expectation of enjoyment in carrying it out. Overall they have a focus on the meaning in the argument, the message, or the relationships, Prosser and Trigwell (1999), deep approaches generate high-quality, well-structured, complex outcomes and commitment to the subject, Ramsden (2003). In the examples given by Prosser and Trigwell (1999) and Biggs and Tang (2007) the students who adopt a deep approach seek meaning and understanding in their approaches to learning, they are intrinsically motivated and are prepared and actively engage in the classroom. In contrast, students who adopt a surface approach to learning take a pragmatic approach, seeking to meet the demands of the task with minimum effort. Surface approaches lack insight and understanding and the qualitative nature of the learning that takes place with this approach is characterised by an inability to relate previous knowledge to new knowledge, organize structure and content into a whole and retain knowledge over longer periods. The deep and surface approach has been dramatized in a presentation by Brabrand (2006) which helps to illustrate the difference in approach to learning adopted by deep learners and surface learners.

The examples given and drama presented illustrate clearly the deep/surface metaphor. Webb (1997) identifies the simplicity, universality and power of this metaphor and how this makes the message appealing, practical and generalisable. However the simplicity of the metaphor belies its shortcomings as highlighted by Haggis (2003) who questions the attempts to develop generalisations and argues that the model is acting as a normative paradigm with ideas falling outside or challenging the foundations of the

paradigm becoming invisible. This is an important criticism as it highlights the narrow focus of approaches to learning research.

4.3 The learners approach to learning

The literature on teaching effectiveness in higher education reflects the research and thoughts about the qualitative aspect of teaching and the focus on learning and understanding. Effective teaching in higher education is focused on the learner. Learning is about how we perceive and understand the world, about making meaning, Marton and Booth (1997), as cited in Fry, Ketteridge and Marshall (2003). Learning may involve mastering abstract principles, understanding proofs, remembering factual information, acquiring methods, techniques and approaches, recognition, reasoning, debating ideas, or developing behaviour appropriate to specific situations. Understanding learning is a starting point in much of the literature.

Differences with which learners approach learning or come to the learning situation is one of the central themes adopted by Prosser and Trigwell (1999). Motivation, attitudes and expectations of learners and their experiences both prior to the learning situation and during the learning situation are identified as key considerations. In addition prior conceptions of a subject and the students' conceptions of the nature of the subject matter they study are closely related to the students' orientations to the study of that subject matter.

Setting the stage for effective teaching as discussed by Biggs and Tang (2007) requires an understanding of what motivates students and determining whether that motivation is intrinsic or extrinsic. Students' expectations of success or failure and the teachers' role in managing those expectations are also important. Biggs and Tang (2007) highlight the powerful effect that teacher feedback can have on students' expectations of success and the importance of engaging students based on how they are motivated (intrinsically or extrinsically). Previous knowledge and experience of students will have an influence on learning. The increasing heterogeneity and diversity of students coming to higher education even when compared to the 1980s impacts on this previous knowledge and experience Entwistle (2009). Rapid expansion in higher education has provided opportunities for social groups previously excluded from higher education as well as ethnic minorities who bring with them different cultural beliefs and attitudes. Increasing access for students with disabilities has also added to the heterogeneity and diversity of learners and created a more varied and richer mix of experience among students. These changes will cause additional problems for academic staff Entwistle (2009: p 18). How students' approach learning will affect how they learn and the qualitative nature of their learning.

There are differences in the approaches to learning adopted by learners and the effective teacher should be aware of what these differences could be and how they can come about. Through the concept of approach to learning we can begin to unlock the puzzle of poor-quality learning Ramsden (2003: p 60).

The underlying methodology employed by the above researchers is phenomenography. Phenomenography is an empirical study of the limited number of qualitatively different ways in which we experience, conceptualise, understand, perceive, apprehend, etc. various phenomena and aspects of the world around us Prosser and Trigwell (1999). Marton (1981) describes phenomenography as research which aims at description,

analysis, and understanding of experiences; that is, research which is directed towards experiential description. Svenson (1997) describes phenomenography as "describing conceptions of the surrounding world" (p 163). The descriptions of conceptions were/are developed to get descriptions of knowledge in research on student learning and are based on the assumption that knowledge fundamentally is a question of meaning in a social and cultural context Svensson (1997). As stated above phenomenography is the main underlying methodology and theory of knowledge in approaches to learning research. The next section looks at theories and approaches to teaching based on these methodologies and theories, followed by criticism and discussion of the shortcomings of these approaches.

4.4 The teaching perspective

Ramsden (2003: pp 85 - 86) addresses some of the "myths surrounding teaching in higher education" including, the illusion that good teaching in higher education is an elusive, many-sided, idiosyncratic and ultimately indefinable quality. He also challenges the belief that there are no better and worse ways of teaching or, no general attributes that distinguish good teaching from bad. There are two prevalent misconceptions about teaching in higher education, the first being that teaching at higher level consists of presenting or transmitting information from teacher to student, or demonstrating the application of a skill in practice and secondly that students in higher education must not be too closely supervised, lest the bad habits of dependent learning they are supposed to have acquired at school are reinforced. A combined focus on the teacher, their teaching strategies and transmission of information to students is generally referred to as a 'teacher-centred' focus on teaching, while a combined focus on students, their learning, development and conceptual understanding is generally referred to as a 'student-centred' focus. A teacher centred focus is consistently seen across the range of studies as constituting a less sophisticated understanding of teaching than a student-centred focus, and is regarded as less likely to produce high-quality learning outcomes amongst students Åkerlind (2007). Ramsden (2003: pp 86 – 87) identifies the important properties of good teaching, seen from the individual lecturer's point of view and distils them into 6 principles of teaching outlined below:

Principal 1 Interest and explanation
Principal 2 Concern and respect for students and student learning
Principal 3 Appropriate assessment and feedback
Principal 4 Clear goals and intellectual challenge
Principal 5 Independence, control and engagement
Principal 6 Learning from students

These principles reflect a belief that good teaching starts with an attempt to identify with the student, trying to understand what the student perspective on learning is and designing and delivering teaching that improves the quality of student learning. Ramsden (2003) describes three theories of teaching to illustrate what he believes effective teaching is:

Theory 1: Teaching as telling or transmission
Theory 2: Teaching as organising student activity
Theory 3: Teaching as making learning possible

These theories are summarised in the table below:

Table 1. Theories of university teaching

	Theory 1 Teaching as telling	Theory 2 Teaching as organising	Theory 3 Teaching as making learning possible
Focus	Teacher and Content	Teaching techniques that will result in learning	Relation between students and subject matter
Strategy	Transmit information	Manage teaching process; transmit concepts	Engage; challenge; imagine oneself as the student
Actions	Chiefly presentation	'Active learning'; organising activity	Systematically adapted to suit student understanding
Reflection	Unreflective; taken for granted	Apply skills to improve teaching	Teaching as a research-like, scholarly process

Source: Ramsden (2003: p 115)

Biggs and Tang (2007) adopt a similar approach to theories of teaching or as they describe, levels of thinking about teaching. They also present three levels of teaching which correspond to a sequence in the development of teachers' thinking and practice;

> **Level 1.** Focus: What the student is
> At level 1, teaching is didactic – the teacher transmitting information to the student. Referred to as a 'blame the student' theory of teaching.
>
> **Level 2.** Focus: what the teacher does
> At level 2, teaching is didactic however the focus is on the teacher not the student. Biggs and Tang (2007) believe level 2 is also a deficit model, the 'blame' this time being on the teacher as they are lacking the skills and competences to be good teachers.
>
> **Level 3.** What the student does
> Here teachers focus on what the student does and how that relates to teaching. This is a student centred model of teaching, with teaching supporting learning. Expert teaching includes mastery over a variety of teaching techniques, but unless learning takes place, they are irrelevant; the focus is on what the student does and on how well the intended outcomes are achieved.

Level 3 teaching as espoused by Biggs and Tang (2007) marks the distinction between the type of teacher or teaching typified in the teaching guides books identified earlier and teaching that focuses on the student and how well the intended outcomes are achieved. This implies a view of teaching that is not just about facts, concepts and principles to be covered and understood, but also to be clear about.

1. What it means to 'understand' content in the way that is stipulated in the intended learning outcomes.

2. What kind of teaching/learning activities are required to achieve those stipulated levels of understanding?

Both Biggs and Tang (2007); Ramsden (2003) take a similar view of approaches or 'theories' of teaching. They both believe that effective teaching requires an understanding of how the student learns and how to achieve the intended learning outcomes. They both focus on the student and what the student does. Prosser and Trigwell (1999) contend that good, or effective, teaching is about creating contexts which make learning possible. Good teaching is about:

- Teachers developing a coherent and well-articulated view of what they are trying to achieve and how they are planning to achieve that outcome
- Teachers discovering the variation in the ways students perceive the planned learning context
- Working towards bringing their students into relation with, and understanding of that articulated view. Prosser and Trigwell (1999: p 11)

This is in contrast to views that good teaching is about presenting and structuring content or, developing good teaching skills or, flexible delivery or, giving student's choice. Students do not live in an 'objective' world but in an experienced world Prosser and Trigwell, (1999: p 59). The learning and teaching issue is not that of how the teacher has designed and constructed their subjects and courses, but rather how their students perceive and understand the way they have designed and structured them. This means that teachers need to take a student perspective on teaching.

Some academics seem to take the role of the teacher rather for granted according to Entwistle (2009: p 74). They see teaching in terms of conveying information and ideas to students in the ways conventionally accepted within their subject area. But 'good teaching' (his emphasis) also depends on explaining ideas in ways that are accessible to most of the students and monitoring how much has been understood.

The essential difference between contrasting approaches to teaching Entwistle (2009: p 75) is in the relative attention given to the subject matter seen from the teachers' perspective and to the activities that best support learning as experienced by the students. Seen from the teacher's perspective alone, the intention is to convey information as efficiently as possible but, if we introduce the student's perspective, this shifts the focus towards encouraging both active learning and conceptual change. The distinction can be seen, in its simplest terms, as a contrast between teacher-focused and student-focused approaches to teaching rooted in contrasting ways of thinking about teaching and learning.

Entwistle (2009) illustrates his thoughts about 'good teaching' in the following figure 1. The figure shows how a sophisticated conception of teaching and learning brings together knowledge and feelings, and links them together in thinking about the subject matter, teaching activities and relationships with the students. Entwistle (2009) also acknowledges the differences that each student brings to the learning situation which reflects the views of Prosser and Trigwell.

These ideas and theories outlined above have found general acceptance in UK higher education circles, however there are several criticisms of the methodological and theoretical bases of the approaches to learning research. Lindsay (2004) states that the theoretical framework adopted by both Biggs (2003) and Ramsden (2003) is simply dogma. Lindsay (2004) is also critical of phenomenography as is Webb (1997) who suggests that the 'qualitative' nature of the research is undeveloped and lacking the hermeneutical values usually associated with human as opposed to positivist science.

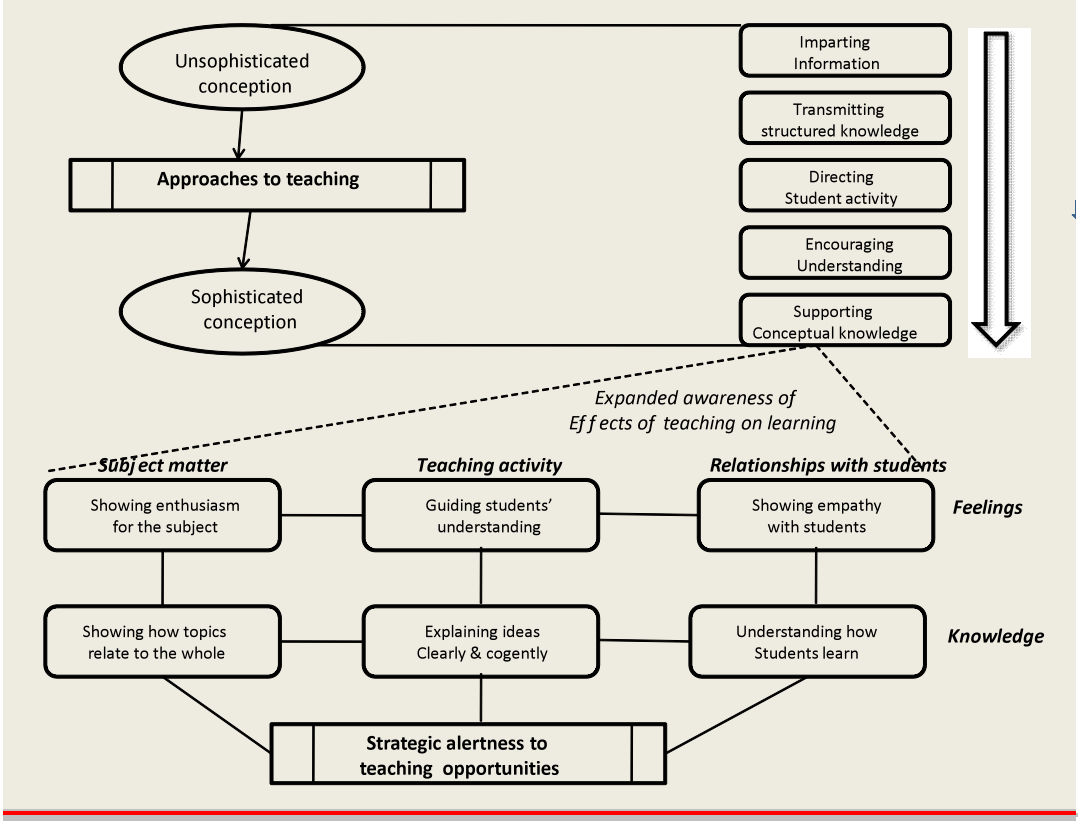

Figure 1: Approaches to teaching and aspects of a sophisticated conception
Source: Entwistle (2009: p 76)

As stated above Lindsay (2004) questions the validity of the studies of Martin and Säljö (1976a, 1976b) and also with regard to Biggs (2003) and Ramsden (2003) questions the conceptual basis of what he disparagingly labels "educational developmentology, ED". Lindsay (2004) argues that there is a need to provide practitioners with appropriate conceptual tools to develop real theories, dismissing ED as being a nostrum and dogmatism rather than science.

Malcolm and Zukas (2001) argue that the current literature and discourse in 'teaching and learning' in the UK takes a too narrow and technicist view. They advocate the building of 'conceptual bridges' between understandings of the social and political context of higher education, epistemological inquiry, and discussions on teaching and learning. Haggis (2003) also calls into question the epistemological clarity of the model and its scientific rigour and also highlights a failure to take account of wider, more social perspectives on learning. Haggis (2003) maintains the approach has created a narrow conception of the problems of the field.

There is much validity in the criticisms outlined above, particularly with regard to the apparent lack of a link to established education research and theory. A link between research and teaching in higher education would place the theories and approaches in context with regard to the two major families of contemporary learning theory, neo-behaviourism or behaviourism and cognitive theories, Bigge and Shermis (1999) and provide the conceptual tools as identified by Lindsay (2004) above. Gredler (2001) describes three trends in theory from the 1950s; the first from 1950 to the mid 1970s was the shift from laboratory research to instructionally relevant research. The second

from the mid 1970s to the 1990s was the rise of cognitive psychology and overlapping this trend from the mid 1980s was the rise of social, cultural and personal factors in learning. As a result of the narrow focus of the approaches to learning research there is no consideration of important developments in learning theory especially with regard to the social and cultural aspects and theories of learning such as Vygotsky, Bandura and Lave and Wenger. Van der Aalsvoort and Herinck (2000) state that social interaction and its role in contributing to learning outcomes should not be underestimated. Lave and Wenger (1991) in particular with their theories and concepts such as communities of practice have great relevance in higher education and higher education research. Lave and Wenger (1991) see learners as moving towards participation in the sociocultural practices of a community. Their concept of legitimate peripheral participation provides a framework for a theory of learning as a dimension of social practice.

These limitations are highlighted by Haggis (2009) who states that even in the 2000s, a great deal of discussion about learning in higher education is still focused upon the same basic questions that arose in the 1970s:

- What can we discover about how individuals learn?
- What are the implications of our knowledge about individual learning for classroom teaching and curriculum design?
- How can we get students to take a deep approach to learning the content of our curricula?
- What is going on outside the classroom which might impact upon learning outcomes?

Despite the limitations and problems identified, the theories and methodologies discussed are not without relevance or value. They provide a base on which more robust and rigorous scientific research could be built and a platform on which to broaden research into areas that will enhance the conceptual basis of the theories. The value and usefulness of these theories is illustrated in the next section which examines models for teaching and learning based on these theories and methodologies.

4.5 Models for teaching and learning

To validate and give meaning to their theories and thoughts about teaching and learning the authors outlined above provide frameworks and structures within which their theories can be applied. Without such structure and frameworks these theories would be little more than observations on teaching, learning and understanding.

Biggs and Tang (2007 p 52) outline an approach to teaching called constructive alignment. It is 'constructive' because it is based on the constructivist theory that learners use their own activity to construct their knowledge or other outcome. The intended outcomes specify the activity that students should engage if they are to achieve the intended outcomes as well as the content the activity refers to, the teacher's task being to set up a learning environment that encourages the student to perform those learning activities, and then assess the outcomes to see if they match those intended. The alignment in constructive alignment reflects the fact that the learning activity in the intended outcomes needs to be activated in the teaching if the outcome is to be achieved and in the assessment task to verify that the outcome has in fact been achieved.

In constructive alignment we see that the learners prior experiences, prior understanding and conceptions of learning are considered when designing the intended learning outcomes and considering what activities the learners will engage in, this is then aligned with the teaching and learning activities and with the assessment task.

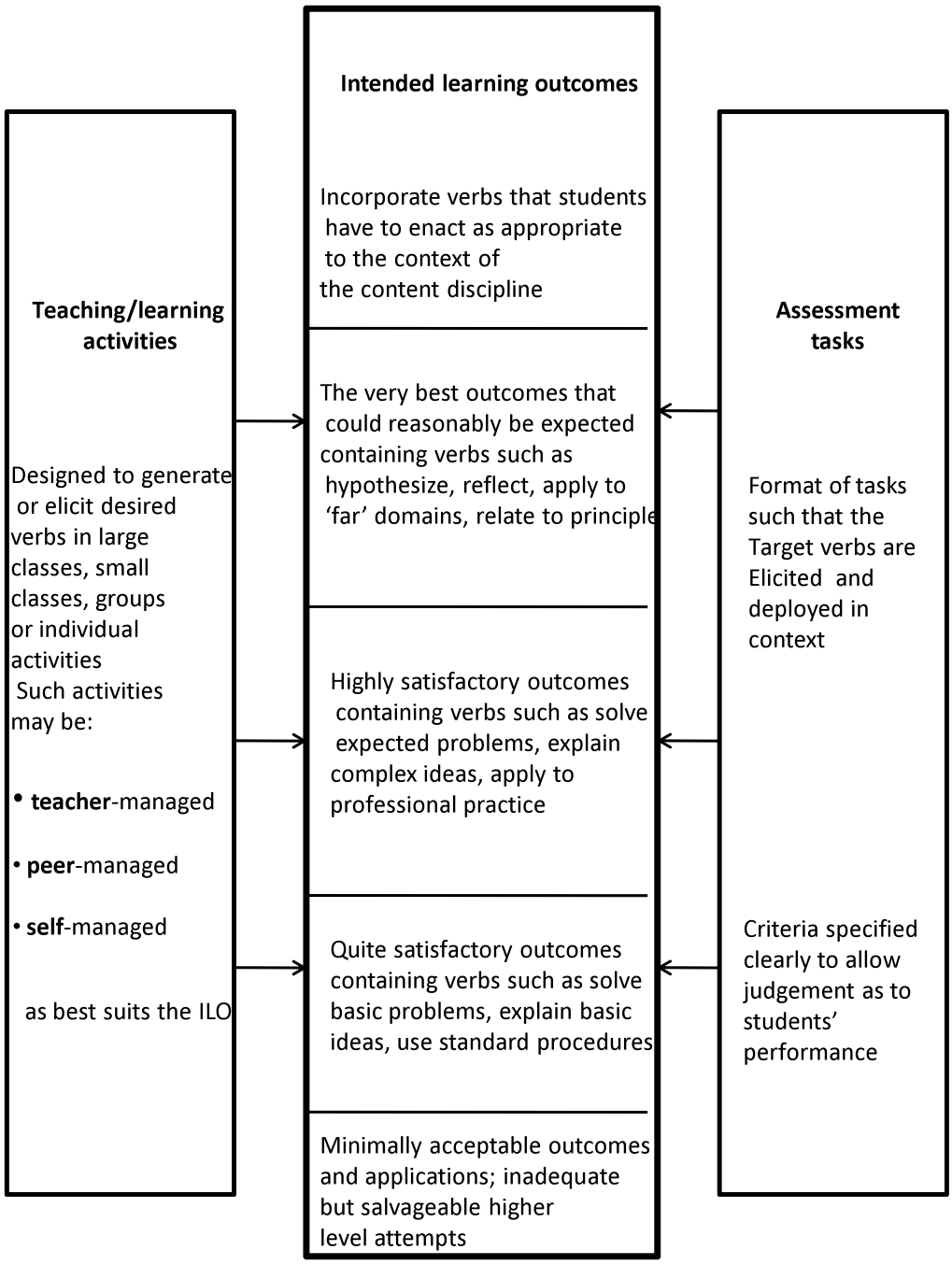

Figure 2. Aligning intended learning outcomes, teaching and assessment tasks
Source: Biggs and Tang (2007: p 59)

Ramsden's (2003) approach is to address the design for learning and he does this by posing questions around problems to be overcome. These problems are the problem of goals and structure, the problem of teaching strategies and the problem of assessment. Again these questions or problems mirror to a greater or lesser extent the components

as identified by Biggs and Tang (2007). Ramsden (2003) addresses the question/problem of goals and structure by considering expectations of the student in a general sense; he then discusses content, aims and objectives. The question/problem of teaching strategies considers the importance of deep approaches to learning and selecting an appropriate method of teaching. The question/problem of assessment is a critical one and one which is often misunderstood. Fundamentally assessment is about helping students to learn and teachers to learn about how best to teach them. Case studies of effective practice are given to illustrate the proposed framework.

In addition to considering the questions/problems outlined above Ramsden (2003) addresses the question/problem of evaluating the effectiveness of teaching in a reflective way as part of the structure and framework for implementing his theories and finally considers the question/problem of accountability and educational development. Here the discussion is centred on creating an environment that encourages the underlying principles of good learning and teaching in higher education. The importance of good academic management and leadership is stressed as are coherent policies for the encouragement of good teaching. Another important dimension is the context and process of educational development where there is a shift away from a simplistic way of understanding teaching to a more complex, relativistic and dynamic one. Here the application of theoretical knowledge is integrated with the practice of teaching. This model implies recognition that learning how to teach is a process that never ends.

Prosser and Trigwell (1999: p 166) do not propose or identify a framework or model for teaching, rather they propose principles of practice arising from their view of learning. They articulate these principles in a two dimensional table which provides a summary of their research into students' prior experience, perception of the learning situation, their approach to study and the student's learning outcome as a basis for practical development of learning and teaching contexts. It is noted that the issues highlighted in the table are not meant to be guidelines for, or provide templates or recipes for good practice, but to highlight those aspects which teachers need to maintain in the foreground of their awareness when designing or redesigning learning and teaching contexts in higher education. This reflects the overall theme of their book which emphasises the need to understand how students understand and that teaching methods and assessment methods must reflect this and is a continually changing process. Effective teaching requires teachers to continually research their students and their students learning if they are to be student centred.

Table 2. Analysis of principles of practice

Aspect	Variation in aspect	Relationship between aspects	Situation evocation	Learning outcomes
Student's prior experience	Students enter our learning and teaching situation with substantial qualitative variation in their prior experiences of learning and teaching	These prior experiences of learning and teaching are related to specific prior situations in which those experiences occurred	A new learning and teaching situation they find themselves in evokes certain aspects of these prior experiences, the aspects evoked being related to the congruence between the previous situation and the new situation	The aspects evoked have a subsequent substantial impact on what and how students learn in the new situation
Student's perception of learning situation	Students have substantial qualitative variation in the way they perceive their learning and teaching situation	This variation in perceptions is related to their prior experiences of study and present approaches to study	In a new learning and teaching context, different students focus on or perceive different aspects of their situation in that context	The aspects focused on or perceived are related to their approach to study in integrated or disintegrated ways, the nature of this relationship being fundamentally related to their post conceptual understanding sand achievement
Student's approach to study	In the same learning context, there is qualitative variation in the way students approach their learning	This variation in approach is related to students' perceptions of the learning situation and their prior experiences of learning	Different teaching/learning situations evoke different approaches to learning	The way students approach their learning is fundamentally (not just empirically) related to their learning outcomes. For example, if they do not seek to understand, then they do not find understanding
Student's learning outcome	In the same learning context, there is qualitative variation in the outcome of students' learning	This variation in outcome is related to students' perceptions of the learning situation, their prior experiences of learning and their approach to their learning	Different teaching/learning situations evoke different learning outcomes	The quality of students' learning is fundamentally related to their ability to draw on their understanding in new and abstract situations

Source: Prosser and Trigwell (1999: p 167)

As stated above these models and frameworks validate and give meaning to the ideas and theories of approaches to learning research. In their questioning of the dominance of explicitly psychological versions (particularly humanistic and cognitive models) of the learner and teacher Malcolm and Zukas (2001) suggest a link to 'Governments' new found enthusiasm for evidence-based practice' Malcolm and Zukas (2001: p 35). Government motives are also alluded to by Lindsay (2004) in his review and critique of the books of both Biggs (2003) and Ramsden (2003). Haggis (2003) also sees links to government policy issues through the monitoring activity of the Quality Assurance Agency (QAA) and the provision of evidence for 'evidence based' policy. There are undertones of suspicion and opposition to managerialism, Deem, Hillyard, and Reed (2007) in Malcolm and Zukas (2001); Haggis (2003); Lindsay (2004).

4.6 Summary of teaching, learning and understanding

Given the criticism and limitations of approaches to learning theories it is evident that there are many questions about the applicability and relevance of this research. However, as noted by Case and Marshall (2005) it is nevertheless a powerful framework with which to make sense of aspects of student learning situations. Rather than discarding these approaches and theories Case and Marshall (2005) argue that other perspectives have the potential to enrich and extend it and in so doing address some of the valid critiques levelled against it. Malcolm and Zukas (2001) advocate the

building of 'conceptual bridges' between understandings of the social and political context of higher education, epistemological inquiry, and discussions on teaching and learning. Malcolm and Zukas (2001); Haggis (2003) conclude by calling for a broader academic debate on the nature of the educational transaction rather than an outright dismissal. This debate would include current conceptions but also would include a critical understanding of the social, policy and institutional context of learning and teaching.

The following section examines the policy/institutional structures and environment with regard to effective teaching in higher education. It looks at developments over the past two decades with regard to supporting excellence in teaching in higher education and analyses the impact of changes and developments.

5. Policy Considerations

In considering effective teaching in higher education, or in education in general, the importance that is given to and the esteem in which effective teaching is held by stakeholders is useful in gauging both its acceptance and its adoption in practice. The stakeholders that have the greatest influence are the government and policy makers, the higher education institutes and finally academics themselves. This section of the paper explores the policies, institutions and structures within which effective teaching in higher education is promoted and fostered.

5.1 Government, Policy Makers and their Agents

Universities in the UK are publicly funded bodies with considerable autonomy. They are legal entities, with overall responsibility for the sector lying with the appropriate government department. The Higher Education Funding Council for England (HEFCE) was established in 1992 to exercise funding direction within the context of Government policy. Each year the Secretary of State 'advises' the HEFCE as to the policy shifts the Government wishes to see, and the major changes in policy and structural arrangements are introduced through legislation Layer (2002). Today the HEFCE works within a policy framework set by the Secretary of State for Business, Innovation and Skills, but not as part of the Department for Business, Innovation and Skills (BIS). The HEFCE has distinct statutory duties that are free from direct political control HEFCE (2010). The policies, planning and strategy of the universities therefore act as a yardstick by which commitment to effective teaching can be gauged. The role of government, policy makers and government sponsored agencies in the promotion and fostering of effective teaching and learning is examined below.

5.1.1 UK Government Reports

The report of The National Committee of Enquiry into Higher Education in the Learning Society (1997) generally referred to as the Dearing report has had a significant impact on teaching and learning in higher education. The Dearing report outlined a vision for higher education over the following 20 years and articulated this vision in the wider economic and social context in which it operates. The report states that the United Kingdom will need to develop as a learning society. In that learning society, higher education will make a distinctive contribution through teaching at its highest level, the pursuit of scholarship and research and increasingly through it contribution to lifelong learning. The linking of research, scholarship and education is identified as being a way in which the distinctiveness and vitality of higher education

can be maintained. The report explicitly states that one of the visions for higher education is to be at the leading edge of world practice in effective learning and teaching.

The report identifies increasing student numbers not supported by a proportionate increase in funding as being potentially problematic in achieving the objective of excellence in teaching and also commented that despite significant changes to structure, traditional teaching methods still prevail. This raises questions about lack of expertise, and/or a lack of readiness, and/or a lack of trust or belief in alternative methods of teaching and also points to a need for training/development in education for teachers/lecturers in higher education.

Further observations in the report point to a lack of real and perceived support for effective learning and teaching or to encourage excellence in teaching envisioned by the report:

> "a number of those offering us evidence commented on the irony that, in institutions devoted to learning and teaching and to the advancement of knowledge and understanding, so little attention is paid to equipping staff with advanced knowledge and understanding of the processes of learning and teaching." (Dearing, 1997: 3.41)
>
> "With certain exceptions, staff perceive promotion opportunities and financial rewards to be associated with long service or research excellence, and not with excellence in teaching, in spite of many institutions stated commitment to consider research, teaching and administration." (Dearing, 1997: 3.44)

The report also recognises that there are few funding incentives to encourage teaching excellence (Dearing, 1997: 3.92) and that Higher Education Institutes are drawn towards the Research Assessment Exercise (RAE), because it is "one of the few opportunities for securing additional funding". It could also be argued that the RAE draws energy away from teaching insofar as funds are awarded on the basis of research active staff and research outputs, Queen's University Belfast (2010). There is no benefit to be gained from the RAE for excellence in teaching. This policy of rewarding excellence in only a limited range of activities, particularly research, has encouraged all institutions to try to achieve in those activities. (Dearing, 1997: 3.117)

The report recommended the establishment of an Institute for Learning and Teaching in Higher Education (ILTHE). This Institute was launched in 1999 Evans (2001) and has since merged with the Learning and Teaching Support Network (LTSN), and the Teaching Quality Enhancement Fund (TQEF) National Co-ordination Team (NCT) to form the Higher Education Academy (HEA). The report recommended that with regard to the ILTHE that institutions of higher education begin immediately to develop or seek access to programmes for teacher training of their staff, if they do not have them, and that all institutions seek national accreditation of such programmes from the ILTHE (Dearing, 1997: Recommendation 13) and additionally that it should become the normal requirement that all new full-time academic staff with teaching responsibilities are required to achieve at least associate membership of the ILTHE for the successful completion of probation (Dearing, 1997: Recommendation 48). This points to a

recognition of the importance of learning and teaching in higher education and recommendations as to how the recognition and professional development of teaching in higher education could be achieved.

The later report, The Future of Higher Education DfES (2003), a government white paper presented by then Secretary of State for Education and Skills, Charles Clarke, in January 2003 also recognised the importance of teaching and learning and made proposals to link funding to strength in teaching, proposed reform to support improvements in teaching quality in all institutions, new professional standards for teaching in higher education and the celebration and reward of teaching excellence. The white paper created impetus for the Higher Education Academy and made proposals with regard to centres of excellence in teaching and increasing the size of the National Teaching Fellowship Scheme.

The Future of Higher Education report mirrored the Dearing report in recognising the stronger link between performance in research and promotion.

> "In the past, rewards in higher education – particularly promotion – have been linked much more closely to research than to teaching. Indeed, teaching has been seen by some as an extra source of income to support the main business of research, rather than recognised as a valuable and high-status career in its own right. This is a situation that cannot continue. Institutions must properly reward their best teaching staff; and all those who teach must take their task seriously." (DfES 2003: p 51)

The Future of Higher Education report is probably best remembered as the white paper that led to the Higher Education Act 2004 and the controversial changes in funding in higher education and the operation of tuition fees, replacing the up-front fixed fee. In addition to the more controversial aspect of the white paper it also restated government support for the enhancement and recognition of excellence teaching in higher education and endorsed the recommendations of the Teaching Quality Enhancement Committee for the creation of a new unitary body to oversee quality enhancement of learning and teaching in higher education (TQEC, 2003). This new unitary body was to become the Higher Education Academy (HEA).

Both of the main contemporaneous reports discussed above have had a significant impact on the structure of higher education in the UK. With regard to teaching in higher education much of the infrastructure has been directly influenced by the findings and recommendations of these reports. This would indicate a level of effectiveness and success in achieving change. The bodies discussed below have been successful in raising the profile of teaching in higher education. However, questions still remain with regard to the status of teaching relative to research. Recently Clegg and Smith (2010) state that the highly selective approach to research assessment puts pressure on researchers to concentrate on research at the expense of teaching. It would appear that a culture change in higher education is necessary to change this situation. Nevertheless at a macro level it would appear that government policy and objectives have been successful in fostering and promoting teaching in higher education.

5.1.2 Higher Education Funding Council for England HEFCE

The Higher Education Funding Council for England (HEFCE) distributes public money for teaching and research to universities and colleges. In doing so, it aims to promote high quality education and research, within a financially healthy sector. The Council also plays a key role in ensuring accountability and promoting good practice, HEFCE (2010). Excellence in teaching and learning is one of the main strategic aims of the HEFCE.

One of the key roles of the HEFCE in learning and teaching was the establishment of 74 Centres of Excellence in Teaching and Learning (CETLs) in 2005. These centres of excellence in teaching and learning were first proposed in the white paper on higher education in 2003, DfES (2003). The 74 CETLs are widely distributed geographically throughout England and have two main aims. The first aim is to reward excellent teaching practice, and secondly to further invest in that practice so that CETLs funding delivers substantial benefits to students, teachers and institutions, HEFCE (2010).

From 1995 to 2009 the Fund for Development of Teaching and Learning (FDTL) supported a total of 164 projects aimed at stimulating developments in teaching and learning in higher education and to encourage the dissemination of good teaching and learning practice across the higher education sector.

Through the funding of programmes such as the FDTL and the CETLs the funding councils have an active and strategic role in the promotion and fostering of teaching in higher education. The evidence would suggest that this role is carried out successfully and has seen many initiatives and developments that have enhanced teaching in higher education.

5.1.3 Higher Education Academy

The Higher Education Academy (HEA) was formed in October 2004 to work with the higher education community to enhance all aspects of the student experience. It aims to promote high quality learning and teaching through the development and transfer of good practices in all subject disciplines, UK centre for Materials Study (2010). The HEA was formed from a merger of the Institute for Learning and Teaching in Higher Education (ILTHE), the Learning and Teaching Support Network (LTSN) and the Teaching Quality Enhancement Fund (TQEF).

The ILTHE itself was created from the Institute for Learning and Teaching, a direct result of the Dearing Report of 1997, Trowler, Fanghanel and Wareham (2006). The aims of the ILTHE were to enhance the status of teaching in higher education, to improve the experience of learning and to support innovation in higher education teaching and learning, Stefani (2003). The LTSN was set up specifically to provide resources tailor-made to the teaching and learning demands of 24 different disciplinary-based subject areas, and for the purposes of disseminating good practice within and across different subject areas. The TQEF has supported three strands of developmental work to enhance learning and teaching in higher education: institutional, academic subjects/disciplines, and individual. The institutional strand has centred on funding higher education institutes to support enhancements in learning and teaching subject to the production and implementation of institutional learning and teaching strategies HEFCE (2005).

Thus the Higher Education Academy assumed the roles previously adopted by the three previously separate entities. The strategic plan (2008 - 2013) of the HEA outlines the vision, mission and strategic aims of the academy. The strategic aims are as follows:

- Identify, develop and disseminate evidence-informed approaches
- Broker and encourage the sharing of effective practice
- Support universities and colleges in bringing about strategic change
- Inform, influence and interpret policy
- Raise the status of teaching (HEA, 2008)

The HEA acts as an independent broker working with individual academics, subject communities and institutions across the UK, to share expertise and to disseminate evidence-based practice (HEA, 2010). It is a manifestation of a culture and commitment in the UK higher education sector to excellence in learning and teaching. This commitment and culture is further reflected in the HEA's statement of support for teaching and learning; teaching, curriculum and assessment are central to the student experience and to effective learning outcomes (HEA, 2010).

One of the key supports to teaching and learning provided by the HEA is through the subject centres (HEA, 2010). The subject centres provide subject-specific support for enhancing the student learning experience through a nation-wide network of 24 Subject Centres. They are located in higher education institutions and each engages in a wide variety of activities to support academics, departments and institutions. Some of the subject centres cover a single discipline and some a group of related disciplines.

The approaches to learning research has achieved widespread acceptance across institutions such as the HEA. As noted above these approaches have been questioned. Malcolm and Zukas (2001) are critical of what they call 'cafeteria' psychology approaches, adopted by the Institute of Teaching and Learning in Higher Education (ILTHE), now part of the Higher Education Academy (HEA), and the Staff and Educational Development Association (SEDA), criticising them both for their implicit assumptions of how theory informs practice; theories as sets of rules for professional behaviour rather than a form of critical engagement with and understanding of practice. This reflects the prominence and status of approaches to learning research in the HEA. Webb (1997) also points to the underlying theory of knowledge and methodology as not concerning itself with the social consequences of education or being politically radical. This neutrality and the simplicity, universality, and power of the metaphor are the qualities that make the message appealing, acceptable, practical and generalisable, particularly so for educational and staff developers.

Despite these and earlier criticisms of approaches to learning research the emergence of the Higher Education Academy and the associated structures and supports points to a successful and effective structure to enhance teaching and learning in higher education.

5.1.4 Teaching and Learning Research Programme (TLRP)

The TLRP was a response to Government concerns about the quality of educational research in higher education across the UK. This led to a major programme managed by the Economic and Social Research Council (ESRC) but funded by the HEFCE and the other funding councils. The focus of the research undertaken by the TLRP was on how to improve the quality of teaching and learning throughout education from pre-

school to higher education and lifelong learning (TLRP, 2009). The TLRP addressed the following questions with regard to post compulsory education:

- What are universities for and how should they be organised?
- Are they to be mainly of benefit to the economy, society or the individual student?
- Should different types of university receive similar resources for similar purposes, or should each type of university focus on specialisms and select its students accordingly?
- Do the differences between subject areas such as social science versus Science, Technology, Engineering and Mathematics (STEM) affect the quality of student learning in different subjects, settings or contexts?
- Do 'research active' staff offer better pedagogic practices than 'teaching active' staff?
- Are findings in this area based upon pedagogic research, or upon research which contrasts the social sciences and humanities with the natural sciences? TLRP (2009: p 8)

The TLRP's output and findings are in the form of commentaries and research briefings. The research briefings cover topics across the spectrum of education and some notable research briefings in the context of this paper are No. 17 Learning how to learn in classrooms, schools and networks, and No. 31 Learning and teaching at university for example TLRP (2010). Other outputs include books, journals, videos and conference booklets.

In the commentary on effective learning and teaching in UK higher education recommendations are addressed at the government policy level, the institute or university level, the subject and course leader level, reflecting the views of Trowler et al. (2005) with regard to the meso level, and finally the individual academics, lecturers and tutors. The recommendations for improvements and more research across a range of issues in higher education however the recommendations that have specific relevance to this paper are; pedagogic research to develop teachers and lecturers in higher education and professional educational or academic development, the development of expertise and experience in relation to pedagogies to engage socially diverse students and social and informal contexts for learning in the full range of institutions and subjects including the active engagement of the student as learner TLRP (2009: p 37).

The TLRP generic project work ended in September 2009 although the TLRP is due to continue until 2011. The TLRP is another example of government policy actively promoting education in the UK and supporting effective teaching in higher education.

5.2 Summary of Policy Considerations

The Dearing report has been something of a watershed in teaching in UK higher education. It marks a concerted effort in the UK to enhance the status of teaching in higher education and may be seen as an attempt to manage the move from what can be described as an elitist model of education to a popular or 'populist' model Milliken and Barnes (2002). Developments since its publication have seen the establishment of the Higher Education Academy, Centres of Excellence in Teaching and Learning, the TLRP and changes in funding through the funding bodies to promote and reward excellence in teaching. These developments and changes are all evidence of a

commitment to teaching and learning, however it would appear that teaching has still not achieved the same status and recognition as research. Nevertheless the structures and rewards to support and encourage effective teaching in higher education in the UK have been put in place.

The next section examines how identity impacts on effective teaching in higher education and how professional development in teaching is perceived in the UK.

6 Professional Identity and Development

There is a sound theoretical basis for the study of effective teaching in higher education and from my research and observations there appears to be a coherent, structured, and supportive environment in place to enable academics examine their roles in teaching and the role of teaching in higher education. There is considerable support at government and policy level for the development of excellence in teaching in higher education. Nevertheless it appears that the role of teaching in higher education is not highly valued, especially in relation to the perceived high value placed on research Dearing (1997: 3.44); Lea and Callaghan (2008). This has a negative impact on how academics perceive and engage in their professional identity and professional development as teachers.

6.1 Identity

With regard to identity, West (2006) observes that academics describe themselves as being 'historians' or 'computer scientists' more readily than they describe themselves as employees of their university, and that is a constant source of tension between loyalty to their profession or to their university. Their primary loyalty is often horizontal to discipline rather than vertical to institution. Great emphasis is placed on the stability and the centrality of the discipline in constructing academic identity and membership of the disciplinary community James (2000).

In Becher and Trowler (2001) academic careers and in some instances personalities are defined by research interests and perhaps revealingly "the actual process of *teaching* (my emphasis) was generally held to be enjoyable and worthwhile and could sometimes be found to have a broadening effect on one's research", (p 148). Taylor (1999) argues that the concept of identity is broader than that of role, 'identity' referring to aspects of the person's character generally, while 'role' refers to the part played by a person in a particular social setting. Taylor (1999) outlines three 'levels' of academic identity: signs linked to the site of one's work; signs linked to the discipline of one's work, and more universal signs of being an 'academic'. The first level involves relationships with employer and work. Universities aren't identical. In the UK for example there are the traditional universities and the new 'post 1992' universities.

In Ireland there are traditional universities, new universities (DCU, University of Limerick) and, the Institutes of Technology (occupying a similar space to that occupied in the UK by the Polytechnics prior to 1992). According to Taylor (1999) these differences impact on the way the public, and therefore those who work within them, view them and are viewed. This has an impact on what he calls 'the index of self' that is signalled by the type of institution and of work by, and with, which academics are involved: 'I'm from Trinity' for example. The second level of identity as discussed above involves identification with an academic discipline. Here the identity is signalled

through reference to the discipline: 'I'm an historian' (see above). Taylor (1999) describes a third identity or 'version of self shaping', Taylor (1999: p 42). Academics have to learn to work with two 'publics': the general community, and the disciplinary community. This equates to the more universal image of the academic identity, one which overlaps disciplinary boundaries, a cosmopolitan identity. Here the identification is with the career: 'I'm an academic'. Hocking, Cooke, Yamashita, McGinty and Bowl (2009) suggest that teachers' identities are influenced by their own educational experiences, their conceptions of knowledge generation in subject communities, referring to academic discipline, and by their beliefs about themselves and their students.

These 'identities' influenced their pedagogic practice and were refracted to some extent in student learning. This identity with educational experiences is reflected somewhat by Henkel (2000) who states that academics for the most part engage with their disciplines or subject communities in higher education institutes. These discipline or subject communities have their own traditions and values, which make their own contribution to academic identities. The critical relationships within which academic identities are pursued are those between individual, discipline, department and institution, although the balance of importance as between these relationships varies between individuals, Henkel (2000).

The formation of academic identity is influenced by three key roles – researcher, teacher and academic manager. The key components of identity are academic values, academic agendas and sense of self esteem. Key variables are discipline, institution and age, Henkel (2000). An area for research is prompted insofar as how are these identities affected by major reform and change in higher education? What are the patterns of continuity and change?

6.2 Development

Given the multifaceted nature of academic life it is understandable that there is a fairly high likelihood that individual academics may be aware either consciously or subconsciously of various identities as academics. If there is a strong identity as a teacher, then, there must arise a need to develop and achieve excellence or proficiency in teaching. In my experience however, this is not always the case. Since becoming a lecturer in an HEI in Ireland in 2001 and prior to that, having spent fourteen years in further education in Ireland I note that relatively few of my academic colleagues have any formal qualifications or training in teaching or pedagogy. To become a recognised second level teacher in Ireland one must complete post graduate qualification in education, (equivalent to a PGCE in the UK), in addition to a primary degree, or alternatively one must graduate with a specialist degree in education, for example a B. Mus. Ed. to teach music. I find it surprising that until recently in Ireland there were no formal qualifications in teaching in higher education available to those involved in the sector. The situation was similar in the UK; however recent years have seen the introduction of the Post Graduate Certificate in Higher Education (PGCHE) which in some instances has become a prerequisite for individuals wishing to pursue academic careers in the UK. At the time of the Dearing report, only just over half of academics had ever received any training in how to teach and over two thirds of those had received training only at the beginning of their careers. Dearing (1997: 3.40). It is understandable therefore that there has been much emphasis put on teaching in the

wake of the Dearing report and there is a greater level of consciousness about development in teaching in higher education.

Blackmore (2009) notes a major increase in the attention paid to formal support for development at individual, group and organisational levels in UK universities over the past 10 years. At national level, two agencies exist: the Higher Education Academy (HEA), dealing with teaching and learning issues; and the Leadership Foundation for Higher Education (LFHE), dealing with leadership and management. Other organisations have been nationally influential. The Staff and Educational Development Association (SEDA) has, since 1992, focused on the support of educational development.

The Chartered Institute for Professional Development (CIPD) is the main body dealing with the development and recognition of expertise in human resources-based development functions. At institutional level, institutions have invested in a range of development centres, units, and functions, which have been arranged in a huge variety of ways. The number of people involved in the provision of support has grown substantially over the period.

Blackmore (2007) acknowledges the difficulty in defining development in the academic context and staff development, educational development (development of curriculum and assessment), academic development (the development of academics' expertise), faculty development (development of academic staff, usually relating to teaching, in the USA), and organisational development (focused at an institutional level). Blackmore proposes a model for development based on four dimensions; Inclusion, Strategy, Integration, and Scholarship (ISIS), however almost immediately he draws attention to limitations of such a complex model. The model provides insight and is thought provoking however the fundamental difficulty with the model is its one-fits-all model of development for the university.

There are obvious difficulties with the implementation of such a model for example the issue of academic tribes and territories, Becher and Trowler (2001) and suspicion and rejection of 'new managerialism', Deem et al (2007). Blackmore (2009) also acknowledges that allegiance to academic and professional groupings can be an effective means of safeguarding an appropriate level of autonomy and of assuring standards, including ethical issues. This suggests equity of approach as an alternative to uniformity or a one-fits-all model. Blackmore (2009) cautions against the pluralist approach, however in conclusion he notes the inherent negative image and suspicion of Human Resources and advocates an overarching framework that accommodates all the disparate pluralist provision.

What does it mean to develop as a teacher? Effective teaching means becoming a reflective practitioner, and for that you need a theory of teaching, Biggs (2003). In the context of his own theories of teaching that theory should be what he describes as theory 3 teaching, see above. Biggs (2003) advocates a wider perspective in reflective practice including review at the departmental and institutional level, however, it is important to consider development at the level of practitioner or individual teacher/lecturer. Academic development is considered in the overall context of continuous professional development, Pennington and Smith (2002). It is not uncommon for individuals to adopt a short-term here-and-now stance aimed at

identifying an area of current 'deficit' requiring some form of 'remedial' action and typically, with few exceptions, little attempt is made to reconcile longer and medium-term objectives or to mediate between individual, group or 'corporate' goals, Pennington and Smith (2002). This offers some insight into the reasons why there is a lack of medium to long term engagement in the academic development of teaching within academia with the focus being on development of qualifications portfolio, or research portfolio or perhaps short term training courses to address syllabus or curriculum changes. At the individual level it is up to the individual academic to take responsibility for their own development however there is a need for a well managed environment where institutional and subject-related CPD needs are transparent, acknowledged and resourced.

7. Conclusion

It would appear that teaching in higher education is an under-researched area and there is potential to develop research beyond the narrow confines and scientifically limited scope of current research and theory, Malcolm and Zukas (2001); Haggis (2003, 2009); Case and Marshall (2005). The foundational status that approaches to learning research has achieved has been viewed with suspicion, Webb (1999) states that phenomenography and the deep/surface metaphor developed contemporaneously with the growth of educational development centres in HEIs. Lindsay (2004) also makes a connection between approaches to learning research and educational development centres and makes a further link to "cost-cutting agendas of governments and universities".

There has been significant development in support for teaching and learning at the policy and structural level since the Dearing report (1997). This support has not been as effective as it could be as a result of opposition to and suspicion of compulsory courses on teaching and learning and standardised practices. This "imposed professionalism", Skelton (2005) avoids fundamental epistemological, relational, and political questions and undermines the development of knowledge, responsibility, and autonomy. Deem et al (2007) state that the power, status and role of academics in university governance and management have declined as a long term consequence of what they call 'new managerialism' or 'new public managerialism'.

This new managerialism has dominated the ideological context, policy agenda, and organisational technology through and on which universities have been transformed in the course of the last two decades, Deem et al (2007). The changes and developments driven by the Dearing report such as the Higher Education Academy have thus been tainted by their association with new managerialism and imposed professionalism.

The impact and importance of identity in higher education is not to be underestimated. Academic identities are complex, Jawitz (2009) and tribal and territorial, Becher and Trowler (1999). One could look to the work of Wenger (1998) to suggest ways in which academic identity could be linked to the practice of teaching through the development of communities of practice in teaching in higher education.

Wenger, McDermott and Snyder (2002) suggest seven principles for cultivating communities of practice in an organisational context. Whether these seven principles could be adapted to the higher education arena is debatable.

Table 3. Linking academic identity to the practice of teaching

practice as...	Identity as...
• negotiation of meaning (in terms of participation and reification) • community • shared history of learning • boundary and landscape • constellations	• negotiated experience of self (in terms of participation and reification) • membership • learning trajectory • nexus of multimembership • belonging defined globally but experienced locally

Source: Wenger (1998. p150)

In conclusion a number of different directions and avenues for research are suggested by this paper. How can the narrow focus of approaches to learning research be widened? How can the scientific rigour of approaches to learning research be intensified and deepened? How can the disparity of esteem between teaching and research in higher education be addressed more effectively? What role/significance do academic identities have in determining effectiveness in teaching in higher education? Can academic identities be changed? Are there core, generalisable skills and knowledge in teaching in higher education? What are the arguments for and against a 'one-fits-all model' of development in higher education? Is there potential to build a model of development for teaching in higher education? How can such a model be implemented whilst gaining widespread acceptance amongst academics?

The answers to the questions above are important because there is a definite, if not always, manifest link between effective teaching in higher education, the academic identities of teachers in higher education and their professional development. Further study of these issues and the relationships between them will develop our understanding and hopefully lead to more scientifically relevant theories and research in teaching in higher education and, by extension, to more effective teaching in higher education.

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