ITB Journal

Issue Number 14, December 2006

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The academic journal of the Institute of Technology Blanchardstown
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Editorial

I am delighted to introduce the **14th edition of the ITB Journal**, the academic journal of the Institute of Technology Blanchardstown.

The first paper in this journal from Alessio Frenda examines the complexities involved in the coding of grammatical gender within Irish and explores, in particular mutation, inflection and their consequences at the morphsyntactic interface across three macro-dialects (Ulster, Connacht, Munster), and standard Irish. In the second paper, Anne Herwig motivates a discussion on how emotions can be viewed as abstract cognitive events without an external reference object. Wityhin this view, they are cognitive relations in the sense that they consist of two or more primarily autonomous events, which are set in relation to each other. Accordingly, their conceptual structure is relatively complex and this is reflected in a broad variety of lexicalisation patterns, both within and across languages. Their complexity is reflected in the rich inventory of emotion terms in many cultures. According to Herwig, the processing of emotion terminology can provide important information about the cognitive organisation of conceptual and linguistic knowledge. The next paper, by Denise Lyons, describes the practice of providing art therapy as a support for a teenage boy, living within a residential group home. A brief history of residential care is introduced and the role of art therapy as an intervention within a holistic approach to social care practice discussed. This paper concludes with a case study illustrating the practice of art therapy in residential care. The paper by Kelly and McCabe studies the body of existing research into procedural city generation and provide an overview of their implementations and a critique of their functionality and results. After this, they present areas in which further research into the generation of cities is required and outline their research goals for city generation. The final paper by Dawn Duffin on working towards an inclusive model of practice hypothesises that third level tutors are not required to and do not generally possess teaching or disability awareness qualifications and that the third level colleges would benefit from a collective approach towards more inclusive practice.

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

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Gender and mutation in Irish: a preliminary account for further investigation

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Abstract

Standard Irish is the outcome of language planning and as such it significantly diverges from the three main spoken dialects of the language (or traditional Gaeltacht varieties) that provided the basis for its creation. It is also expected to differ, in its codified form, from the way it is actually employed within the small, usually urban communities of bilinguals who employ standard Irish and not some form of Gaeltacht Irish as a second language. The reason why such difference is expected is that the language planners codified as part of the standard many complex structures that had already been abandoned in the spoken dialects, basing their reconstruction on historicity rather than actual usage (especially as the actual usages were far from uniform). In this article, which presents part of the work involved in my currently ongoing research, some such complexities are presented which pertain to grammatical gender.

1 Introduction

In this article I present some preliminary work carried out as part of my research in progress (Frenda, forthcoming), which is going to be concerned with a survey of grammatical gender systems in minority-language contexts, with particular attention paid to the evolution of this category as a new standard of the minority language is created in order to promote its diffusion. The context for my overall analysis is provided by two Celtic languages, Irish and Welsh, which have been selected to represent the two branches of the Celtic family, traditionally known as Q-Celtic and P-Celtic, respectively. Of these two, however, only Irish is going to concern us here.

As a starting point, we can take an observation by Jim McCloskey (reported by Pullum, 2004): he observes that traditional Gaeltacht Irish will meet certain death "in the next 30 years or so", because its transmission as a first language has now completely ceased. But, he observes,

> what is unique in the Irish situation, I think, has been the creation of a second language community now many times larger than the traditional Gaeltacht communities (I think that 100,000 is a reasonable estimate for the

> size of this community). And being a part of that community is a lively and engaging business. A friend of mine who produces a weekly current affairs program in Irish on TV reports that it is always possible to do a report on whatever topic they like in any part of the country and find people who are willing and able to do the business in Irish. And it is true that certain recent developments have boosted this community and its self-confidence—the success of some poets (Celia de Fréine) and musicians (Liam Ó Maonlaí, John Spillane, Larry Mullen), the availability of an Irish TV channel, a vigorous presence on the net […] (McCloskey in Pullum, 2004)

As McCloskey further points out, "[t]here is a great range of varieties called 'Irish' in use in this community", from what can be defined "a close approximation of traditional Gaeltacht Irish" to a series of "new urban calques, heavily influenced by English in every way", to such an extent that McCloskey does not hesitate to speak of pidginization and creolization for the varieties in use by those schoolchildren who go through Irish-medium education, or to define as completely bidialectal those teenagers who are able to switch from more traditional Gaeltacht varieties that they may hear from their parents to the "new urban varieties in use among their peers".

Language-contact situations, when there is asymmetry between the two varieties spoken on the territory, often record ongoing structural simplifications in the variety spoken by the minority. This has been reported about a number of Aboriginal languages: Dyirbal, for instance, is of particular interest here on account of the simplification of its gender system, reported by A. Schmidt (cited in Aikhenvald, 2000: 390; and in Corbett, 1991: 17f.). In its traditional variety, Dyirbal has four genders and a rather complicated, semantically-driven attribution system; in the younger generations' variety it only has three semantically straightforward genders reminiscent of the three-way distinction of English (*he/she/it*), which happens to be the displacing language. "Loss of constructions through simplification for the benefit of non-speakers" is reported for Kayardild, another Aboriginal language of Australia, by Evans (2001: 263).

In the case of Irish extensive language-contact phenomena have taken place in the history of the contact with English: Stenson (1993) examines a number of such phenomena. But the Irish of McCloskey's "second language

community" is not simply the result of some form of pure Irish interspersed with Anglicisms: it is the product of a language-planning effort. As Dorian (1994: 484f.) points out, the project of revitalizing Irish (which started after the political independence from Great Britain) implied the creation of a new standard. A compromise between the three main spoken dialects was necessary, since they all had the same weight in terms of prestige and number of speakers and selecting one of them as the standard would have incurred in its rejection by the speakers of the other two. A new language was created that sought to be a happy medium between the existing norms of usage and that would seek "simplicity and regularity in all cases of rule formation" (Ó Baoill, 1988: 117). This met with hostile reactions on the part of the native speakers:

> To speakers of living Irish dialects, however, the result is *Gaeilge B'l' Ath'* 'Dublin Irish', a stilted, unnatural form of Irish (Dorian, 1994: 485)

The conservativism of such speakers, observes Dorian, corresponds to the different conservativism of the language planners, who had tried to do away with regional and dialectal forms but had not been too keen to renounce "the grammatical complexities of conservative forms of the language" (Dorian, 1994: ibid.). Complexities that, as Ó Baoill (1988: 117) observes, were already largely disregarded even in the language(s) of the native speakers—and many more, continues Ó Baoill, will inevitably be lost.

What are we to expect, then, from McCloskey's "second language community"? Will their members conform to prescriptive norms already dismissed by the Gaeltacht dialects, or will their language follow a similar evolutive pattern and eventually do away with (some of) them, as Ó Baoill foresees that will happen if Irish is to become a "viable means of communication among the general population" (1988: 125)? This is precisely the issue that I will address in my research, aiming to provide a description of the status quo in the micro-domain of grammatical gender by analyzing a corpus of texts, both written and spoken, produced by this L2 community.

It is particularly interesting that among the complexities explicitly mentioned by Ó Baoill are initial mutations, which play an important role in

the expression of gender agreement within the noun phrase. Gender agreement and the role initial mutations play in it are considered in this article.

2 Initial mutations and the realization of gender agreement

A variety of lexical items in Irish shows agreement in gender, whose surface realization is, in morphological terms, twofold: by means of word-final adjustments (endings) and word-initial adjustments (initial mutations). In the case of pronominal agreement, the choice of different lexical items might also reflect gender agreement. Initial mutations are common to all Celtic languages and perhaps among the most widely-known features thereof (Hamp, 1951: 230).

Historically, initial mutations represent the petrified reflexes of sandhi phenomena. Sandhi phenomena are non-distinctive modifications of certain sounds occurring across word boundaries and determined by the phonetic properties of the context; when the context that triggered the modification has ceased to exist, the modifications may linger on—they have become what is known as initial mutations. In the Celtic family, the absence of the triggering context is caused by the historical loss of word-final unstressed syllables (apocope).

Some examples will help to make the point clear. A well-represented mutation, in the inflection system of Celtic, is lenition, a cover term for a number of sound changes that affect the articulation of a consonant or consonant cluster, normally in a way that may be impressionistically described as "making it weaker" (Giannelli & Cravens, 1997: 35; Kirchner, 2004: 313). A particular kind of lenition is spirantization, a sound change whereby an occlusive is turned into its homorganic fricative. This is a common enough process which we find, for instance, in the variety of Italian spoken in Florence (Giannelli, 1997; Kirchner, 2004: 316–20; Loporcaro, 1997). Here, the word *prato* "lawn" may be realized as [ˈpraPθo] (or even [ˈpraPho]) rather than as [ˈpraPto] as in standard Italian. A lenited occlusive, in this case [t], becomes its fricative counterpart (i.e., the homorganic fricative [θ]). The lenition of [t] is triggered by its intervocalic position.

Intervocalic lenition in Florentine may take place not only word-internally, but equally well across word boundaries, affecting the initial consonant of a word in a way that is quite similar to what initial mutations do. The sequence *la casa* "the house", which in standard Italian is realized as [laˈka:sa], is heard in Florence as [laˈxa:sa] or [laˈha:sa]. Here the voiceless occlusive /k/ lenites to its fricative counterpart [x]. (As it happens, both /t/ and /k/ can be further reduced to [h] and thus neutralized in faster and less monitored speech registers: cf. Kirchner, 2004: 319). However, the phrase *a casa* "(at/to) home" sounds [aˈk:a:sa] in Florence and in the standard language alike. Lenition of /k/, which would be legitimately expected in view of its intervocalic position, is blocked by historical reasons: *a casa* is the modern reflex of Latin *ad casa(m)*, with an assimilated consonant cluster /dk/ > /kk/ phonetically realized as lengthened [k:] (*raddoppiamento fonosintattico*: cf. Loporcaro, 1997: 42; Rohlfs, 1966: 235–38). As Bechert (1990: 133) puts it, one effect of sandhi phenomena is surely that "they make the word group stand out more clearly against the single word"—from a synchronic point of view, i.e. in the absence of historical information about why *casa* is pronounced [xa:sa] in *la casa* but [k:a:sa] in *a casa*, only the salience of the phonological word can make the speakers prolong two different realizations that are devoid of any functional load.[1] There is in Florentine no phonological opposition of [k] and [x], the latter being a context-determined allophone of /k/. It is to be remarked that the context may or may not be synchronically evident: it is evident in the case of intervocalic lenition in [laˈxa:sa], but not in the case of the phonosyntactic doubling and lack of "intervocalic" lenition in [aˈk:a:sa].

While the initial mutations of the modern Celtic languages lack synchronic motivation too, they give rise to phonemic, not merely phonetic, oppositions: in other words, after apocope had deleted the word-final segments that triggered the mutations, the once allophonic alternation was made phonemic (Hamp, 1951: 239–42; Kortlandt, 1982). Hamp (p. 241) provides the following illustration, where the initial sound of the adjective

[1] Cf. Skousen (1989) and his proposed theory of analogical modelling of the language, based on the how salient and frequent the occurrences of different tokens are in the usage.

bodi- "blond" lenites to [v] in intervocalic position, while staying [b] in non intervocalic contexts:

(1)

Proto-Goidelic			Old Irish	
*wir-uP	bodi-u: [v]	>	fiur	buidiu /v/
man-DAT.SG	blond-DAT.SG			
"blond man" (dative)				
vs.				
*wir-as	bodi-as /b/	>	fer	buide /b/
man-NOM.SG	blond-NOM.SG			
"blond man" (nominative)				

(Hamp, 1951: 241, adapted)

Old Irish orthography is inconsistent in showing lenition (hence the need to add the actual sounds in phonemic transcription). Old Irish corresponds to a post-apocope period of the language: we can see that the once allophonic [v] has now become a phoneme in its own right, in that its distribution is no longer context-determined, and, as shown below, the opposition can now be used distinctively to convey a difference of meaning.

Another common initial mutation of Celtic is the so-called *nasalization*, which would historically involve sound change across word boundaries triggered by the presence of a nasal segment. Nasalization as a synchronic (i.e., contextually activated) feature can be observed in Modern Greek (cf. Bechert, 1990: 133), where, for instance, the cluster /-n # p-/ is realized as [-m # b-]. In Proto-Goidelic, nasalization worked along the same lines, being phonetically determined by a word-final nasal; after apocope, the nasalized version of the following segment was retained in the new context as a new phoneme of the language (cf., again, Hamp, 1951: 239–42; Kortlandt, 1982).

Nasalization poses different problems, in that its realizations are more varied than those of lenition both within a dialect and across different dialects. Roughly speaking, nasalization in Irish is about turning voiceless oral segments into their voiced counterparts (assimilation in sonority, as in the Greek example) and voiced oral segments into nasal (nasalization proper); as to "nasalized" vowels, it must be observed that these are not in

fact nasal vowels but simply vowels to which *n-* has been prefixed. The details will be discussed below.

One interesting feature of agreement marking by initial mutation is that it challenges an assumption commonly entertained about canonical agreement (in the sense of Corbett, 2006): that the controller and target of agreement are two distinct entities. The facts about Celtic initial mutation seem to blur this distinction. A clear example is given in (2):

(2) *béal* /bʹɛːl/ (m.) "mouth" → *an béal* "the mouth"
bean /bʹan/ (f.) "woman" → *an bhean* /van/ "the woman"

The lexical entries *béal* and *bean* both begin with the same phoneme, /bʹ/. However, when preceded by the definite article (*an*), *béal* stays the same, while *bean* undergoes lenition. Of all nouns beginning with /bʹ/, all masculines behave like *béal* and all feminines like *bean*: their distribution is grammatically conditioned. Now, gender is inherent in the noun, not the article: therefore the noun, not the article, is the controller. But agreement is marked on the controller, or so it seems. The case can be made that Irish is a head-marking rather than a dependent-marking language, but is it really so? A closer look suggests that the answer is no. To begin with, this would not be the case if the target was an adjective, as can be seen from (1), or in modern standard Irish, (3):

(3) (a) béal bocht
mouth(M) poor.M
"poor mouth"[2]
(b) bean bhocht /v/
woman(F) poor.F
"poor woman"

In (3), it is obviously the dependent and not the head that is marked.

[2] Part of an Irish idiomatic expression, made famous by the title of Flann O'Brien's satirical novel *An béal bocht*.

The problem posed by (2) can be resolved if we assume two synchronic forms of the article: *an*$_1$ (masculine, non-leniting) and *an*$_2$ (feminine, leniting); adopting a notation common in Celtic linguistics, one can represent them as *an* and *an*^{L} respectively. This representation is historically more accurate in that it reflects the two distinct, earlier forms of the article that motivate the initial mutation. In Hamp's (1951) terms, *an* and *an*^{L} are distinguished by the absence/presence of the final morphophoneme /^{L}/, which is responsible for the triggering of the initial mutation in the following word:

(4)	NP realization	Underlying representation	Surface
	an béal	/aN bʹɛːl/	[a(N) bʹɛːl]
	an bean	/aN^{L} bʹan/	[a(N) van]

This way, it is the article that shows agreement—namely, the feminine form is marked by the suffixing of the leniting morphophoneme—and it is only an accident that the controller is affected by the latter. Morphophonemes like /^{L}/ are understood by Hamp to be part of the inventory of morphemes, although phonetically they do not correspond to any set of sounds; they rather constitute functions whereby certain following phonemes are changed according to regular patterns. Synchronically, this interpretation has to rely on underlying representations (and orthography is in this regard misleading in that it ignores morphophonemes and just records the mutation); notwithstanding, it captures the historic truth, namely the fact that two separate forms of the article once existed whose continuators are no longer distinguished by the ending but only by the final morphophoneme.

A different analysis of initial-mutation triggers has been proposed by Green (2006), who sees mutations as not pertaining to phonology at all and therefore refuses the morphophonematic interpretation. According to Green, all mutated forms of a lexical entry are stored in the lexicon and activated by the context, in the same way as different case forms are in Latin or German (i.e., by a form of government relation). His motive in proposing a lexical analysis is the observation that the changes involved in most contexts of

initial mutation not only in Irish but in the Celtic languages more generally are too irregular and to account for them by posing ad hoc morphophonemes ("floating autosegments") would require too high a number of them. Morphophonemes are only postulated for the purposes of explaining initial mutations and there is in the language no independent evidence of their existence. The phonological changes that they induce are not always easily amenable to straightforward sound-change pattern: so for instance lenition in Irish turns stops into homorganic fricatives, except for the dentals /t/ and /d/, which are debuccalized (see discussion below). Green's attractive analysis presents the distinct advantage of doing without any specially posited theoretical constructs, while at the same time providing an alternative analysis that is consistent with a typologically well known and widely attested phenomenology. In what follows I shall continue, for the sake of simplicity and brevity, to make use of the standard symbolism associated with the morphophonematic analysis as a convenient shorthand, in pretty much the same way as one would use the notation *ad*$^{\text{ACC}}$ to signify that the Latin preposition *ad* governs in the accusative case. I am therefore not committing myself to the theoretic framework criticized by Greene.

Initial mutations as markers of agreement can also be found on adjectives, as seen in (3). In what follows, we will point out how initial mutations contribute to the functioning of the gender opposition in modern standard Irish.

3 Realization and scope of gender agreement in Irish

Irish has two genders, masculine and feminine. Initial mutations in Irish belong to three basic types (Ó Siadhail, 1989: §6.2): besides lenition and nasalization (or "eclipsis") we also have *h*-prefixing (or "provection"). A fourth type of initial mutation, the prefixing of *t*-, is less general and may in fact be triggered only by the article (see below); it is however crucial in terms of gender marking. It is crucial to keep in mind that initial mutations are selective as regards the phonemes that they may affect, and that constraints blocking the mutation of otherwise "mutable" phonemes may apply, which will in turn affect the expression of gender agreement.

3.1 Lenition

Lenited plosives turn into homorganic continuants (except for dental plosives /t d/, which turn into the back fricatives /h ɣ/); lenited /l/, vibrant and nasals become [– TENSE] (Ó Siadhail, 1989: 111); lenited fricatives /s/ and /f/ turn into /h/ and ∅, respectively. A prospect of lenition in Irish is given in (5):

(5) Lenition in Irish (source: Ó Siadhail, 1989: 112)

Basic consonant	Lenited consonant	
	(phonemic transcription)	(spellings)
plosives		
c /k kʲ/	/x çʲ/	*ch*
g / g gʲ/	/ɣ jʲ/	*gh*
t /t tʲ/	/h hʲ/	*th*
d /d dʲ/	/ɣ jʲ/	*dh*
p /p pʲ/	/f fʲ/	*ph*
b /b bʲ/	/w vʲ/	*bh*
fricatives		
s /s ʃ/	/h hʲ/	*sh*
f /f fʲ/	/□ ʲ/	*fh*
nasals		
n /N Nʲ/	/n/	*n*
m /m mʲ/	/w̃ vʲ/	*mh*
lateral		
l /L Lʲ/	/l lʲ/	*l*
vibrant		
r /R Rʲ/	/rʲ/	*r*

As Ó Siadhail (1989: 112–14) points out, lenition may be blocked in certain phonological contexts (a certain degree of inter-dialectal variation applies). This is relevant to our investigation in that, where lenition is the only marker of gender agreement, its blocking will of course result in the loss of the gender distinction. Ó Siadhail lists the following relevant points:

(i) ***r-***: its lenition is realized as palatalization (as in the Dunquin and West Muskerry dialects); it is however a feature preserved almost only by older Munster speakers—elsewhere, lenition of /r/ is inaudible (note that it is not represented orthographically);

(ii) initial ***n-*** and ***l-***: their lenition corresponds to a loss of tension; however, since tense *n-* and *l-* (/N L/ respectively) only appear in Munster, there is no audible lenition of these segments in dialects other than Munster (again, orthography does not represent their lenition);

(iii) initial ***f-***: its lenition is rather unstable in some dialects, e.g. in that of Cois Fhairrge;

(iv) lenition between two dental segments (i.e. lenition of a dental preceded by another dental) may be blocked in certain contexts, e.g. after the article, as in (6):

(6) an$^{(L)}$ diabhail
ART.GEN.M.SG devil.GEN.SG
"of the devil"
(Cois Fhairrge dialect, Ó Siadhail, 1989: 113)

(Parentheses indicate blocked lenition.) However, lenition between two dentals may be preserved in case of compounds or habitual collocations, as in (7):

(7) sloítin^{L} **dh**raíocht
cane.DIM magic.GEN.SG
"magic wand"
(Cois Fhairrge dialect, Ó Siadhail, 1989: 113)

(v) lenition in English **loan-words** is limited; in particular /ṭ/ and /ḍ/, as well as /s/ and /f/, remain unlenited in this particular class of nouns.

3.2 Nasalization

Only plosives and the fricatives /f f′/ can be nasalized; as to words beginning in a vowel, nasalization consists in the prefixing of *n-*. In fact, the term nasalization would properly cover only the mutation of voiced plosives, which turn into homorganic nasals; voiceless plosives are not nasalized but turned into their voiced counterparts (sonority assimilation), while /f/ and

/f′/ are turned into /w/ and /v′/ respectively.[3] A table of the relevant modifications is provided in (8).

(8) Nasalization ("eclipsis") in Irish (source: Ó Siadhail, 1989: 112)

Basic consonant	Nasalized consonant	
	(phonemic transcription)	(spellings)
plosives		
c /k k′/	/g g′/	*gc*
g /g g′/	/ŋ ŋ′/	*ng*
t /t t′/	/d d′/	*dt*
d /d d′/	/ɴ ɴ′/	*nd*
p /p p′/	/b b′/	*bp*
b /b b′/	/m m′/	*mb*
fricatives		
f /f f′/	/w v′/	*bhf*

3.3 h-*prefixing ("provection")*

According to Ó Siadhail (1989: 122), the prefixing of *h*- to a word-initial vowel falls within the scope of initial mutations as a case of no sound-change: *h*- is inserted before two vowels to mark hiatus, i.e. to avoid vowel elision, as in

(9) na **h**amadáin
ART.PL fool.PL
"the fools" (cf. *amadán* "fool"; *h*- prevents the outcome *n'amadáin*)
(Ó Siadhail, 1989: 123)

However, continues Ó Siadhail (ibid.), *h*-prefixing may serve the purpose of grammatical functions which are "largely shared by dialects". As we shall see below, these include realizing certain gender distinctions. Remarkably, in those dialects where /h/ is regularly dropped between two vowels (cf. Ó Siadhail, 1989: 81f.), a redundant *h*- (i.e. a non-distinctive one) might be

[3] Only in a limited number of dialects is eclipsis of /s s′/ found, realized as /z j/ respectively (Ó Siadhail, 1989: 114).

dropped, while a grammatically functional *h-* is more stable: compare the "certain amount of hesitancy" between *ní hiad* ~ *ní iad* (Cois Fhairrge dialect) "it is not them", where *h-* is redundant (i.e. its presence/absence carries no meaningful distinction) to the more stable *h-* in *a hathair* "her father" (vs. *a athair* "his father")—where *h*-prefixing distinguishes the gender of the possessor pronoun.

Gender agreement in Irish is reflected by a number of targets, which will be examined in turn. The situation we are about to describe conforms with Greenberg's (1966: 95) Universal 37, with the marking of gender opposition, where present, being limited to the singular and never interesting the plural.

3.4 Article

Irish has only a definite article, which agrees with the head noun in gender, number and case. Gender is relevant only in the singular and is completely neutralized in the plural. The forms of the article in the standard language are given in (10):

(10) Article paradigm in Standard Irish: singular forms (cf. Mac Congáil, 2004: 20–23)

	Masculine	*Feminine*
Nominative	an^{T}	an^{L+T}
Genitive	an^{L+T}	na^{H}
Prepositional I	an^{N}	an^{N}/an^{L+T}
Prepositional II	an^{L}	an^{L+T}

The following should be noted:

(i) *t*-prefixing in the nominative masculine applies to nouns beginning in vowel, e.g. *an t-asal* "the donkey".

(ii) Lenition is blocked if the noun begin in a dental, cf. (6).

(iii) The genitive masculine and the nominative feminine forms of the article are syncretic. In both forms, *t-* is prefixed to a lenited *s-*, i.e. in a cluster *s-* + sonorant (V or *l*, *n*, *r*), but not to nouns beginning in a vowel. In this case, lenition of *s-* is not realized in the usual way (i.e. as *h-*)—in fact, it is simply dropped, and *t-* is prefixed to

the noun: e.g. *an tsúil* /əɴ ˈtuːlʲ/ "the eye", *an tsrón* /əɴ ˈt̪ɾɔːn/ "the nose" (Mac Eoin, 1993: 113; Ó Siadhail, 1989: 127).[4]

(iv) *h-* in the genitive feminine is prefixed to a noun beginning with a vowel, e.g.

(11) na **h**abhann
ART.GEN.F.SG river(F).GEN.SG
"of the river"

(v) The prepositional forms of the article are used after a preposition.[5] They can be distinguished into two subtypes, that we suggest should be called "prepositional I" and "prepositional II", in terms of the initial mutation they trigger in the following noun. Roughly speaking, prepositional I nasalizes the following noun, while prepositional II lenites it, *irrespective of grammatical gender*; as usual, lenition is blocked before dentals (except for *s-*, see below); nasalization, in standard Irish and at least in Connacht, is blocked before *t-* and *d-* (Ó Siadhail, 1989: 127), and does not, in any case, affect initial vowels (Mac Congáil, 2004: 22):

[4] From the historical point of view, lenited *s-* is not dropped: it is the encounter between the historical ending *-d* of the article and the *h-* resulting from the lenition of *s-* that yielded the *-t-* in the sequence *an t(s)úil*: /nd#h/ > /n#t/ (cf. Ball & Müller, 1992: 48).

[5] This case is sometimes called "dative" (cf. *Graiméar*, 1960: 48; Mac Congáil, 2004: 30, 32). However, the label "prepositional"—as found in Ó Dochartaigh (1992)—seems to be more appropriate, in view of both historical and synchronic considerations. Synchronically, as explained in the text, the prepositional case is differentiated in two subtypes on the basis of initial-mutation patterns: these are in turn selected by the preceding preposition, with a certain degree of inter-dialectal variation (see §4). Historically, this reflects the fact that, in Old Irish, some prepositions would govern dative NPs, others accusative NP, and yet others both cases (cf. Thurneysen, 1961: §§249, 251). So prepositional I continues the accusative, whose ancient ending *-n* justifies the nasal mutation, and prepositional II continues the dative, which would end in a vowel and therefore trigger lenition.

(12)

ag	an^{N}	ngeata	*vs.*	ag	an$^{(N)}$	
	doras					
at	ART.PREP_I	gate		at	ART.PREP_I	door
“at the gate”				“at the door”		

(Mac Congáil, 2004: 22)

(13)

de-n^{L}		bhord	*vs.*	de-n$^{(L)}$	
	diallait				
from-ART.PREP_II		table		from-ART.PREP_II	
	saddle				
“from the table”				“from the saddle”	

(ibid.)

(14)

ó-n$^{(N)}$	iasc
from-ART.PREP_I	fish

“from the fish” (ibid.)

Gender opposition can only be maintained in the case of nouns beginning in a cluster *s-* + sonorant, which are not mutated if masculine, and undergo lenition and *t*-prefixing, if feminine (as shown in (iii) above); in this case, prepositional I and prepositional II behave in the same way:

(15) Prepositional I

M:	ó-n^{N}	**sagart**
	from-ART.M.PREP_I	priest
	“from the priest”	
F:	ó-n$^{L + T}$	**tseilf**
		/t’el’f’/
	from-ART.F.PREP_I	shelf
	“from the shelf”	

(16) Prepositional II

M:	do-n$^{(L)}$	**sagart**
	to-ART.M.PREP_II	priest
	"to the priest"	
F:	do-n$^{L + T}$	**tseilf**
		/t′el′f′/
	to-ART.F.PREP_II	shelf
	"to the shelf"	

So, as far as the article is concerned, the possibility of gender agreement being realized at surface level is constrained by the following conditions: (a) the controller is singular in number; (b) in the nominative, the noun must begin in either a consonant that may undergo lenition, or a vowel; (c) in both prepositional I and II, the noun must begin in a sequence *s-* + sonorant. If condition (a) is not met, agreement is not possible (the plural forms of the articles are gender-neutral); if either condition (b) or condition (c) is not met, agreement will apply vacuously, i.e., will not have any possible surface realization. From what has been observed, it follows that only in the genitive singular is agreement realized regardless of phonemic constraints, since the forms of the article are different in both their stems and their mutational morphophonemic endings.

3.5 Adjectives

Gender agreement with adjectives is limited to the attributive position in the singular:[6] predicative adjectives are not inflected (Mac Eoin, 1993: 115). Adjective inflection is realized word-initially (initial mutations) and word-finally (inflectional endings); the following illustrates the prescriptive standard use (the examples are modelled on, and partly drawn from, Mac Congáil, 2004: 89f.):

[6] The basic word order in the Irish NP is noun + adjective. Only a few adjectives may precede the head noun, in what Ó Siadhail (1989: 118) regards as formation of compounds: e.g. *seanfhear* "old man" (*sean* "old"), but they do not agree with the noun. Lenition of the noun, unless phonologically constrained (e.g. *seanscéal* "old story (*scéal*)"), normally applies. Other adjectives must precede the head noun: these include numerals (see below), interrogatives, and certain indefinites (cf. *NIG*, 2004: 60). These do not mark gender agreement.

(17) Nominative

M: an fear **mór** (*unmarked*)
ART man great
"the great man"

F: an bhean **mh**ór (*lenition*)
ART woman great
"the great woman"

(18) Genitive

M: an fhir **mh**óir (*lenition, palatalization*)
ART man great
"of the great man"

F: na mná **móire** (*palatalization, suffixing*)
ART woman great
"of the great woman"

(19) Prepositional I

M: leis an bhfear **mór** (*unmarked*)
with ART man great
"with the great man"

F: leis an mbean **mh**ór (*lenition*)
with ART woman great
"with the great woman"

(20) Prepositional II

M: do-n fhear **mór** (*unmarked*)
to-ART man great
"to the great man"

F: do-n bhean **mh**ór (*lenition*)
to-ART woman great
"to the great woman"

(21) Vocative

M: a fhir **mh**ór (*lenition*)
oh man great
"(oh) great man"

F: a bhean **mh**ór (*lenition*)
oh woman great
"(oh) great woman"

In examples (17)–(21) the adjectives were chosen so that both initial mutations and inflectional ending might be visible where relevant.

Let's now take a closer look at word-final inflection. Standard grammars posit a number of adjective declensions, the realization of agreement depending on what class the adjectives belong in. The number of classes varies from description to description: of two recent prescriptive grammars, the *New Irish grammar* (*NIG*, 2004: 63ff.) posits eight classes (not counting adjectives ending in a vowel or those undergoing syncopation), while Mac Congáil (2004: 86ff.) has three in total. At any rate, final inflection is mainly brought about by two strategies, which can be used separately or combined: (a) switching the [± PALATAL] feature in the final consonant, and (b) adding a final vowel (unstressed /ə/, spelled *-a* or *-e*) (Ó Siadhail, 1989: §6.3.1, and p. 148). Strategy (a) is traditionally referred to as broadening/slendering.[7] Since the prepositional case is only differentiated from the nominative in terms of initial mutation, it follows that we are only going to be concerned with differences in the realization of the genitive.

(22) is an attempt to put together the *NIG* eight-class analysis with Mac Congáil's three-class analysis. Adjectives of the first declension form the genitive masculine form by slendering the final consonant (cf. *bán* /bɔːn/ "white" → *báin* /bɔːn′/). If the latter is already slender, it undergoes no change (*glic* /g′l′ik′/ → *glic* /g′l′ik′/ "clever"). Certain monosyllabic adjectives ending in a tense consonant (orthographically a geminate, e.g. *mall* "slow") or *-ch(t)* /x(t)/ (e.g. *nocht* "naked") have unaltered genitive masculine. Their genitive feminine form is formed by adding *-e* /ə/ after the final consonant, which must be made slender (or be originally slender): e.g. *maille* (/ʟ/ made slender → /ʟ′/), *maithe* (/h′/ originally slender). Adjectives of the second declension have unaltered genitive masculine and form their

[7] Cf. Ó Siadhail (1989: §6.3.1). "Slendering" a non-palatal ("broad") consonant means to palatalize it; "broadening" a palatal ("slender") consonant means, on the opposite, to make its articulation non-palatal. Orthographically, palatalization is represented by <e> and <i>, which must precede or follow (or precede and follow, word internally) the consonant grapheme. So for example the sequence <ona> is orthographically correct, while the sequence <ina> is not, because it is not clear whether the palatal /n′/ or the non-palatal /n/ is meant.

genitive feminine by making final *-l* or *-r* broad and adding a final vowel /ə/. Finally, adjectives of the third declension, i.e. those ending in a vowel, are indeclinable except for *breá*, which has a distinct genitive feminine form *breátha*.

(22) Adjective declensions according to *NIG* (2004: 63ff.) and Mac Cóngail (2004: 86ff.)

NIG				**Mac Congáil**
Nominative	Gen. m.	Gen. f.		
bán "white"	*bá**in***	*bá**ine***	(1)	**1st declension:** adjectives ending in a consonant, except those in the 2nd declension.
díreach "straight"	*dír**igh***	*dír**í***	(2)	
bacach "lame"	*bac**aigh***	*bac**aí***	(3)	
mall "slow"	*mall*	*mai**lle***	(4)	
maith "good"	*mai**th***	*mai**the***	(5)	
buíoch "grateful"	*buíoch*	*bu**íthí***	(6)	
gnách "usual"	*gnách*	*gná**thaí***[8]	(7)	
leisciúil "lazy"	*leisciúil*	*leisci**úla***	(8)	**2nd declension:** adjectives ending in ***-(i)úil*** and **some** adjectives ending in ***-(a)ir***.

Adjectives ending in a vowel (Mac Congáil's 3rd declension)

rua "red" (Nom., gen. m., gen. f.)

Exception: ***breá*** "nice" (Nom., gen. m.), *breá**tha*** (gen. f.)

Adjectives that undergo syncopation: a subset of Mac Congáil's 1st declension. Some bisyllabic adjectives which form the gen. f. by adding a vowel (i.e. an extra syllable) drop the central syllable in the same form (so they remain bisyllabic). E.g. ***ramhar*** "fat", gen. m. *ramhair*, gen. f. ***raimhre*** (< *ramh(ai)re*); ***íseal*** "low", gen. m. *ísil*, gen. f. ***ísle*** (< *ís(i)le*).

Vocative: the vocative masculine form of a first-declension adjective is identical to its genitive masculine, the vocative feminine to the nominative feminine.

[8] Irregular: Ó Dónaill (1977: s.v. *gnách*) has the regular *gnáiche*.

A few observations can be made about the grammar of adjective inflection:

(i) In the nominative, masculine and feminine are opposed by the presence/absence of lenition alone: lenition characterizes the adjective as well as the head noun.

(ii) In the genitive, both lenition and final inflection play a role in gender agreement: the masculine is lenited, while different endings distinguish the masculine from the feminine (see below).

(iii) In the prepositional, the norm prescribes unmarked masculine and lenited feminine, without distinction between prepositional I and II; however, dialectal variation plays quite an important role in this regard (see §4).

(iv) No gender opposition is found in the vocative, as both masculine and feminine adjectives are lenited.

The above can be represented as follows:

(23) Expression of agreement in Irish adjectives

	← 3rd declension		
		← 2nd declension	
			← 1st declension
Lenition	/ə/-suffixing	Palatalization	
–	–	–	• Nom. m. sg. • Prep. m. sg.
+	–	–	• Nom. f. sg. • Prep. f. sg. • Voc. m. & f.
–	+	+	• Gen. f. sg.
+	–	+	• Gen. m. sg.
–	–	+	(Not found)
–	+	–	(Not found)
+	+	–	(Not found)
+	+	+	(Not found)

By looking at the diagram in (23) two syncretic expressions of agreement immediately stand out, namely (a) unmarked form for nominative and

prepositional in the masculine and (b) simple lenition for the nominative feminine, prepositional feminine and vocative (both genders). We also see that the three formal features (lenition, palatalization and /ə/-suffixing) can only occur on their own (lenition) or in pair (palatalization + suffixing, lenition + palatalization), but never simultaneously.

Another interesting observation that (23) enables us to make concerns which distinctions are more at risk of being lost on account of their dependence on lenition as a means of expression: when the adjective begins in a non-mutable sound, there certainly will be no distinction between masculine and feminine in the nominative singular. Furthermore, (23) is sensitive to differences between adjective declensions. The first declension may exploit all of the three formal devices—"may", as for instance adjectives ending in a palatal consonant in the citation form (the nominative singular) cannot further exploit palatalization, while monosyllables ending in a tense consonant or /xt/ never palatalize (see above). The same holds true of the second declension, whose adjectives all end in a palatal consonant in the nominative; while the third declension does without either palatalization or /ə/-suffixing. This is illustrated by the arrows drawn on top of the diagram, which show the expressive power of each declension according to the standard account. So, for instance, the third declension can only rely on lenition: hence, in case of non-mutable initial, adjectives belonging to it will be indeclinable; under the same circumstances, second-declension adjectives may still oppose masculine to feminine in the genitive, and first-declension ones may further distinguish the genitive masculine from the nominative, prepositional and vocative forms thanks to palatalization.

However, it should be noted at this point that final inflection as a means of marking gender and case agreement is on its way out. The paradigms just shown are referred to as "classical" by Ó Dochartaigh (1992: 56; 74), who points out the rapid change towards simplification that this class is undergoing in modern Irish; and it has been pointed out that inflection of the attributive adjective

> continued to be the norm in the literary language until very recent times, though there was a considerable reduction of form in use. In the modern spoken language,

> declension of the adjective in the singular has largely been abandoned, though old forms survive in many set phrases (Mac Eoin, 1993: 115f.)

What's more, continues Mac Eoin (ibid.: 116), the little adjective inflection surviving is threatened by the gradual decline of the attributive position altogether, which tends to be avoided in speech and is felt to be "bookish". "Various stratagems are used to ensure that the adjective is usually in predicative construction" (H. Wagner, cited in Mac Eoin). Therefore, the tendency seems to be for the adjective to become a completely indeclinable element. The comparative and superlative forms of the adjective, whether regularly or irregularly formed, are not inflected either (*NIG*, 2004: 70–72).[9]

3.6 Attributive nouns

Nouns used in attributive position (N_2) to modify the preceding head noun (N_1) may undergo lenition. There are various and rather idiosyncratic rules, in some cases depending on the gender of the head noun, so that lenition can be legitimately taken to mark gender agreement. Not all such cases, however, have to do with gender proper, as they instead may involve other forms of noun classification, based on different criteria, like proper vs. common nouns, definiteness vs. non-definiteness. The following description is based on Ó Siadhail (1989: 119–21), Mac Congáil (2004: 58–60), and the *NIG* (2004: 15f.), which all provide further details on the issue.

Nouns which immediately follow the head noun (and modify, determine, or specify it, are—at least traditionally—regarded as being in the genitive case.[10] The familiar rule blocking lenition between two dentals generally applies and is therefore to be regarded as a constraint on gender agreement when this is relevant.

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[9] For the sake of completeness we shall note that the comparative and superlative are identical to the genitive singular feminine form, preceded by various particles (depending on degree of comparison and tense of the verb) (*NIG*, 2004: 70f.).

[10] Some nouns do not have a distinct genitive form, e.g. those whose nominative ends in a vowel; other nouns are understood to be genitive in function, although nominative in form, when they are followed by a further (definite) noun in the genitive form (cf. *NIG*, 2004: 30–32; chapter 7).

A distinction is to be made between definite and indefinite N_2's: for the purposes of this rule, the former are either made definite by virtue of their being proper names (personal names, place names, etc.), by a following genitive phrase, or by a cardinal numeral used as an ordinal (cf. *NIG*, 2004: 25f.). These normally lenite, the trigger for lenition being definiteness and not gender.[11] As to indefinite nouns, they lenite after a feminine singular N_1, *provided that the latter is not itself in the genitive*:

(24) (a) aimsir$_1$ **bh**áistí$_2$
weather(F) rain.GEN
"rainy weather"

(b) an ghaoth$_1$ **Mh**árta$_2$
ART.F wind(F) March.GEN
"the March wind"

(c) cúis$_1$ **gh**áire$_2$
cause(F) laughter
"reason for laughter"

(*NIG*, 2004: 15)

There are certain exceptions to this latter rule, some semantically and some syntactically motivated. The following have to do with semantic reasons (apart, once again, from the phonetic constraint of lenition between dentals): a feminine N_1 does not trigger lenition of N_2 if it

- "denotes excess, part, want" (*NIG*, 2004: 15) ("quantity", cf. Mac Congáil, 2004: 59): e.g. *barraíocht$_1$ **c**ainte$_2$* "too much talk (lit. excess of talk)", *breis$_1$ **b**ainne$_2$* "extra milk (lit. addition of milk)", *easpa$_1$ **c**odlata$_2$* "lack of sleep", *roinnt$_1$ **b**agúin$_2$* "some bacon (lit. portion of bacon)";
- names a part of a person's or animal's body or a part of a thing or apparatus, e.g. *cos$_1$ **p**áiste$_2$* "the foot of a child", *cluas$_1$ **c**upáin$_2$* "the handle (lit. ear) of a cup" (Mac Congáil, 2004: 59);

[11] Although a noun phrase can be made definite by the presence of an article, a possessive (see below), or a quantifier (e.g. *gach* "every"), these precede N_2, which therefore does *not* immediately follow N_1. Therefore, lenition of N_2 in such instances is *not* covered by the rules we are now examining.

- is followed by a partitive genitive (which may also function as an apposition), or a genitive of material, e.g. *scuaine*$_1$ ***c**aorach*$_2$ "a flock of sheep" (Mac Congáil, 2004: 59), *óinseach* ***m**ná* "a fool of a woman" (Ó Siadhail, 1989: 121);
- denotes something owned by, or meant for, N_2 (the latter being a common noun, cf. Mac Congáil, 2004: 60): *culaith*$_1$ ***f**ir*$_2$ "a man's suit", *bróg*$_1$ ***p**áiste*$_2$ "a child's shoe";
- is grammaticalized into a compound preposition (compound prepositions are comprised of a simple preposition + N_1 and are followed by a genitive) and N_2 is *not* a proper name: cf.

(25) (a) *Compound preposition + (lenited) proper name:*

as cionn$_1$ [**Gh**arrdha na Raithní]$_2$
out of head.DAT [Garrdha na Raithní].GEN
"above Garrdha na Raithní"
(Ó Siadhail, 1989: 120)

(b) *Compound preposition + (unlenited) common noun:*

i láthair$_1$ **m**úinteora$_2$
in presence teacher.GEN
"in the presence of a teacher"
(Mac Congáil, 2004: 60)

- is a verbal noun:[12] e.g.

[12] However, Ó Siadhail (1989: 121) observes how all dialects have a selection of set phrases in which nouns following feminine (and masculine) verbal nouns *do* lenite: e.g. *ag fáil*$_1$ ***bh**áis*$_2$ "dying (lit. finding of death)". Ó Siadhail adds as "noteworthy" that "there is a core of phrases common to all dialects" where lenited nouns follow a verbal noun: among these are the aforementioned *ag fáil bháis*, *ag cur*$_1$ *fhataí/(phr(e)átaí)*$_2$ "sowing of potatoes", and others. It would appear that "many such phrases contain common verbs such as *fáil* 'get', *cur* 'put' and the lenition serves to bond the phrase with a particular meaning."

(26) (a) ag baint$_1$ **m**óna$_2$
at extracting(F) turf.GEN
"digging out turf"
(*NIG*, 2004: 15)

(b) beannacht$_1$ **b**aintrí$_2$
blessing(F) widow.GEN
"a widow's blessing"
(Mac Congáil, 2004: 60)

As to the syntactic restriction, N_2's fail to lenite when followed by an adjective qualifying them:

(27) oíche **g**aoithe móire
night(F) wind.GEN great.GEN
"a night with a high wind" (Ó Siadhail, 1989: 121)

Given the complexity of the rules governing lenition of attributive nouns, it will be particularly interesting to investigate the extent to which they are observed in the actual usage.

3.7 Demonstratives

There is a three-term set of deictic particles corresponding to *proximal* (*seo* "here, this"), *distal$_1$* (*sin* "there, that"), and *distal$_2$* (*siúd/úd* "yonder, that over there").[13] They are indeclinable per se, and can stand on their own as pronominal elements:

(28) **seo** mo mháthair
this POSS:1SG mather(F)
"this is my mother"
(Mac Congáil, 2004: 111)

They may also be accompanied by pronouns which are marked for gender (see below):

[13] The labels *distal$_1$* and *distal$_2$* are chosen purely out of convenience and are not meant to allude to any theoretic framework.

(29) (a) **seo** **í** mo mháthair
this 3SG.F POSS:1SG mother
"this is my mother"

(b) **seo** **é** do sheans
this 3SG.M POSS:2SG chance
"this is your chance"

(Mac Congáil, 2004: 111)

As adjectives, they follow the noun and require that it be accompanied by the article; again, they do not inflect, but the accompanying article does, in the ways we have already seen:

(30) (a) **an** fear **seo**
ART.M man this
"this man"

(b) **an**^{L} bhean **sin**
ART.F woman that
"that woman"

(ibid.)

3.8 Numerals

Numeral adjectives (whether cardinal or ordinal) precede the head noun and do not inflect for gender. Standard Irish has a special set of numerals for use with personal nouns (nouns denoting humans) when counting from two ("2") to ten ("10"). Within this range, personal nouns require a special set of numeral elements which are sometimes called "personal numbers" but are really nouns followed by a partitive genitive, the resulting construction thus literally meaning "pair of *x*'s", "triplet of *y*'s", and so forth. The two sets are compared in (31):

(31) Common and "personal" numerals in Irish (cf. Mac Congáil, 2004: 190, 194)

Number	Non-personal (adjectives)	Personal (nouns)
2	***dhá*** *bhád* "two boats"	***beirt*** *bhan* "two women"
3	***trí*** *bhád* "three boats"	***triúr*** *ban* "three women"
4	***ceithre*** *bhád* "four boats"	***ceathrar*** *ban* "four women"
5	***cúig*** *bhád* "five boats"	***cúigear*** *ban* "five women"
6	***sé*** *bhád* "six boats"	***seisear*** *ban* "six women"
7	***seacht*** *mbád* "seven boats"	***seachtar*** *ban* "seven women"
8	***ocht*** *mbád* "eight boats"	***ochtar*** *ban* "eight women"
9	***naoi*** *mbád* "nine boats"	***naonúr*** *ban* "nine women"
10	***deich*** *mbád* "ten boats"	***deichniúr*** *ban* "ten women"

The following should be observed:

(i) In the *non-personal* series, the numerals are followed by the noun in the singular. While this is obligatory with "2", optional with subsequent numerals (cf. Acquaviva, 2006). What initial mutation specifically follows each numeral has also nothing to do with gender.

(ii) Personal numerals are followed by the genitive plural. As we have already said, these are in fact numeral nouns: they have a gender of their own (*beirt* is feminine, *triúr* to *deichniúr* are masculine), which is reflected in the use of the article preceding them (e.g. ***an***^{L} ***bh****eirt bhan* "the two women", but ***an***^{T} ***t****-ochtar bhan* "the eight women (lit. the octet of women)") (Mac Congáil, 2004: 194f.).

(iii) Note that the lenition of the genitive noun after *beirt*, which is feminine, appears to contradict the tendency for partitive genitive not to undergo lenition (see above): this corroborates the impression of high complexity governing the mutation of attributive nouns noted above.

3.9 Possessives

Although we will not enter the question whether possessives should be considered, from a synchronic point of view, adjectives or genitival forms of the personal pronoun, it must be observed that their pronominal force is notable in constructions with verbal nouns (see (33) below), where these forms are used for the semantic role of object (i.e. the role fulfilled by an accusative pronoun with a finite form of the same verb; see below).[14] The possessive series is characterized at the surface level by a mutational pattern which, at any rate, has grammatical function only in the third person, where the mutational morphophonemes distinguish masculine from feminine and singular from plural. This is shown by the table in (32):

[14] Evidence in favour of their pronominal nature seems to come from the behaviour of the emphatic suffixes, which agree in person, number and gender with the possessive as they do with the pronoun, although they do not attach to the possessive but to the intervening noun (see discussion in §3.10).

(32) Possessives in Irish

Person	Possessive	Example
1SG	*mo*^{L}	*mo*^{L} **bh***ád* "my boat"
2SG	*do*^{L}	*do*^{L} **bh***ád* "your (SG) boat"
3SG.M	*a*^{L}	*a*^{L} **bh***ád* "his boat", *a*^{L} *athair* "his father"
3SG.F	*a*^{H}	*a*^{H} *bád* "her boat", *a*^{H} **h***athair* "her father"
1PL	*ár*^{N}	*ár*^{N} **mb***ád* "our boat"
2PL	*bhur*^{N}	*bhur*^{N} **mb***ád* "your (PL) boat"
3PL	*a*^{N}	*a*^{N} **mb***ád* "their boat"

As can be seen in (32), if deprived of their final morphophonemes the third person possessives would be *a* /ə/ regardless of number and gender.

Irish possessives mark agreement with the grammatical gender of the possessor, not the possessum: there are no distinct forms of the possessive depending on whether the head noun is masculine (e.g. *carr* "car") or feminine (e.g. *carraig* "rock"): cf. *a*^{L} *charr* "his car" ~ *a*^{H} *carr* "her car", just like *a*^{L} *charraig* "his rock" ~ *a*^{H} *carraig* "her rock".

Synchronically, a separate set of forms is used for third-person possessives with verbal nouns. This includes *á*^{L} (masculine singular), *á*^{H} (feminine singular), and *á*^{N} (plural): while the mutational pattern is shared with the other series, the difference between the two series involves the stem vowel, which is /aː/ instead of /ə/: the former is structurally "heavier" in that it corresponds to the sequence preposition (*do* "to" or *ag* "at") + possessive which is found in all other persons: compare (33) to (34):

(33) do/ag **mo** mholadh
to/at POSS:1SG praising
"praising me (lit. to/at my praising)"
(Mac Congáil, 2004: 107)

(34) **á**^{L} **mh**oladh
to.POSS:3SG.M praising
"praising him"
(Mac Congáil, ibid.)[15]

[15] The form *á* represents the phonetic development of the forms *ag a*, *do a* with lenition of /d/ and /g/ (through the forms /aɣa/, /ɣa/) (cf. Ó Cadhlaigh, 1940: 48–50; I am grateful to Damian McManus for this reference).

3.10 Personal pronouns

There are two sets of personal pronouns: subject pronouns and object pronouns (three sets if one considers possessives as genitive forms of the personal pronouns). All two (or three) of them can take emphatic particles. Again, it is only the third-person singular pronoun that has distinct forms for the masculine and the feminine gender. These are *sé* (m.), *sí* (f.) for the subject series, and *é* (m.), *í* (f.) for the object series. The emphatic suffixes m. *-s(e)an* (/sən/ or /ʃən/), f. *-se/sa* (/ʃə/ or /sə/) attach to them: *(s)eisean* "himself", *(s)ise* "herself".

Prepositional phrases with suffixed pronominal endings (the so-called "prepositional pronouns") behave correspondingly: gender is marked on the third person singular only, and emphatic suffixes preserve the distinction of gender (*NIG*, 2004: 82–84): e.g. *aige* "at him" (*ag* + 3SG.M) vs. *aici* "at her" (*ag* + 3SG.F), emphatic forms m. *aigesean* "at himself", f. *aicise* "at herself".

Note that emphatic suffixes mark gender agreement in the third person singular even when they are not suffixed directly to the pronoun but to some intervening constituent:

(35) (a) a^{L} chota-**san**
POSS:3SG.M coat-EMPH.3SG.M
"his coat"

(b) a^{H} bróg bheag-**sa**
POSS:3SG.F shoe small-EMPH.3SG.F
"her small shoe"

4 Dialectal variation and double gender

Dialectal variation with respect to grammatical gender involves at least three distinct aspects, to which we shall turn in this section:

(i) syntactic constraints on the surfacing of agreement, depending on the possibility for a preposition to govern noun phrases standing in different cases in different dialects;
(ii) idiosyncratic gender assignment at the lexical level, depending on the different linguistic varieties;
(iii) anaphoric agreement, which may vary across the dialects.

We shall consider each of these three points in turn.

4.1 Syntactic constraints

At the level of **syntactic constraints** on agreement, the northern dialects of Irish stand out on account of their treatment of prepositional case. The distinction between prepositional I and prepositional II is only possible when the article is present: a noun immediately following a preposition mutates according to the preposition itself (lexical trigger, syntax-independent). Jackson (1942: 272f.) points out that the treatment of nouns within determiner phrases (ART + NP) diverges widely from the standard account, depending on the dialects. In the standard model, it is expected that the article will ordinarily nasalize the noun unless the latter begins with *d-* or *t-* (phonological constraint); after the preposition *de* or *do*, the noun will instead be lenited. Jackson outlines the following, threefold situation, which is motivated on a dialectological basis:

- Ulster and West Mayo (northern dialects): only lenition, no nasalization;
- Aran Islands (west): compliant with the above standard grammar generalizations;
- Most of County Clare (west): differing from the standard account in that nouns beginning with *d-* and *t-* nasalize too.

O'Rahilly (1932, cited in Jackson, 1942: 273) and Ó Siadhail (1989: 127–29) give us the following picture. Prepositional II is generalized with all prepositions in the northern dialects (Ulster and West Mayo). Elsewhere, prepositional I is the norm with only *de* "from" and *do* "to" regularly taking prepositional II. However, in Waterford and some parts of Kerry (Munster dialects, south), and in some parts of northern Connacht (western dialects), even *de* and *do* may take prepositional I. Some West Munster dialects (e.g. County Clare, as mentioned above) may extend nasalization to nouns beginning with the dentals *t-* and *d-*. In West Munster, the preposition *i*(*n*) "in" ordinarily takes prepositional II; elsewhere, it takes prepositional I.

The above dialectal differences are not—per se—significant from the point of view of gender marking, insofar as they apply across the board to

both masculine and feminine nouns. However, there are two gender-motivated phenomena that intersect with dialectal boundaries: the first concerns the particular behaviour of a restricted class of feminine nouns in Connacht (phonologically defined as beginning in *s-* + V or *s-* + *-l-*, *-r-*, *-n-*), where, as observed by Ó Siadhail (1989: 127), the leniting form *an t-*/ənt^{L}/ of the article (nom. f. sg.) is generalized as with all prepositions (36):

(36) faoin^{L} tsúil
/tu:l′/
under.ART eye(F)
"before the eye"
(Ó Siadhail, 1989: 127)

(Compare *faoin*^{N} ***mb****ean* (f.) "before the woman" with nasalization and *faoin*$^{(N)}$ *sagart* (m.) "before the priest", with no mutation.) The second of these gender-relevant phenomena has to do with cross-dialectal differences, in that the choice of prepositional I or prepositional II may be relevant in terms of the marking of gender agreement on post-nominal adjectives, at least if we go by the standard account (*NIG*, 2004: 17f.), whereby

(i) an adjective following a feminine noun in the prepositional II is lenited, as in (37):

(37) do-n^{L} bhean **bh**eag
to-ART.PREP_II woman(F).PREP_II small.PREP_II.F/M
"to the small woman"
(*NIG*, 2004: 17)

(ii) an adjective following a masculine noun in the prepositional II *need not* (but *may*) be aspirated, so both examples (a) and (b) in (38) are grammatical:[16]

[16] There are however, according to the *NIG* (2004: 18), certain circumstances in which the masculine adjective is ordinarily unlenited, namely when the noun itself is not lenited: e.g. *ar an* ***h****ata* (M) ***d****ubh* "on the black hat". In other words, masculine adjectives will not ordinarily "outmark" the noun. According to the *NIG* (2004: 17), there is a further complication regarding masculine definite noun phrases in the prepositional II: an adjective following the

(38) (a) do-n^{L} fhear **mh**ór
to-ART.PREP_II man(M).PREP_II big.PREP_II.F/M
"to the big man"

(b) do-n^{L} fhear **m**ór
to-ART.PREP_II man(M).PREP_II big.PREP_II.M
"to the big man"
(*NIG*, 2004: 17)

(iii) an adjective following a feminine noun in the prepositional I must be lenited, as shown in (39):

(39) as an^{N} gcoill **mh**ór
out.of ART.PREP_I forest(F).PREP_I big.PREP_I.F
"out of the big forest"
(*NIG*, 2004: 17)

(iv) an adjective following a masculine noun in the prepositional I, on the other hand, does not undergo either type of initial mutation, as shown in (40):

(40) as an^{N} mbád beag
out.of ART.PREP_I boat(M).PREP_I small.PREP_I.M
"out of the small boat"
(*NIG*, 2004: 17)

To summarize, the prepositional-I case, with its unmarked masculine adjectives and its lenited feminine adjectives, has a stronger potential of gender distinction than does the prepositional-II case, where both masculine and feminine adjectives may take initial lenition. It follows that dialects such as the northern ones, in which the use of prepositional II is extended to all prepositions, have a weaker potential of gender distinction by means of initial mutations than do other dialects. Of course, one must always bear in mind that gender distinction by means of initial mutation is constrained by

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noun "need not" be lenited if the preposition heading the PP is either *de*, *do*, or *i*(*n*); but it must be lenited if the PP is headed by any other preposition.

the usual phonological factors, i.e. the fact that only a limited number of initial phonemes may undergo lenition.

As can be seen from the above, in standard modern Irish gender agreement in the adjective is characterized in terms of lenition versus no lenition: nasalization is not employed as a contrastive device.

Analyses conducted at a more local level show an even more irregular picture. Two studies conducted in the Munster dialectal area, namely Breatnach's (1958–61) on Déise Irish (i.e. the variety spoken in West County Waterford and South Tipperary) and Jackson's (1942) on Peig Sayers's (†1958) corpus of folk tales, both focussing on the variable occurrence of nasalization and lenition in prepositional phrases, show that the same preposition may at times command different cases (prepositional I or II) depending on phonological factors—e.g. whether the preposition in question ends in a vowel or a consonant and whether the noun begins with a voiced or a voiceless consonant; which in turn may affect the post-nominal attributive adjective (Jackson, 1942: 274f.).

Therefore, gender agreement with adjectives depends on a number of factors: syntax, dialectal variation and phonological idiosyncrasy. I will be particularly interested in observing whether a corpus of data from actual usage will offer a picture that is different, perhaps in terms of simplification and regularization, from the complex and multifaceted one presented by both the standard and the local varieties.

4.2 Lexical idiosyncrasy and double gender

A second, interesting effect of dialectal variation has to do with a set of phenomena referred to by Ó Siadhail (1984: 174; 1989: 145) as double gender (henceforth, DG). Ó Siadhail distinguished two distinct instances of double gender agreement, which he simply terms "1" and "2". Both DG1 and DG2 consist in pairs of inconsistent gender agreement forms: DG1 nouns command masculine agreement with the article but feminine agreement with the attributive adjective, as in (41); DG2 nouns, on the other hand, may control (consistent) masculine gender agreement when in the nominative and

(consistent) feminine gender agreement when in the genitive, as in (42), or the other way round:

(41) Cois Fhairrge dialect

(a) an^{T} **t-**eolas
ART.M knowledge(DG1)
"the knowledge"

(b) eolas **mh**aith
knowledge(DG1) good.F
"a good knowledge"

(Ó Siadhail, 1984: 174)

(42) Gaoth Dobhair dialect

(a) an^{T} **t-**am
ART.NOM.M time(DG2)
"the time"

(b) i rith **an** ama
in flow ART.GEN.M time(DG2).GEN

(c) i rith **na**^{H} **h**ama
in flow ART.GEN.F time(DG2).GEN
"all the time"

(Ó Siadhail, 1984: 175)

This kind of variation is both lexical and dialectal, in that the status of DG noun may pertain to different lexical items in different dialects: so *leoraí* "lorry" is DG1 in Gaoth Dobhair; *aistir* "journey", *méid* "amount" and *eolas* "knowledge" are DG1 in Cois Fhairrge; and *radharc* "sight" is DG1 in Kerry (Ó Siadhail, 1984: 174; 1989: 146). A dubious point and one which will be worth investigating further concerns which gender agreement form will be controlled by DG1 nouns when the article and the adjective co-occur, as Ó Siadhail (1989: 174) admits to not having found any such co-occurrence in his corpus.

Other nouns are double gender in a broader sense, that is they may control consistent agreement within a single dialect but be assigned to different genders in different dialects. Some such examples include *paróiste*

(Donegal *paráiste*) "parish", which is masculine in Connacht and Kerry dialects, feminine in West Muskerry and Donegal; *mí* "month", masculine in Munster dialects but feminine in Connacht and Donegal; *gaineamh* "sand", which is masculine in Connemara[17] and Donegal, feminine in Erris (Mayo) and Munster, and various others (Ó Siadhail, 1989: 147).

Cross-dialectal fluctuation in terms of gender might also be explained, for certain items, as reflecting "a certain hesitancy in assigning a gender and inflectional pattern" to ancient neuters (Ó Siadhail, 1984: 175): nouns like *ainm* "name" and *dlí* "law" provide a good example, being treated as masculine in standard Irish but not in Kerry, where they are feminine; and similarly *loch* (m.) "lake", which is reported by Wagner (1958: 69, cited in Ó Siadhail, 1989: 147) to have both feminine (*na locha*, *na loiche*) and masculine (*an locha*) forms in the genitive singular "with no discernible pattern".

4.3 Anaphoric agreement

Finally, we turn to the cross-dialectal differences in **anaphoric agreement**. Here we shall observe that with inanimate referents there is remarkable scope for variation (all of the following examples are drawn from Ó Siadhail; reference will therefore be made by indication of year of publication and page only). *Leabhar* (m.) "book" is an apt example of inconsistent gender agreement across dialects, as reference to it may optionally be expressed by a feminine pronoun "in all major dialects" (1989: 146). Its peculiar behaviour pattern in terms of gender agreement is further complicated by the fact that in the spoken usage of Rannafast Irish (Donegal) an altogether new declension has been developed for *leabhar* and now flanks the old one: in the new declension, which is used with feminine forms of both the article and adjectives, a new genitive singular *leabhra* established itself at the expenses of its standard opponent *leabhair*, which might have been felt to be

[17] These examples, as acknowledged in the text, are drawn from Ó Siadhail (1989). In his book, *gaineamh* is quoted as "Cn", which in his abbreviation table corresponds to "Connacht". However, there are in the table two abbreviations for Connacht, the other being "C", while Connemara does not appear on the list. Ó Siadhail (personal communication) confirmed my doubt that a typographical error had occurred and that "Cn" was actually meant to correspond to "Connemara".

masculine in view of its being formed by palatalizing the ending of the nominative, according to the typical first-declension (hence masculine) pattern (1989: 146). Two very basic dimensional terms, both feminine—*áit* "place" and *uair* "hour; time, occasion"—are commonly referred to by a masculine anaphoric pronoun in Kerry and Cois Fhairrge (1984: 175).

The picture presented thus far, unsystematic as it is and made up of isolated lexical items, seems to reflect a rather idiosyncratic situation in which long-established and so-to-speak unchallenged irregularities are interspersed in the spoken usage of some dialects. However, it would appear that a different states of affairs characterizes the Irish of Gaoth Dobhair, where a masculine pronoun is used as the appropriate anaphora for all inanimate referents (Ó Siadhail, 1984: 175). Such usage is, observes Ó Siadhail, well established even among the older members of the Gaoth Dobhair community (some of whom in their late eighties) and might therefore not be (at least in Gaoth Dobhair) a recent development due to the influence of English (contrary to the opinion of other scholars, among whom Greene, 1979: 124, cited in Ó Siadhail, ibid.). However, it remains to be seen whether or not the data point to a similar situation outside Gaoth Dobhair.

5 Conclusions

As we have seen, speaking of Irish as a whole means, in many respects, dealing with a rather abstract generalization. Irish is not a monolithic entity: far from it, it is rather a label for different although obviously related models or varieties of Irish. In the first instance, the Irish spoken by the few surviving native speakers: three macro-dialects (Ulster, Connacht, Munster), further subdivided at county or even town level; then we have standard Irish, a language created in the effort of revitalizing the language and promoting its use after the Independence; finally, the same standard language as actually employed by its L2 users, through both the spoken and written medium.

The resulting picture, when one investigates any given structure of the language, is therefore far from uniformity, resulting as it does in a collation of the particular usages of each micro-system. While coherence must be sought at precisely this level, it is still possible that the micro-system of L2

users' Irish, in the sense defined by McCloskey and cited at the beginning of this article, may be more flexible and less codified than any other established variety, still in its fieri so to say, and that different tendencies towards simplification may be identified and described within it. This is precisely the aim of my research project.

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The Conceptual Structure of Negative Emotions Revealed by Shocking, Annoying, and Scary Examples of Lexical Processing

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Abstract

Emotions can be viewed as abstract cognitive events without an external reference object. They are cognitive relations in the sense that they consist of two or more primarily autonomous events, which are set in relation to each other. Accordingly, their conceptual structure is relatively complex, and it can be of diverse nature. This is reflected in a broad variety of lexicalisation patterns, both within and across languages. The significance of emotions for human interaction and their complexity is reflected in the rich inventory of emotion terms in many cultures. Their processing in a second or foreign language requires conceptual restructuring, making high demands on the learner's cognitive abilities. The processing of emotion terminology can therefore provide interesting information about the cognitive organisation of conceptual and linguistic knowledge.

1 Introduction

The present paper is concerned with the conceptual structure of negative emotions, their lexicalisation patterns, and the processing of their terminology in language production. It aims to link a psycholinguistic perspective on lexical processing to a cognitive view of conceptual organisation. Starting point is the hypothesis that conceptual structure is mirrored in lexico-semantic organization and can be traced by analysing lexical processing activity. The investigation is centred on the organisation of shock-related emotion concepts, both theoretically and in the light of an empirical investigation of productive processing in L1-L2 translation. Its main focus is on the structure of lexico-semantic networks and the processing of emotion words. Another issue of interest are the general mechanisms involved in verbalising a conceptual content in a given communicative situation.

2 Theoretical Considerations

2.1 Conceptualising and Verbalising Emotions

2.1.1 The Cognitive Structure of Emotions

Emotions as basic conceptual domains (Langacker 1987:151) may at first sight appear to have a relatively simple cognitive structure. On closer scrutiny, however, it becomes clear that they cannot be accounted for adequately without reference to their experiencer and his evaluation of a certain event or situation. This view is supported by their lexicalisation structures, which give evidence of a range of possible different perspectives on one and the same emotional state, depending on the grammatical category chosen to express this state (cf. below). Emotions are also interesting in that they can be conceptualised differently across cultures, which is reflected in diverging lexicalisation patterns.

"Feelings are the meeting place of mind, body and behaviour" (Johnson-Laird 1988:380). Emotions belong to the wider domain of *internal states*, or feelings, but as opposed to *bodily sensations*, such as pain, emotions are *mental states*, originated from the cognitive interpretation of a physiological state (e.g., Schachter/Singer 1962; Johnson-Laird 1988). As such, they are highly complex bio-psychological events with a physiological as well as mental dimension. They are associated with autonomous bodily reactions, such as typical facial expressions, differences in heart rate, skin temperature, or muscle tension (cf., e.g., Johnson-Laird 1988:372).

A widely accepted perspective distinguishes five basic emotions, or emotion categories, namely HAPPINESS, SADNESS, ANGER, FEAR, and DISGUST[18], which can take a variety of shapes, depending, for example, on their intensity or the object they are directed at (ibid.:379). They can be defined along the lines of a number of classifying dimensions, the most basic of which would be the positive-negative continuum (Langacker 1987:151). With a view to the

[18] For the sake of lucidity in the following discussion and later data analysis, I will formally distinguish conceptual entities, lexical items, and real-life objects in the following way: Concepts will be capitalised, lexical items written in italic script, and reference objects in normal font.

later data analysis, I will here concentrate on the discussion of negative emotions.

Following Johnson-Laird (1988), the four negative states can tentatively be distinguished in the following way: ANGER can be seen as a precursor to aggressive behaviour, FEAR to submissive behaviour or flight, and DISGUST as a precursor to rejection, SADNESS determines an inner withdrawal to overcome a loss. Despite this variety of reactions, all negative emotions are thought to relate to essentially the same state of arousal, i.e., they are emotions of the same valency (cf., e.g., Bamberg 1997b; Schachter/Singer 1962). They are differentiated from one another only by the experiencer's perceptions and beliefs about the context and her position with regard to it (ibid.).

In addition to the basic emotions, SURPRISE is an interesting inner state. It could be characterised as a pre-emotional reaction to something unexpected, and "can play a part in the genesis of any emotion" (Johnson-Laird 1988:372). SHOCK as a more violent variant of surprise is described by Wierzbicka (1992:565) as a state of confusion, which leaves the experiencer lost for words, thoughts, and actions. Contrary to SURPRISE, which is a primarily neutral reaction, its cause is always something experienced as negative. Consequently, SHOCK is a precursor to negative emotions.

Similar to other members of a category, emotion concepts have been found to overlap to a considerable extent (cf., e.g., Wierzbicka 1992; Bamberg 1997b). They can be contrasted, for example, with reference to semantic primitives, or by scrutinising their usage contexts. Wierzbicka (1992:558ff) defines a series of emotions, or rather, their lexical expressions, in reaction to bad experiences, by homing in on semantic primitives. This enables her to structure the continuum of emotion concepts, and at the same time contrast the meaning of related terms and trace their underlying similarities. SHOCK, for example, as described above, is characterised by the inability to react, and can give way to a range of aversive emotional states ranging from DISMAY to ANGER after the shocking event has been conceptually evaluated. DISMAY involves a particular strong element of rejection along with passiveness,

while ANGER has an air of active aggressiveness. Another example would be species of the category SADNESS, including, for example, DISTRESS and also SADNESS in a more restricted sense. While SADNESS portrays a present state of mind in reaction to a past event, DISTRESS includes an anxious outlook to the future. It may even be regarded as a variant of FEAR, foregrounding concern about possible consequences, rather than the upsetting effect of the experience.

The examples show that emotions are highly differentiated concepts, but that their boundaries are anything but clearcut. Depending on the perspective taken on a given event, i.e., the evaluation of it, an experiencer (or onlooker) may develop rather different emotions about it.

The results of Wierzbicka's corpus linguistic analysis are supported by Bamberg's (1997a) investigation of verbalisation patterns in children's narratives. Bamberg focused on the use of opposing terms, such as anger and fear, or even happiness and sadness in the description of one and the same situation. He discovered that this verbal behaviour does not reflect the simultaneous experiencing of two more or less distinct feeling states, "but that it is the product of the linguistic ability to view a situation for two discursive purposes" (ibid.:219). "What at first sight looked to be a description of an internal state of the protagonist, turned out on closer scrutiny the expression of a particular perspective" on the given situation (ibid.:214).

Interpreted from a slightly different angle, it seems that the fact that emotional situations do allow for different perspectives could be seen as an indication of the overlap of emotion concepts. ANGER and FEAR may be considered a pithy example of the phenomenon of having 'mixed feelings' about something: a person may experience a certain situation in a way that it arouses both ANGER in her, for example with a given offender, and a FEAR of possible consequences. A foregrounding of either ANGER or FEAR in the very situation, could then be seen as indicating the experiencer's temporal orientation more than the overall quality of her inner state.

In conclusion, emotion concepts must be seen as highly complex cognitive structures with considerably more variables than may be obvious at first sight. They are bound up in a continuous domain, definable along a number of quality dimensions which can be delineated in terms of semantic primitives. The conceptual field of emotions appears to bear some resemblance with the colour spectrum, in that its concepts merge into each other, and more so in that 'opposite' emotions (such as fear and anger) like 'opposite' colours (such as green and red) might be more appropriately regarded as complementary rather than antagonistic. An important aspect of emotional conceptualisation appears to be the perspective taken in respect of evaluating and/or reporting on a given situation or experience.

The following section investigates the different ways in which emotions are lexicalised, using as an example expressions for fear.

2.1.2 Lexicalisation Patterns

To explain the lexicalisation patterns of emotions, I will use the example of FEAR. FEAR could very generally be described as a negative emotional state caused by a situation perceived as threatening, whereby the intensity of this feeling can vary considerably. It is accompanied by specific bodily reactions ranging from a fearful facial expression via sweating to an increased heart rate or blood pressure. Resulting behavioural patterns in the natural world include species of avoidance, such as flight, 'freezing', or submission (Johnson-Laird 1988:373), which usually become manifest in the form of more moderate and subtle responses in human behaviour. The variety of descriptive viewpoints on a person in FEAR is reflected in the variety of verbalisation possibilities for her feeling. Two overall perspectives can be distinguished: her experience can be described with reference either to her internal state, or to her outwardly observable physiological or behavioural reactions. Accordingly, different linguistic means will be employed to express the situation. In more abstract terms, we may say that the perspective taken on a scene is important to both semantic and grammatical structure (Langacker 1987:120). This hypothesis will be scrutinised in what follows.

One of the most striking features of the emotional domain is its extremely rich lexicalisation. Several different shades of FEAR, for example, which relate to the intensity of the feeling and to other variables, are identified lexically (e.g., APPREHENSION, ANXIETY, WORRY, FRIGHT, TERROR, or PANIC, to name just a few). This clearly indicates the significance of the domain for human interaction. More interesting in relation to the present study, however, is a different aspect of emotion terminology. The terminology associated with emotional states or reactions is spread across all semantic word classes, ranging from nouns and verbs to adjectives and adverbials (cf. Langacker 1987:189). Each type of category denotes a particular perspective on an emotional state. Adjectives, like *afraid* or *anxious* identify the feeling as a qualitative state of the experiencer, while nouns like *fear* or *anxiety* appear to view it in a more abstract way, almost as a disembodied entity. Verbs, like *worry* or *fear* seem to emphasise the development of the feeling, accentuating its persistence over time. A participle like *worried* could be described as combining the qualities of verb and adjective, characterising the inner state of a worried individual as a persistent quality.

The examples show that the lexico-semantic field of fear is a rich inventory of expressions not only for different species of FEAR, but also for different ways of viewing these species. Beside these immediate lexicalisations of the conceptual category, a second set of lexical items, again covering all major grammatical categories, are associated with FEAR. It includes expressions depicting physiological reactions like wide(ned) eyes or shivering, non-verbal behaviour like cowering, and peculiarities in verbal behaviour like whispering or stammering. The lexico-semantic field could now be illustrated as in figure 1, as a network of connections organised around the relatively general item fear, with lexicalisations of the emotional state as central members, and lexicalisations of bodily expressions of fear distributed towards the periphery.

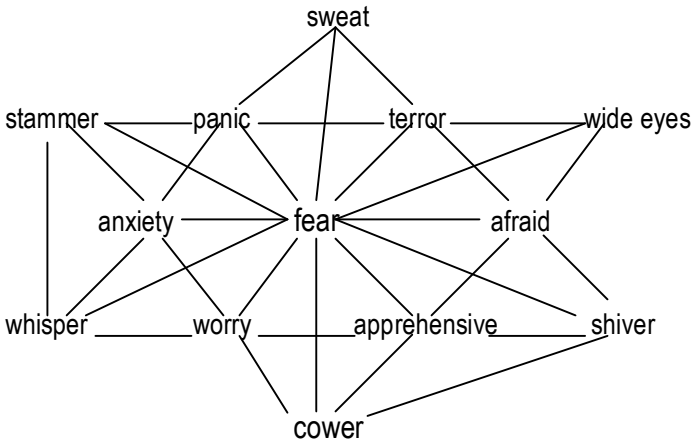

Figure 1 Semantic field associated with FEAR

In sum, the conceptual complexity of emotions as exemplified by the notion of FEAR is documented by a rich inventory of referring expressions, which reflects the complex structure of the cognitive domain.

2.1.3 Emotion across Languages

Crosslinguistic and cross-cultural studies suggest that the conceptualisation of emotions is socio-culturally shaped (cf., e.g., Kitayama/Markus 1994; Wierzbicka 1999). Accordingly, lexicalisation patterns vary. Many emotion terms do not have exact translation equivalents, owing to the fact that they relate to culture-specific emotion scripts (ibid.). Lexical asymmetries across languages include lexical gaps in one language where in another language certain concepts are lexicalised. However, they not only vary in relation to whether or not they *are* lexicalised, but also in relation to the semantic and formal structures by which they are represented. Such differences reflect different ways of conceptualising certain events, in particular different perspectives on a scene (cf. Langacker 1987:120). A simple example, comparing English and German, can be given from the field of emotional states. Here, the two languages differ, for instance, in their most general way of expressing the concept of FEAR. While English avails of an adjectival construction (*be afraid (of something))*, which expresses the affective state of the experiencer, German employs a nominal construction (*Angst haben (vor etwas*) – 'have fear (of something)'), which seems to model the emotion more as an impersonal entity that has 'taken possession' of the experiencer. Other, more subtle differences manifest themselves in divergent valency structures

of related expressions. These, however, are not relevant for the present discussion.

2.2 Lexical Selection in Language Production

Language production is generally thought of as including a variety of component processes on the way from prelinguistic conceptualisation to articulation. Following Garrett (1988:71), the first step towards expressing a concept in words is *lexical selection*. As Singleton (1999:29) observes, "there is, of course, no doubt that lexical choice and meaning are intimately linked". Lexical selection can thus be regarded as a choice of meaning. It is here used to refer to the process of accessing the semantic items required for verbalising a given conceptual content. Following Aitchison (1994:230), it involves "first a broad sweep through the general area, in which numerous words which fulfil certain outline specifications are activated", eventually resulting in the selection of a situationally appropriate one. This processing activity is related to the principle of *spreading activation*, which assumes that activation fans out from a given centre - in this case a conceptual content - stimulating adjacent structures (ibid.; cf. Also, e.g., Bierwisch/Schreuder 1992; Dell 1986; Dell/O'Sheaghdha 1992; Roelofs 1992; Zimmermann 1994). Aitchison points out that humans are thought to "automatically consider words that are inappropriate, provided they are in some way connected to the topic concerned" (1994.:199). Usually, only the most adequate solution is finally verbalised. These suggestions agree with Baars' (1980) *Competing-Plans-Hypothesis*, which assumes that a speaker/writer often has a number of possibilities for realising a communicative intention, whereby alternative plans convey different shades of meaning (ibid.:41). It is important to note, however, that the process of lexial selection usually happens automatically and does not demand conscious awareness, and that, according to Aitchson (1994:198), "In everyday conversation [i.e., unreflecting language use], words are selected relatively randomly, as opposed to special occasions where they must be selected carefully".

2.3 Translation

In L1-L2 translation, which provides the source of data for the following empirical investigation, both languages are inevitably active, and L2

production is immediately influenced by the given L1 structures. Interactive activation and crosslinguistic consultation happens consciously as well as unconsciously following the principle of spreading activation. Corresponding processing activity is reflective of intra- and crosslinguistic connectivity and will be used for the reconstruction of lexico-semantic networks.

3 Empirical Investigation

The above findings are supported by data collected in a research project on lexical processing in L1-L2 (English-German) translation. The study focussed on a range of aspects of productive processing, among them and relevant for the present discussion, lexical search activity in cases of an unavailability of required target language items. Here, the study set out to investigate the relationship of general conceptual and lexico-semantic structure as becoming evident from the informants' processing activity.

3.1 Data Collection

3.1.1 Subjects

The informants involved in the study were 30 English-speaking university students not specialising in a foreign language but taking German as an additional 2-year module during their undergraduate courses. All of them had attended Irish secondary schools, where they had had German up to School Leaving Certificate level. They constituted a relatively homogeneous group insofar as they all had a similar general educational and language learning background and a similar level of L2 competence.

3.1.2 Methodology

The data collection covered two broad categories: elicited language and introspective data and information on the subjects' linguistic background. The former comprised three sets of data, namely, the composition of a story on the basis of a series of pictures in the subjects' mother tongue, a translation of the same story into German, and think-aloud verbal protocols relative to the performance of the translation task. The personal information included responses to a questionnaire on the subjects' language learning

background and previous linguistic experience and information on their performance in the language modules' examinations.

3.1.3 Task

An important concern of the wider research project was to design a study which would be capable of yielding data on as many aspects of bilingual processing as possible, in order to arrive at a comprehensive view of linguistic organisation. An instrumentation that lends itself most readily to such an investigation is a combined application of written translation and concurrent think-aloud-protocols (cf., e.g., Dechert 1987; Hölscher/Möhle 1987; Krings 1987; Zimmermann 1994). Translation, by definition, requires a reproduction of the source language message in terms of meaning and structure (Bassnett-McGuire 1980:2). With the content of the utterance given, the performer will be engaged in a search for translation equivalents, aiming at accuracy and precision of expression, which, it was hoped, would trigger a high degree of linguistic, in particular lexical processing. In order to reduce the cognitive load on the informants and to ensure that the source text was well understood, the comprehension dimension, normally inherent to translation, was eliminated by having the subjects produce their own translation sources. The advantage of having subjects do this immediately before the act of translating is that the conceptual content has recently received focal attention and is therefore still available in short-term-memory.

The study thus set a first task of composing in their mother tongue a story on the basis of a series of pictures, which was then to be translated. The cartoon, an episode of *Calvin and Hobbes*, in which Calvin gets his hair cut by Hobbes, resulting in a bald head and emotional uproar, featured a number of key situations and elements which were expected to be verbalised. These later provided the basis for a comparison of the students' performance. The informants were not aware that their compositions would be their later translation source, since this might have lead to prior back-translation and avoidance of difficulties.

Of particular interest for the present discussion are situations of non-accessibility of required lexical items. Here, the think-aloud protocols trace

the routes taken in lexical retrieval or search by documenting the informants' chain-of-thought. Think-aloud protocols have been established as a valid instrument of investigation, being widely acknowledged as providing most genuine information without corrupting the thought process (Ericsson 1990:195). Their value lies in their potential to reveal processing activity underlying linguistic behaviour which goes beyond the informative value of the translation product, and possibly even beyond the level of awareness of the informant.

Think-aloud protocols appear to be especially fruitful in relation to the organisation of the (plurilingual) mental lexicon, allowing for conclusions about the cognitive architecture of lexical knowledge. Zimmermann (e.g. 1994) used the method of written translation along with concurrent think-aloud protocols to investigate the mechanisms involved in lexical selection. His findings show that the analysis of productive processing can provide useful information on several issues in relation to lexical organisation and the relationship of L1 and L2. Especially relevant in the present context are findings concerning the relationship between lexical and conceptual organisation. Zimmermann's data suggest that lexico-semantic search activity is indicative of the conceptual frame associated with the semantic content of a given source item.

3.2 Results

The data obtained were analysed with specific focus on issues of lexical processing and the cognitive organisation of linguistic and conceptual knowledge. I will here discuss the informants' processing activity in relation to the verbalisation of emotion concepts, in particular scrutinising mechanisms of lexical selection. For this purpose, two situations which feature related emotional reactions were singled out from the stories, and the corresponding data - an L1 lexicalisation, its L2 rendition, and the documented translation process – will be set in relation to each other. More specifically, the informants' choice of words in both L1 and L2 and their intermediate processing activity will be analysed with reference to the conceptual content to be verbalised. Particular attention will be given to semantic processing, with the objective of gaining information about

conceptual organisation. The associative chains documented by the think-aloud protocols are expected to render possible the reconstruction of lexical networks and an identification of the processing mechanisms at work in lexical selection. The situations selected for investigation both feature the concept of SHOCK. They are (1) the scene where Calvin is confronted with the outcome of the haircut by looking in a mirror, being horrified, angry with his friend, and afraid of his mother; and (2) his mother's reaction, shock and anger, upon seeing his bald head. The two situations, which resemble each other in many ways, will first be considered separately and then set in relation to each other.

3.2.1 Overview of the Data

3.2.1.1 Situation 1

The scene in which Calvin reacts upon the discovery of his bald head involves various aspects and allows for adopting different viewpoints in describing it. Most generally, an intrinsic perspective accounting for Calvin's feelings and an extrinsic one describing his behavioural reactions can be distinguished. His emotional state involves a moment of perplexity, dismay with his looks and with his friend, and fear of his mother. This variety of foci is reflected in the informants' choice of verbalisations for describing the scene. They activated a relatively wide range of lexical items, representing a few central concepts.

The situation is verbalised by 28 subjects, involving a total of 79 English and 61 German lexical activations, which relate to 33 different English and 30 different German items. Lexical activations include L1 source items, L2 written translation products, and L1 and L2 approximations The latter relate to intermediate or temporary solutions as disclosed by the think-aloud protocols. They are of particular interest as they document the fanning out of activation in various directions. Table 2 displays L1 source item, the sequence of lexical activations and a selection of relevant comments, and the L2 written solution as reported by the think-aloud protocols. For reasons of transparency, the associative chains have been simplified in the sense that they show the stages of lexical access without taking account of immediate

repetitions, grammatical processing, or metalinguistic comments and other remarks, unless they are specifically referred to in the data analysis.

L1 source items		L1 approximations		L2 approximations		L2 written solutions	
Shocked	10	surprised	5	Angst	4	Angst	10
Shock	2	surprise	1	*geschocken	3	*angst (a)	1
worried (a)	4	shocked	7	schockiert	2	schockiert	3
worry (v)	4	shock	1	geschockt	2	*verschockt	1
freak (out)	3	afraid	4	schocken	1	Schock	1
fear (v)	2	panic (v)	1	Schock	1	schocken	1
horrified	2	fear (n)	2	erschrecken	1	nicht zufrieden	2
horror	1	fear (v)	1	sorgen	2	besorgt	1
disbelief	1	angry	2	erstaunt	1	Sorge	1
go mad	1	annoyed	1	enttäuscht	1	*sich besorgen	1
scream	1	furious	1	ungeduldig	1	sorgen	1
petrified	1	horror	1	böse	1	schlecht	2
not happy	1	scary	1			furchtbar	1
fearful	1	bad	1			ungeduldig	1
panic (v)	1	worried	1			böse	1
afraid	1	sad	1			sich ärgern	1
terrifying	1	unhappy	1			erstaunt	1
panic-attack	1	impatient	1			schreien	1
astonished	1					(wie) verrückt	1
incredulously	1					erschrocken	1
damage	1					*Schrickt	1
awful	1					Lärm	1
angry	1					wütend	1
think of	1					überrascht	1
						enttäuscht	1
						*paniken	2
						fürchten	1

Table 1 Distribution of activated items relating to the notion of SHOCK/Situation 1

(The asterisk (*) denotes interlanguage forms, i.e., non existing items. The table does not account for misspellings.)

The lexicalisations relate to the following activation sequences:

Sub -ject	Source item	associative chain	written translation product
1	1. shocked 2. (he) fears	1. surprise – surprised - erstaunt 2. er hat Angst über – he's afraid of	1. --- 2. (er) hat Angst über
2	1. disbelief 2. horror	1. --- 2. angry – horror – angry – annoyed – ungeduldig – that could be impatient – I think it's unhappy	1. --- 2. ungeduldig
3	1. shocked 2. worried	1. enttäuscht is not the word - - go for enttäuscht – that's surprised 2. ---	1. entausched 2. ---
4	1. has a minor panic-attack 2. worrying	1. Calvin panics - making a literal translation replacing a <c> with a <k> 2. ---	1. panikt 2. (er) besorgt sich über
5	(Calvin) goes mad	Calvin is like mad	(Calvin) ist wie verrückt
6	1. angry 2. fearful	1. very sad 2. ich habe Angst vor is I'm afraid	1. "angry" 2. (er) hat Angst vor
7	panics	no idea	panikt
8	horrified	---	(er) ist angst
9	freaks out	---	(Calvin) ist Lärm
10	1. freaks 2. worries	1. böse – no – böse? okay I wanna say he's furious so I think that's böse 2. ---	1. böse 2. hat Angst
11	1. shocked 2. worries about 3. afraid	1. schockiert – schockiert? – shocked 2. --- 3. ---	1. shockiert 2. (er) sorgt uber 3. (er) ärgert sich
12	(he) surveys the damage	---	(er) sieht sein Haar
13	shocked	---	1. nicht zufrieden 2. verschockt 3. hat Angst
14	astonished	---	erstaunt
15	(he) screams	schreit	(er) schriet
16	awful	---	schlecht
17	1. he is shocked 2. worried	1. er sieht schockiert aus - to appear shocked 2. ---	1. (er) sieht shockiert aus 2. (er) macht sich viele Sorge
18	no English text	---	(er) hat Angst
19	shocked	---	erschrocken
21	1. shocked 2. terrifying	1. shock – surprised – shocked – surprised - afraid – erschrickt – shocked – surprise – shocked – ein Schrickt? 2. scary - bad	1. er hat ein Schreicht bekommt 2. schlecht

22	1. (Calvin) freaks 2. worried	1. has fear – gets worried – zu – sorgen – sorgt – daß Calvin Angst – it's no surprise that Calvin has – uh – fear 2. besorgt – it's a guess	1. (Calvin) hat Angst 2. besorgt
23	1. horrified 2. petrified	1. --- 2. ---	1. er findet sie [the hair] furchtbar 2. (er) hat angst
24	shocked	schockiert	sochiehert
25	1. shocked 2. worried	1. shocked – schocken – no you can't say he's shocked – er schockt – schocken – that sounds German but I don't think so 2. ---	1. er schockt 2. (er) hat Angst
26	1.(he) looks incredulously 2. (he gets) a shock 3. thinking (of his mother's wrath)	1. --- 2. ist – geschockt – geschocken [laughs] – wütend – I hope that's the word 3. ---	1. (er) sieht 2. wütend 3. (er) hat Angst (vor seine Wut)
28	1. shocked 2. (he) fears	1. geschockt (laughs) – surprised 2. er hat Angst vor – he's afraid that – he fears the reaction	1. überrascht 2. (er) fürchtet
30	1.(he gets) a shock 2. not happy 3. worries	1. shocked – ein Schock – shock – Angst 2. --- 3. ---	1. (er bekommt) ein Schock 2. nicht zufrieden 3. (er) hat Angst über

Table 2 Associative chains relating to the processing of Situation 1

3.2.1.2 Situation 2

Situation 2 is in many ways similar to Situation 1. Calvin's mother is aghast at the discovery of the bald facts, followed by anger with her son. The subjects' processing again involves a broad variety of lexical activations, considered indicative of a few descriptive viewpoints and the structure of the conceptual frame of SHOCK, in this case, however, associated only with the notion of FEAR.

The situation is verbalised by 22 subjects, involving a total of 57 English and 49 German lexical activations, which relate to 29 different English and 25 different German items.

L1 source items		L1 approximations		L2 approximations		L2 written solutions	
shocked	4	horror	4	(sich) ärgern	6	Schock	3
shock	3	horrified	4	*anger	1	böse	3
go berserk	1	surprised	2	*sich ängern	1	wütend	2
go wild	1	surprise	2	Horror	2	nicht glücklich	2
scream	2	angry	2	Horrorfilm	1	*(sich) ängern	2
furious	1	angered	2	nicht zufrieden	1	sich ärgern	1
go mad	1	annoyed	1	*rot gehen	1	*miteinander arger	1
react strongly	1	not happy	1	überrascht	1	*anger	1
outraged	1	go mad	1	erstaunt	1	blöd (*böld)	1
(she) gasped	1	go red	1	wütend	2	rot gehen	1
not happy	1	scream	1	*Spring	1	stark reagieren	1
aghast	1	raging	1	Wut	1	überrascht	1
argue	2	jump	1	Angst	1	Überraschung	1
upset	1	shock	1	geschockt	1	schockiert	1
horror	1	horror film	1	beklagen	1	erschrocken	1
horrified	1	argue	1	diskutieren	1	Angst	1
sceptical	1	discuss	4			*Spring	1
angry	1					Horror	1
give out	1					geschocken	1
start at	1					beklagen	1

Table 3 Distribution of activated items relating to the notion of SHOCK/Situation 2

The lexicalisations relate to the following activation sequences:

sub-ject	**Source item**	**activation sequence/chain-of thought**	**written translation product**
1	shocked	---	böse und nicht glücklich
2	goes berserk	annoyed – nicht zufrieden – not happy	nicht zufrieden
6	goes wild	angry	“angry“
7	furious	---	böse
8	screams	sie ist nicht – sie ist blöd mit Calvin	böld
9	goes mad	sie gehen mad – sie gehen rot – she goes mad – she goes red	sie gehen rot
10	(gets) a shock	I think Schock is there the same as in English	(sie kriegt) eine Schock

11	reacts strongly	---	seine Mutter starke reagiert
13	outraged		böse!
14	she gasped	überrascht – erstaunt und wütend – surprised and angry	uberrascht und wutend
15	not happy	---	nicht glücklich
16	aghast	---	sie hat eine große Überraschung
17	shocked	---	shockiert
18	no English text	she screams	(sie) hat Angst
19	shocked	---	erschrocken
20	no English text	sie hat große anger – she screamed	(sie hat) große anger
21	1. in the shock 2.(they both) argue	1. surprise – spring is to jump – I jump 2. ---	1. (sie) bekommt eine Spring 2. sie arger miteinander
22	very upset	angered – sich ängern – this is a long shot	(seine Mutter) ängert sich
23	1. (she)reacts 2. (with) shock 3. and horror	1. sie schreit 2. --- 3. ---	1. sie schriet 2. mit Schock 3. und Horror
26	1. starts at 2. sceptical 3. and angry	1. to get a surprise 2. --- 3. ---	1. ärgert sie sich 2. --- 3. ganz wütend
28	1. horrified 2. (she) gives out 3. (gives up) arguing	1. horror – Wut – horror – horrified – Angst – horrified – wütend – raging – it's not the same – (later:) horrified – Horror – Horrorfilm – horror film - horror – thinking it could be just the English – horror - Horror – horrified – gesch – geschockt – geschocken 2. sie beklag- beklagen is to give out 3. she argues no more – sie - ärgert sie - nicht mehr – ... [later:] sie ärgert – sie - sie ärgert sich – that's – she's angered – sie ärgert sich – what's to argue – to argue is – diskutieren – ha, that's to discuss – to argue is - I think it's ärgern – weiß ich nicht – sie ärgert sich – sich ärgern	1. geschocken 2. sie beklagt ihm 3. sie ärgert nicht mehr
30	shocked	surprised - gets a shock	(sie) bekommt ein Schock

Table 4 Associative chains relating to the processing of Situation 2

3.3 Discussion of the results

The data will now be discussed in the light of the above considerations about cognitive organisation. Of focal interest will be the subjects processing activity, in particular the dimensions of lexical search, as well as some lexical errors, which will be scrutinised for their informational value concerning aspects of conceptual-semantic organisation.

3.3.1 Situation 1

3.3.1.1 Associogramme

I will begin with a graphic illustration of the aggregated processing activity of the 28 informants. It displays the activated lexical items and the links between them as evidenced by the subjects' activation sequences. The number of lines drawn between items correspond to the number of times these items were associated in sequence.

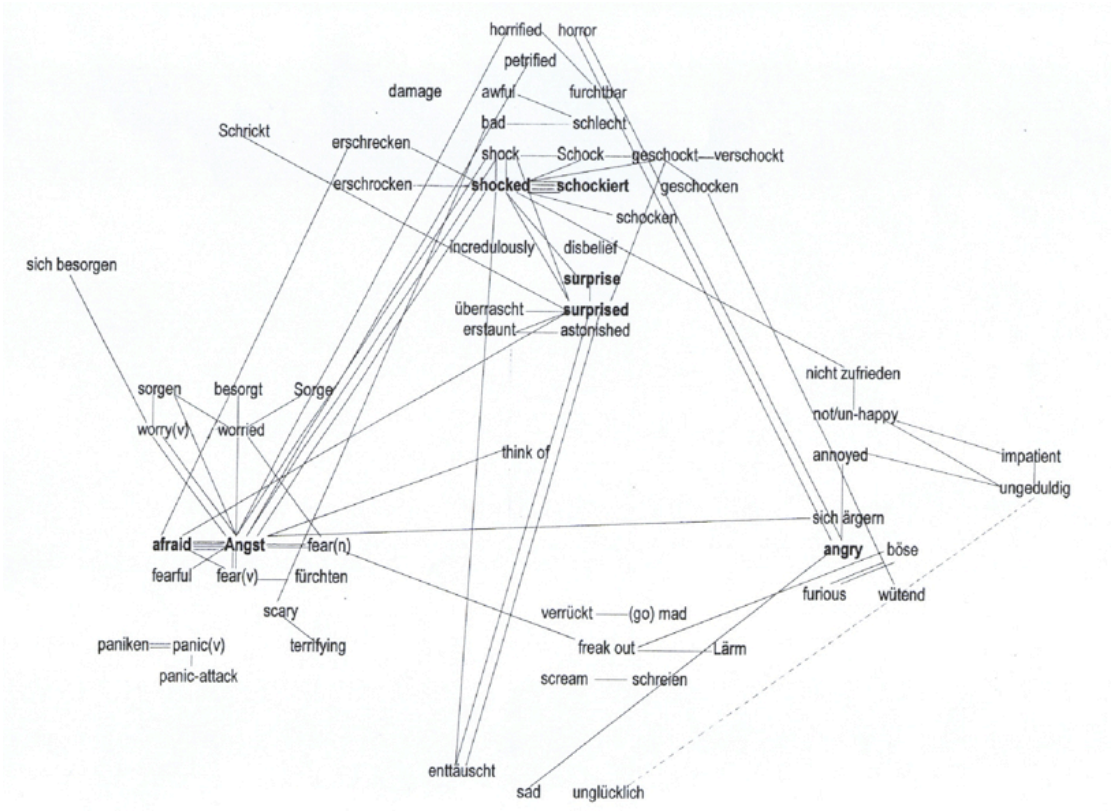

Figure 2 Aggregated search activity in the field of SHOCK/Situation 1

Figure 2 displays the 63 items activated by the subjects in their efforts to verbalise Calvin's emotional reaction in Situation 1 in English and German. (Dotted lines and items in brackets indicate additional links relevant for the understanding of lexical errors.) What is most striking is the fact that together the informants activate a considerable number of items spread across a relatively wide conceptual area with a concentration on a range of apparently central items. Is the illustration a mere collection of individual associations, or can it be interpreted beyond that? Following Zimmermann (e.g., 1994), I will suggest viewing it as a representation of (part of) the subjects' collective conceptual frame associated with the notion of SHOCK, as represented by their aggregated search activity.

In order to approach this hypothesis, we must ask whether the production and translation of these different source items is comparable, and what it can tell us about lexical and conceptual organisation. Investigating this question, I will not exclusively focus on the process of translating, but consider the subjects' choice of words in both their English compositions and in the translation processes and results in a more global perspective. The discussion will build on the overview of the conceptual domain of emotions and its lexicalisation patterns presented above.

3.3.1.2 Conceptual Organisation, Lexical Processing, and Bilingual Connectivity

The verbalisation of Situation 2 gives rise to the question if the multitude of lexical choices employed to verbalise the scene is reflective of a multiplicity of distinct perceptions of it. Do 24 different English lexicalisations in the compositions, and 27 different German translation products across 28 subjects of a relatively homogeneous group represent highly individual conceptualisations of the same situation? This appears to be unlikely, and the data suggest that, in fact, the opposite is the case; namely that the variety of lexicalisations reflect the informants' focal attention on specific aspects of the scene, which include either a description of Calvin's inner state or of his behaviour. The former relates to the notion of PERPLEXITY expressed by items denoting SURPRISE or SHOCK, to the notion of FEAR or WORRY, and to the notion of DISMAY or ANGER. The latter involve verbalisations reflecting an outside perspective, accounting for Calvin's reactions either

neutrally (e.g. *Calvin surveys the damage*) or indicating his inner uproar (*Calvin screams, goes mad*, etc.).

Of interest here is not so much the mere identification of these conceptual realms, but the direction the subjects' processing takes in translating their English verbalisations. It was suggested above that casual language production is characterised by a relatively random and unconscious selection of lexical items, as opposed to more thorough processing in reflecting production (cf. Aitchison 1994). The informants' processing of the present situation is seen as furnishing support for this hypothesis. The composition of the English source text is seen as representing unreflecting language use, given the fact that the tight time frame did not leave much room for contemplation, and also because the subjects were under the impression that the task was relatively insignificant. The performance of the translation task would then, of course, involve careful reflection.

As was mentioned above, the situation allows for different perspectives. They can be divided into specific accounts of Calvin's anger and fear and emotion-unspecific descriptions either of the pre-emotional state of shock or surprise, or of Calvin's behavioural reactions. A range of compositions (cf. subjects 2, 3, 4, 6, 10, 11, 17, 21, 22) include two perspectives, usually an emotion-unspecific and an emotion-specific one; one composition (subject 30) even takes account of Calvin's shock, his discontent with Hobbes and the fear of his mother. Interesting in this connection is a change of focus between the English and the German versions across the informants (cf. table 3). In English, 26 verbalisations avail of lexical items expressing SHOCK and related notions or representing an observer's perspective, i.e., they are neutral in terms of specifying Calvin's state of emotion. 18 specify his emotional reaction in terms of ANGER or FEAR. In German, this distribution of lexical choices is reverse: there are 13 'neutral' as opposed to 28 'emotional' lexicalisations (including a few errors which can be identified as being intended to belong to one of the categories; cf. later discussion).

		English	German
emotion-unspecific	descriptive (e.g., *scream/schreien*)	7	3
	perplexity (e.g., *shock(-ed)/schockiert*)	19	10
emotion-specific	fear (e.g., *worried, Angst*)	15	17
	anger (e.g., *angry, wütend*)	3	11

Table 5 Categorisation of lexical choices

The increase of emotion-specific lexical items is seen as a specification of meaning upon careful reflection. Many pre-emotional or descriptive verbalisations were qualified in the direction of either ANGER or FEAR or both. This suggests that the informant's initial choice of words in these cases started from relatively general conceptualisations and an observer's perspective which availed of emotion-unspecific lexical items, and that the second time they were confronted with the situation, they seemed to develop a more differentiated view and to feel the need for specifying their perspective, or rather, for adopting Calvin's perspective more explicitly.

An impressive example of such processing is given by subject 10. From her English phrase "he freaks", she immediately associates the German item böse ('angry, annoyed'), then hesitates and, contemplating her choice of words, arrives at the interpretation "okay, I want to say he's furious, so I think that's böse". This comment suggests that, indeed, her lexical activations were unconscious and arbitrary in the first place, and that upon reflecting upon them she realises, however, what she actually had in mind using both the phrases he freaked and er war böse. Without hesitation, she accepts böse as equivalent to freak, having identified the latter as representative of the concept of FURY. In other words, freak is viewed as a way of expressing FURY, and so is böse: her prelinguistic conceptualisation of Calvin's feeling allows for different lexicalisations. These lexicalisations, in turn, involve a modification of her prelinguistic conceptual representation.

A similar example of specifying the verb freak is given by subject 22. His chain-of thought reads as follows: (source phrase: Calvin freaks; translation product: Calvin hat Angst)

> ”Calvin – has fear – gets worried – zu – sorgen – sorgt – daß Calvin – Angst – it’s no surprise that Calvin has – uh – fear”

In this case it remains speculative whether the informant specifies the meaning of freak because he lacks a translation equivalent or because he feels the need to do so. More likely, however, is that he cannot translate freak and therefore scans the semantic environment for a suitable substitute. As opposed to the previous case, however, his interpretation goes in the direction of FEAR. Across the two informants, this shows that freak represents a relatively wide conceptual content which allows for different specifications. It depicts a level of conceptual representation at which the notions of ANGER and FEAR meet.

Not only freak, but also shock and related items present themselves as relatively unspecific verbalisations which allow for and lead to specification upon reconsideration. This is evidenced impressively by three subjects, who interpret their initial choice of words in more than one way. Species of SHOCK are differentiated as relating to either ANGER or FEAR, depending on the perspective adopted.

Informant 13 translates her original sentence

> He’s shocked by the result and by the reaction he anticipates from his mother.

as

> Er sieht sein Haar und mit es ist er gar nicht zufrieden. Er ist verschockt. Er hat auch Angst vor seiner Mutter.19
> (‘He sees his hair and with it he is not happy/content at all. He is shocked. He is also afraid of his mother.’)

She interprets the notion of SHOCK as relating to both Calvin’s haircut and to his mother’s anticipated reaction in terms of DISCONTENT and FEAR, and

[19] The grammatical errors contained in the sentences are irrelevant for the present discussion and will not be analysed here.

even retains the element shock as a linking concept. Its placement between the verbalisation of DISMAY AND FEAR may suggest that both these feelings are regarded as species of SHOCK. This would imply that the state of shock (and similarly that of surprise) is not necessarily just a precursor to more specific emotional states as proposed by Johnson-Laird (1988) and Wierzbicka (1992) (cf. above), but that it can, indeed, be perceived as appearing simultaneously with emotions like FEAR and ANGER.

Informant 23 describes Calvin as being horrified by the outcome of the haircut and petrified by the thought of his mother. In the German version, he finds his hair furchtbar ('awful') and hat große angst ('is very much afraid') thinking of his mother.

In informant 26's story, Calvin looks incredulously in the mirror and gets a terrible shock thinking of his mother. DISBELIEF and SHOCK are specified as FURY and FEAR in German: seeing his short hair, Calvin is wütend, and thinking of his mother, er hat angst of her fury.

3.3.2. Situation 2

3.3.2.1 Associogramme

The informants' aggregated search activity represented in figure 3 shows that the subjects again activated a large variety of different items, associated with a range of conceptual perspectives and centred on a few key items. I will again focus on the implications of semantic processing for conceptual organisation and then approach the question whether the aggregated processing activity of the informants can be related to a collective conceptualisation of the given situation(s).

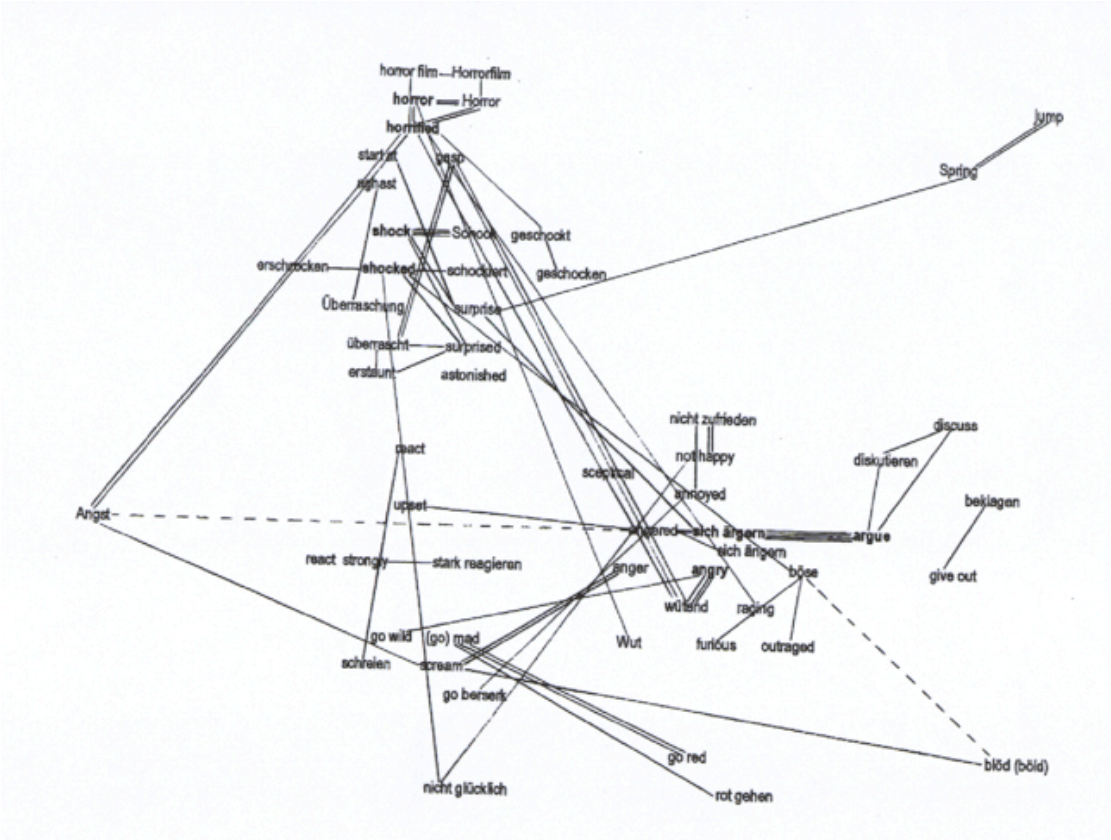

Figure 3 Aggregated search activity in the field of SHOCK/Situation 2

3.3.2.2 Conceptual Organisation and Lexical Selection

In the previous section, the tendency towards modifying a descriptive viewpoint in the direction of adopting the protagonist's perspective was discussed. It involved an increase in emotion-specific terminology in accounting for Calvin's reaction. A similar tendency can be found in Situation 2, the translation of which involves a range of qualifications of emotion-unspecific terms. The most interesting ones are the following:

1 (subject 1) shocked translated as *böse und nicht glücklich* ('angry and not happy')

Here, the informant seems to opt for emphasising the mother's negative reaction by specifying both ANGER and DISCONTENT. A speculative interpretation of this double qualification would be to relate it to her reaction upon the sight of Calvin's head on the one hand, and to her anger with her son on the other. In this view, it would resemble Calvin's earlier

double perspective which depicted his dissatisfaction with, or anger about his friend and the outcome of the haircut, and his fear of his mother.

2 (subject 14) she gasped translated as sie war überrascht und wütend ('she was surprised and angry')
The example resembles the previous one, in this case specifying the description of the mother's physical reaction in terms of its underlying emotional state.

Further instances specify an extrinsic perspective in terms of ANGER (involving a few errors):

3 (subject 6) go wild transposed as "angry"
Subject 6 obviously associates go wild with angry, but gives up on the attempt to retrieve a translation equivalent.

4 (subject 7) she screams translated as sie ist böld (pronounced as blöd)
The target item here was presumably böse; the erroneously triggered form blöd ('stupid') is misspelt as böld.

5 (subject 22) upset translated as ängert sich
Here, a transfer of the formal quality of angry (*ängert instead of ärgert).

6 (subject 26) she starts at translated as ärgert sie sich
Finally, the rendition of start at as sich ärgern results in a correct German utterance.

As in Situation 1, the modification of the narrative viewpoint is seen as a specification of meaning upon reflection. The relatively frequent occurrence of this process is interpreted as furnishing support for the hypothesis that reflecting language production involves more careful lexical selection than casual production.

3.3.3. A Collective Mental Representation of Emotion Concepts and Terminology?

I will conclude the discussion with a look at the question of whether the above illustrations of the aggregated processing activity of the subjects could

be viewed as the collective mental representation of their conceptualisation of Situations 1 and 2. Following Zimmermann (1994), such a hypothesis would be supported if the processing activity of the informants overlaps to a considerable extent and if some subjects alone activate larger parts of the lexical field.

Figures 2 and 3 show that the overlap of lexical activations across the informants is more extensive than may be assumed in the light of the multitude of items used. Not surprisingly, it is stronger between central items of the fields, which are frequently activated and appear to serve as a point of orientation in the processing activity.

Detecting extensive and connected processing activity within individual informants across the different conceptual domains is a more difficult task. Subject 28 provides an impressive account of mental connections holding between the different emotional domains and of possible perspectives in accounting for them. Moreover, his processing activity represents a fairly wide range of processing phenomena found across the informants. I will discuss his processing of Situations 1 and 2, beginning with his attempt to account for Calvin's mother's shock upon the sight of Calvin's head.

Figure 4 illustrates his search sequence, starting from the source item horrified. His first association is horror, which he selects as the pivot of his search in different directions, together with horrified. The two items could be seen as representing the central notion of his concept. From there, he activates Wut, but seemingly dissatisfied, returns to horror and to the source item horrified. He begins his search again, this time arriving at Angst, presumably erroneously activated in confusion with anger/Ärger, since Angst is conceptually inadequate. He returns to horrified, trying his luck again in the direction of ANGER, this time associating wütend and the close equivalent raging, which he discards as "not the same". He leaves the problem for a while and, returning to it later, starts again from horrified and horror, this time with a German pronunciation, followed by a new strategy, the retrieval of the required German form through a context of use, namely that of horror films, first with a German, then with an English pronunciation.

Back at horror, he muses that it could be the same word in German and tries a German pronunciation again. Apparently not trusting this thought, he returns to horrified and scans the more immediate semantic environment, which takes him to geschockt ('shocked', colloquially) and finally to the incorrectly derived form *geschocken, which he selects as a solution.

Informant 28: Lexical search sequences and conceptual structure

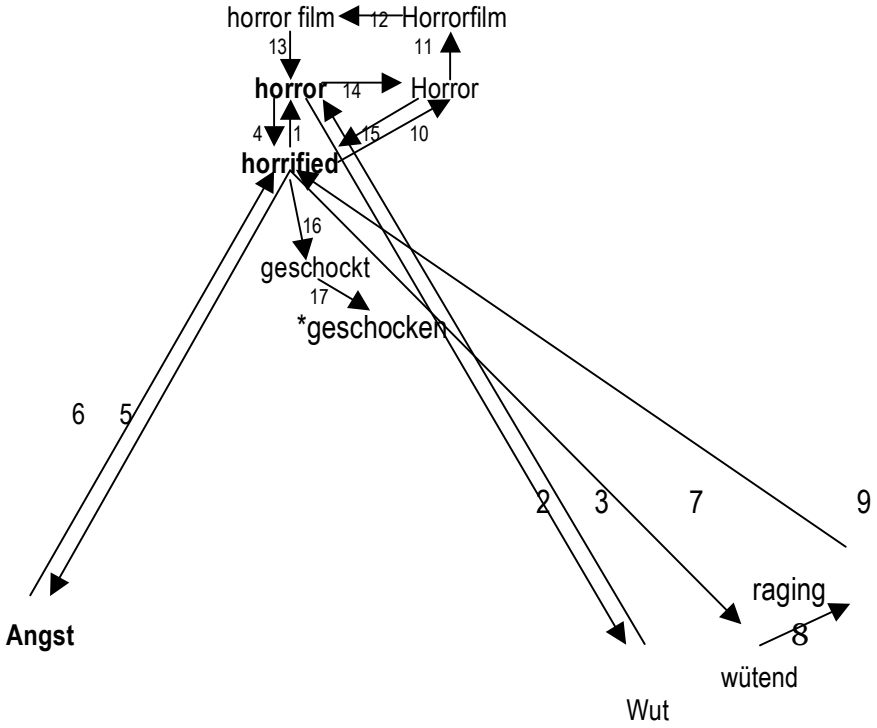

Figure 4 Associative chain of subject 28 in search of a translation equivalent of horrified

Unlike many others, the informant is not prepared to accept a modification or change of meaning in his German translation, presumably due to the task instruction to translate as closely as possible, which is not followed by all the subjects in the same way, as can be seen from the data. His repeated and apparently automatic search in the direction of ANGER (erroneously triggering Angst) and RAGE (Wut, wütend) indicates, however, that he also tends to interpret his initial choice of words in terms of ANGER. His think-aloud protocol provides an impressive account of the systematic scanning of the semantic environment of his source concept. His retrieval of German forms appears to be predominantly conceptually driven, as he triggers them immediately, associating their English equivalents only afterwards, which

seems to provide him with feedback about their meaning. The sequence ”horror – wütend – raging – it’s not the same” suggests that the English item raging mediates the insight that wütend is unsuitable as a solution. Unsuccessful with his strategy of semantic approximation, he approaches the problem in a different way, trying to retrieve the missing form in association with a specific context of use. His activation of Horrorfilm reflects his contemplation of the possibility of cognates across English and German, but he does not seem to trust this idea. Unsuccessful in his previous attempts, he finally activates the concept of SHOCK as closely synonymous with that of HORROR, which then takes him to his final (though morphologically incorrect) solution. On the whole, his search for HORROR is seen as evidencing the spread of activation in various directions, both uncontrolled (cf. Angst) and controlled. He uses a range of processing strategies activating different domains of knowledge, and he also evidences different types of errors. His chain-of-thought may be seen as representative of the aggregated processing activity of the 22 subjects – which, in turn, could be interpreted as their collective mental representation of the different facets of the situation.

A further look at informant 28’s processing activity of emotion concepts and items across the two situations, suggests that his data can, indeed, be regarded as representative of the overall processing activity of the 30 subjects in terms of lexical activations, processing strategies, and lexical organisation. Verbalising Situation 2, he continues accounting for Calvin’s mother’s reaction by writing that she gives out to him but eventually gives up arguing, translated into German as *sie beklagt ihn and later *ärgert sie nicht mehr.

The use of beklagen (sich beklagen = ‘complain’) is a semantic error, indicating that the German item is associated with the conceptual content of give out, presumably derived from a specific context of use and generalised, in ignorance of distributional differences. In terms of his choice of words, the use of the items give out/*beklagen and argue/*ärgern represents an extrinsic perspective on the scene, implying without explicitly labelling the mother’s emotional state.

In total, subject 28's verbalisation of the two situations involves 12 English and 11 German items (plus one morphologically incorrect form), relating to 6 source and target items each, and another 12 lexical approximations. These lexicalisations represent the variety of conceptual perspectives evidenced across the 30 subjects and identify the three basic emotional domains of SHOCK/HORROR, ANGER, and FEAR with a range of lexicalisation possibilities, and their interconnectivity (cf. figure 6.9). Their processing documents a range of organisational principles with regard to both conceptual structure and bilingual connectivity.

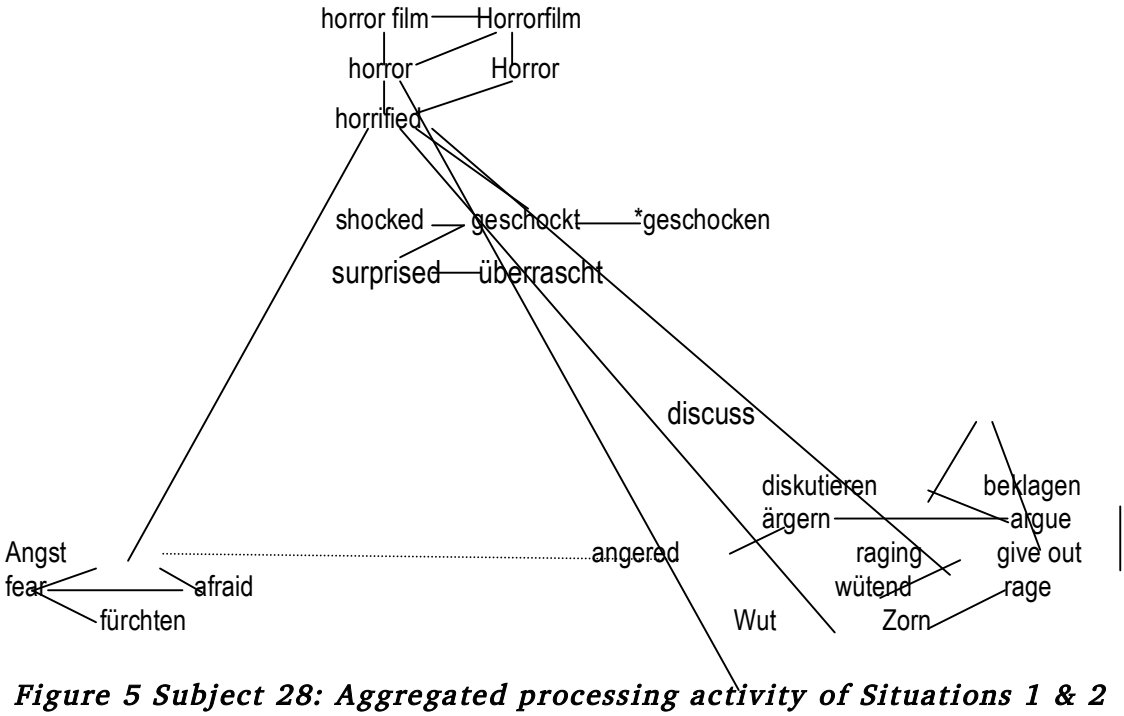

Figure 5 Subject 28: Aggregated processing activity of Situations 1 & 2

On the whole, the processing activity of subject 28 can be said to mirror the aggregated processing of the 30 informants and to identify a range of central principles of (bilingual) lexical organisation. It appears justified to say that his cognitive activity provides an insight into the architecture of the three featured emotion concepts and their lexicalisation patterns. What follows is the question of whether the aggregated processing of the 30 subjects can then be seen as a collective mental representation of the two emotional situations and of the interconnectivity of the concepts of SHOCK, FEAR, and ANGER. The overall distribution of activation peaks and of lexical connections and their representation in a single individual appears to support such a

hypothesis, but it cannot be regarded as sufficient evidence for it. The results, however, constitute encouragement to follow up this question in perhaps more specifically designed data elicitation tasks.

4 Conclusion

The study investigated the conceptual structure of a group of related emotions with reference to lexical processing activity in L1-L2 translation. It scrutinised the mechanisms of lexical selection, giving particular attention to semantic processing and its implications for conceptual organization. The associative chains documented by the think-aloud-protocols rendered possible the reconstruction of lexical networks, which were found to mirror the conceptual frame associated with the emotions in question. It was argued that the informants' aggregated semantic processing activity could be seen as representing their collective conceptualisation of the featured situations, or, more precisely, of the emotional aspects of those situations. The identified conceptual frames were found to include a range of key items representative of certain central concepts, and further lexicalisation possibilities representing specific perspectives on those concepts.

The data analysis also compared the semantic quality of the informants' lexical choices in their L1 compositions to that of their L2 translations. This resulted in an interesting observation: It appeared that in their L1 accounts, which are seen as representing relatively casual, unreflecting language use, the subjects' choice of words was relatively random, often emotionally unspecific and/or depicting an observer's perspective. In their L2 translations, which are characterised by carefully reflected processing, many of them opted for interpreting their initial lexical choices in terms of specifying the protagonists' emotional reaction.

It appeared that being confronted with the same situation a second time, they developed a more specific understanding of it, which is reflected in more specific lexicalisations and also documented by some explicit comments. At the same time, the overall variety of lexical choices suggested that different

individuals have their own preferred way of verbalising the same conceptual content, provided that the associated lexical field allows for such variation.

The empirical data on which this study is based are also revealing about other dimensions of linguistic organisation, in particular the relationship between two languages in the mind. For a more differentiated analysis of such aspects, also relating to the processing of other scenes from the picture story, cf. Herwig 2004.

Concerning possible future research directions relating to the above discussion, more specifically designed semantic processing tasks could be used for a comprehensive investigation of the conceptual structure of emotions and other complex conceptual fields.

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The Use of Art Therapy within Residential Care

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Denise Lyons is a Social Care Lecturer in the Department of Humanities, Institute of Technology, Blanchardstown. Prior to becoming a lecturer, Denise worked with children in residential care, both as a social care worker, and later, as an art therapist. *This paper describes the practice of providing art therapy as a support for one teenage boy, living within a residential group home. This paper begins with an introduction to the history of residential care, describing the role of art therapy as an intervention within a holistic approach to social care practice. This paper concludes with a case study, illustrating the practice of art therapy in residential care.*

History of Residential Care

Historically, residential care in Ireland consisted of children living in crowded conditions in workhouses, with few provisions (Barrington, 1987; Burke, 1987; Faughnan, 1990). The Reformatories Schools Act was introduced in Ireland in 1858, advocating the care of young offenders in purpose built institutions. The popularity of reformatory sentencing grew, and by 1870 ten reformatory schools were established, five for boys and five for girls, all funded by the public exchequer (Craig, Donnellan, Graham &Warren, 1998; Rafferty and O'Sullivan, 1999). Due to the availability of space in the reformatory schools, some homeless or abandoned children were inappropriately placed there. In the late 1860s, there was a growing recognition that reformatory schools were unsuitable for some of the residents, and in 1868 the first industrial school was opened in Ireland (Craig et al, 1998). These institutions remained virtually unchanged until the 1900s. The role of religious orders in child care provision was common throughout Europe as well as in Ireland.

The progress into smaller family run group homes was pioneered by Britain and America in the 1950s, whereas change in Ireland began later on, between the 1970s and 1980s. The principal movement for change in Ireland was influenced by the 1970 Kennedy Report, stressing the closure of the Industrial schools in favour of smaller family-run units (Gogarty, 1995; Craig, Donnellan, Graham, Warren, & Kelleher 1998; Dooney and O'Toole, 1998; Healy and Reynolds, 1998). These smaller homes evolved into the current

situation of 'residential group homes'. According to the Social Services Inspectorate (SSI) Report (DoH, 2004: 23), a total of 4984 children were in the care of the Department of Health and Children in October 2004, with "559 living in residential care".

Social Care Practice within Residential Care

Everyday life within a residential centre evolves around the normal experiences of mealtimes, school, homework, family visits, and activities (Harrington and Honda, 1986; Frost, Mills and Stein, 1999; Byrne and McHugh, 2005). It is within the doing of normal life experience that the core of social care practice is performed. The key-working role, where one or two workers are named to assist in the promotion of personal and individualised care, encourages this sharing of life-experiences between both the worker and other (Byrne and McHugh, 2005). Within the practice of social care, the worker performs 'direct and indirect care' where tasks are carried out with, for, and on behalf of others (Ainesworth and Fulcher, 1981; Anglin, Denholm, Ferguson & Pense, 1990). Direct care includes building attachments, developing a relationship, listening, providing clothes, cooking dinners, and engaging in activities together. Vander Ven (1999) discussed the role activity plays within social care practice, which she defined as Activity Theory. These activities or everyday life experience, shared between the worker and young person, may include going for a walk, playing cards, or engaging in a game of football. The primary benefit of participating in activities is the development of a strong relationship (Cashdan, 1988; Fewster, 1990; Maier, 1990; Eraut, 1994; Garfat, 1999; Krueger, 1999). Nevertheless, through participation, the young person also learns new skills, interests, and ways of interacting. Indirect Care or 'organisational activities' relates to organisational design, or the environment in which the individual receives the service. It includes adhering to policies and procedures, filling out forms, writing care plans, programme planning, and communicating with schools, social workers, and other related personnel (Ainsworth and Fulcher, 1981; Anglin et al, 1990; Byrne and McHugh, 2005).

According to Anglin et al (1990), social care practice also involves the therapeutic response of the worker to the needs of others. Byrne and McHugh

(2005) stated that many children have experienced homelessness, neglect, psychological, and sometimes physical abuse, prior to entering care. As a result, the children require equal care and support for their emotional as well as physical, social, and safety needs. In order to meet the psychological needs of children, many social care agencies seek external support in the form of psychiatrists, psychologists, counsellors, and creative therapists, to name a few.

The Role of Art Therapy in Residential Care

Art therapy practice is commonly offered to children presenting with emotional or behavioural difficulties, as they are deemed to have a natural relationship with image-making (Case and Dally, 1992; Robbins, 1994; Schroder, 2005). The therapeutic core of Art Therapy is based on Sigmund Freud's psychodynamic approach, which focuses primarily on unconscious thoughts, aiming to 'make the unconscious, conscious' (Mabey and Sorensen, 1995: 37). Within this therapeutic approach, past experiences are viewed in relation to the impact they may hold on the present. Image-making is viewed as pre-verbal, and engaging in image making enables the clients to experience a deeper connection to their emotions, than words alone (Waller and Gilroy, 1992; Hogan, 2001; Buchalter, 2004). Thus, images are viewed as less direct modes of communication for the client, and using the psychoanalytic approach, as possible insights to the unconscious.

The therapeutic relationship in art therapy is defined as 'triangular', between the client, the image, and the therapist (Buchalter, 2004). Within this process, the young person learns to trust both the therapist, and the message hidden within his or her own images (Case and Dally, 1992; Malchiodi, 2003). The therapist's role within this process is to guide the young person as they learn to develop a line of communication with the art images created within the session (Waller and Gilroy, 1992; Schroder, 2005). This triangular relationship is a formal contract, defined by specific boundaries (Schroder, 2005). Therapeutic boundaries are the primary difference between engaging in art activities, and the practice of art therapy (Case and Dally, 1992; Robbins, 1994; Vander Ven, 1999). The first boundary includes the creation of a safe space. If it is necessary for the art therapy sessions to occur within a designated room in the residential centre, it is important to clarify the

previous origin of this room, thus ensuring that the child does not have negative associations within the space (Robbins, 1994; Schroder, 2005). Safety is then ensured with a 'do not disturb' sign on the door, thus protecting this shared experience from interference (Buchalter, 2004). Time is also used as a therapeutic boundary, where the session occurs at a fixed time, on a designated day each week (Riley, 1999). The therapist will strictly adhere to the 'hour', which encloses the experience in a reliable time frame. According to Malchiodi (2003), the limit of time provides a structure for the experience, enabling the young person to have control over how much they are willing to share, determined by the point in the session in which they begin to discuss their feelings.

Robbins (1994) described the art therapy session as a two stage process, art making, followed by a discussion around the images made. However, Schroder (2005) stated that clients need to be developmentally, emotionally, and cognitively able to explore the possible meanings in their images, for the second stage to occur. Thus, this two stage process is only applicable to older children and adults (Riley, 1999; Kramer, 2001). The following case study is a summary of one young person's journey through art therapy. The art therapy sessions occurred within a residential centre over an eleven month period. The case study presents the two aspects of the art therapy session, the images and the discussion, which are framed within the triangular relationship between the young person, the therapist, and the images created. Permission was granted by the young person and their family, for the use of the images within this article, and all names have been changed to ensure confidentiality.

Art Therapy in Practice

Tom, a sixteen year old boy, has lived in residential care since he was ten. He was placed in care, initially on a temporary basis, after the death of his mum Mary. Tom's dad Frank, suffered depression after Mary's death, and felt unable to care for Tom. Mary also suffered from depression, until her death by suicide. According to the social care team, Tom was a happy young man, who liked school, music, and hanging out his friends. Recently, staff observed that Tom's moods and behaviour appeared to change. He was spending more time in his room, often refusing to go to school, or see his friends. Tom was

referred to art therapy as a alternative therapeutic support, due to his keen interest in art.

At the initial meeting, Tom was introduced to the boundaries and practice of art therapy. For the first five sessions, Tom engaged in structured art exercises, used to slowly introduce him to the practice of image making (Case and Dally, 1992; Robbins, 1994; Schroder, 2005). On week five, Tom created (Image One), entitled 'the sad face'. Tom described this image as a man's face, which appeared quite empty. He did not understand the shapes that appeared on the right. Tom was unwilling to discuss the image further.

Image One *Session Five*

After the eight session, Tom agreed to commit to art therapy on a more long term basis, stating that he was enjoying the art making. At this stage, Tom was beginning to open up, as he gradually began to discuss his images in greater detail.

In session twelve, Tom appeared more subdued than usual, and created (Image Two) after twenty minutes of quietly staring into space, while he twirled the pencil around the page. When he looked up, he had drawn lots of concentric circles. By not concentrating on his image making, Tom enabled the unconscious to emerge (Hogan, 2001; Malchiodi, 2003) He then turned the circles into barbwire and inserted a boy inside. He described the boy as 'screaming on the inside', and then disclosed that he often felt like he was

screaming inside, but he was not sure why he felt this way. For the next eight sessions, Tom focused on current issues, using his images to explore his feelings about school, and friendships. According to Gilroy and McNeilly (2000), clients often temporarily withdraw from their images if they are consciously unable to dialogue with the emerging unconscious meanings.

Image Two *Session Twelve*

On week twenty, Tom appeared eager for the session, and stated that he wished to experiment with paint. Often a change in a material is an indication of a change within the therapeutic journey (Mcalagan, 2001; Malchiodi, 2003). Tom began by swirling yellow paint around the page in circles, in a similar motion used to create image two. He continued by putting red over the yellow, and then added some green. This was when the face appeared, and Tom then used the green paint, mixed with brown, to enclose the image inside a circle shape. Tom stated that he did not like this image, it was not what he wanted to paint, and that he wanted to destroy the image. Tom was asked if he would rather put the image away for a later date, and he agreed, placing the image inside his locked press.

Image Three *Session Twenty*

On session twenty two, a suggestion was made to review of all the images created so far. Tom agreed to include (Image Three) in the presentation. During this session, Tom examined the similarities between the various images he produced, and he set aside the images produced in sessions five, twelve, and twenty. Examining the correlations of symbols or colours used within images encourages a deeper understanding and interpretation of these unconscious messages (Riley, 1999; Kramer, 2001; Malchiodi, 2003). These three images were used as the focus for a more in depth exploration, concentrating on the emerging feelings, associations, and possible meanings. The following is a summary of the awareness that was created from those images, reported within three difficult, but enlightening sessions.

Tom stated that the man in the images was 'him', or rather his fears manifested into a male shape. Tom initially described the male figure as Frank, and he disclosed that he felt guilty about the way Frank was portrayed in the images. He stated that he had felt angry when his father did not take him out of care, especially in the earlier years. Tom added that he loved his father, and that he knew his dad did not reject him, and as a result, he often felt guilty for being angry with Frank.

However, Tom stated that the images had begun to mean something different

for him. He was beginning to understand that he was the man in the image, or rather the drawing represented the 'mad' part of himself. Tom then began to disclose his fear about suffering from a genetic mental health disorder, inherited from his parents. He felt that he had 'madness' trapped inside of him, and that he was afraid of leaving care, in case he could not control this madness on his own. Returning to image one, he stated that the 'ghost' shapes outside the man represented the care staff in the residential centre. He felt that he kept them away, outside of himself, resulting from his fear of discussing his feelings 'out loud'. Image two also held a new meaning, where Tom stated that the barbwire felt safe, a container, and that even though he was afraid of the 'madness' it also felt familiar, 'like a connection' to his mum and dad. For the first time Tom noticed the planet to the left of the picture. He then laughed, stating that he often felt alone in the world, and here he is, the only person on his planet.

Tom spent a long time exploring image three, and according to Gilroy and McNeilly (2000: 86) "thinking involves reflection", which is "a difficult task". He stated that he initially wanted to tear up the painting, because he was afraid of this image, that it represented his madness in the guise of a monster. He was asked to have a 'conversation' with this monster in the image. The introduction of a structured technique, within an unstructured session, may shift the way the image is perceived (Gilroy and McNeilly, 2000; Schroder, 2005). From this conversation, Tom learned that this 'monster', was less scary than he originally perceived. Tom now felt that this monster was 'depression', and that the monster gained strength because he was afraid to face his potential for depression. Tom gave permission for the sharing of certain aspects of this awareness, with the staff team. Tom also stated that he felt ready to learn about the disorders that both his parents suffered from, with the help of his key worker.

In our last session, Tom painted (Image Four), and he appeared delighted with the end product. He described this image as a portrait of himself, as a stronger person. He identified the ghost like shapes, as his 'fears', stating that they have not left him, but now he is more able to face them, on his terms. Initially Tom felt that he was surrounded by green flames, but later added that these were actually fingers and hands, hugging him.

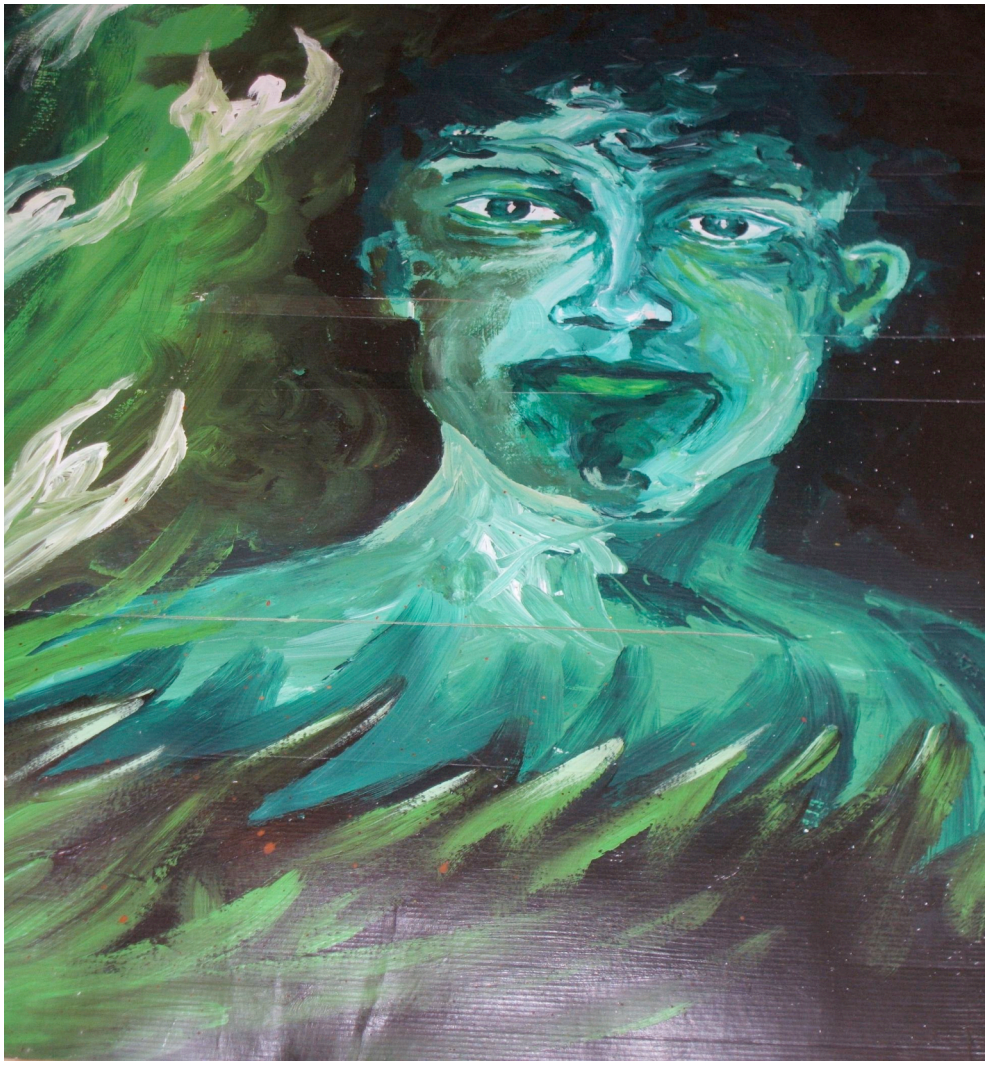

Image Four *The Last Session*

By engaging in the art therapy process, Tom demonstrated his trust in the triangular relationship, between himself, his images, and the therapist (Gilroy and McNeilly, 2000; Kramer, 2001; Buchalter, 2004). Schroder (2005) defined the therapeutic relationship as a 'journey' that has a beginning, and an end, all of which are planned (Malchiodi, 2003). During the final sessions the content focused on Tom's plan after therapy, Tom appeared more confident and assured about entering into a new stage, 'facing all aspects of himself'. Over the thirty four weeks, Tom had learned to trust the messages unconsciously emerging within his images. "The therapeutic relationship, even though structured to end, often has developed a level of intimacy that a client hasn't experienced before" (Schroder, 2005: 83). This was not an issue for Tom, as he had also developed an intimate relationship with his images, which he continued to explore after the sessions ended.

In conclusion, art therapy was used as an extra support, within a holistic approach to Tom's care within the residential centre. Art therapy provided emotional support, enabling Tom to continue to engage in the ordinary activities of his life. The staff team were informed on a weekly basis on Tom's mood after the session, thus forearming the staff on the best approach to take with Tom for the rest of the day. With Tom's consent, certain aspects of the sessions were shared with the team, enabling the staff to make informed decisions about Tom's overall care. As aforementioned, it is common for social care workers to engage in art activities with the young people in their care, and this shared interaction will be a therapeutic experience for the young person. However, this use of art making is different from the role of images created in the art therapy session. Central to this are the therapeutic boundaries of safety, time, an awareness of therapeutic processes, and the role of the triangular relationship between young people, their image, and the therapist.

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A Survey of Procedural Techniques for City Generation

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Abstract

The computer game industry requires a skilled workforce and this combined with the complexity of modern games, means that production costs are extremely high. One of the most time consuming aspects is the creation of game geometry, the virtual world which the players inhabit. Procedural techniques have been used within computer graphics to create natural textures, simulate special effects and generate complex natural models including trees and waterfalls. It is these procedural techniques that we intend to harness to generate geometry and textures suitable for a game situated in an urban environment. Procedural techniques can provide many benefits for computer graphics applications when the correct algorithm is used. An overview of several commonly used procedural techniques including fractals, L-systems, Perlin noise, tiling systems and cellular basis is provided. The function of each technique and the resulting output they create are discussed to better understand their characteristics, benefits and relevance to the city generation problem. City generation is the creation of an urban area which necessitates the creation of buildings, situated along streets and arranged in appropriate patterns. Some research has already taken place into recreating road network patterns and generating buildings that can vary in function and architectural style. We will study the main body of existing research into procedural city generation and provide an overview of their implementations and a critique of their functionality and results. Finally we present areas in which further research into the generation of cities is required and outline our research goals for city generation.

1. Introduction

As technology evolves and computing power increases, the consumer appetite for more detail, realism and scale is ever growing. The modern media industry, including games, films, advertising and television, is struggling to meet the expectations set by the largest projects and everyday production costs are spiralling out of control.

The traditional approach to meet consumer demand has been to simply increase the number of artists working on a project to produce larger, more detailed and realistic content. However, increasingly the artistic pipeline is not scaling, meaning that additional artist numbers do not generate a

proportional yield of content. The additional costs incurred add to the already high development costs and are paid by the consumer. The result of this is that time and money that could have been allocated to improving game play or adding innovative features has been lost on content creation. As a consequence of high development costs, a barrier of entry into the market is created and new fledgling companies find it difficult to get a foothold thus stifling innovation.

A potential solution for the content creation problem is the application of procedural techniques. These techniques have been used for over 20 years in the field of computer graphics [23] for a wide range of applications: adding noise to existing textures [6], creating 3D textures of natural materials such as marble and wood [10], visualising life-like models of various tree and plant species [8] and generating detailed cellular textures such as skin or bark [23]. Entire procedural worlds are now possible and this is demonstrated in the MojoWorld [33] application, where assets including realistic natural features such as terrain, lakes, trees and shrubs are all generated using procedural techniques. Recently procedural applications have been expanded further to simulate special effects including particle systems, water, and even the natural physical movements of assets [32]. Complex scenes containing many different models would normally take months to manually construct, now vast section of these scenes can be created using specialist procedural generation packages [27] that can generate detailed and varied models in minutes. Procedural generation is a time saving method of rapidly and efficiently generating content that can help to alleviate and potentially solve the problems of escalating content creation costs.

Existing procedural solutions primarily apply procedural techniques to the generation of natural phenomena, but many of the same techniques have obvious applications in the generation of man-made artificial phenomena. Our work focuses on the creation of procedurally generated cities for use in games and other graphical applications that are situated in urban landscapes.

Cityscapes are difficult to model. They are rich in visual and functional complexity and are a result of development and evolution over hundreds of years under the influence of countless factors. Some of the major influential factors affecting cities include population, transport, environment, elevation, vegetation, geology and cultural influence. It is a formidable challenge for researchers and developers to create a realistic model of such a large and complex system. We aim to develop an accessible interactive software system that can automatically generate a realistic, detailed and varied model of a city suitable for use in real-time rendering.

In this paper we present a survey of procedural generation techniques and of attempts to apply these techniques to the city generation problem. In Section 2 we provide an overview of procedural generation in general and present a number of key techniques and algorithms. In Section 3 we describe how researchers have attempted to apply procedural techniques to city generation. Section 4 concludes with an outline of our proposed approach for creating a city generation system.

2. Procedural Techniques

The key property of procedural generation is that it describes the entity, be it geometry, texture or effect, in terms of a sequence of generation instructions rather than as a static block of data. The instructions can then be called on when required to create instances of the asset and the description can be parametrised to allow the generation of instances with varying characteristics. A typical example of this approach would be the population of a forest with procedurally generated unique trees [32].

Procedural techniques can thus be employed to produce varied assets. One of the most basic techniques that can be used is the generation of 3d primitives with random parameters, for example a cuboid with random height. Simple algorithms utilizing pseudo random functions can be employed to generate noise for use in texturing and natural formations [6] more complex recursive algorithms such as fractals or L-systems can be used to recreate organic structures found in nature like snow flakes and trees [8]. Ebert et al. [23] identify the following as important features of procedural techniques:

- **Abstraction:** Geometric and texture data is not specified in the conventional sense, instead details are abstracted into an algorithm or set of procedures. These procedures are then handled by the computer and called on when needed. Minimal details are required and the operator can manipulate the model data easily without requiring intimate knowledge of the implementation.

- **Parametric Control:** Parameters are defined and adjusted that directly correspond to a specific behaviour in the procedural generation. The developer can define as many useful controls as required for the artists to operate effectively. Examples of parameters include the height of the mountains in a terrain algorithm or the number of segments in a procedural sphere.

- **Flexibility:** It is possible to capture the essence of an entity without explicitly bounding it within real-world limits. Parameters can then be varied to produce a wide range of results which are not necessarily limited to the constraints of the original model.

Procedural techniques have been applied successfully in the generation of numerous complex phenomena in computer graphics and have proved beneficial for a number of reasons.

Textures, geometry or effects abstracted into procedural algorithms are not fixed at a set resolution or number of polygons. Procedural techniques are therefore inherently multi-resolution in nature and can vary the complexity of their output. This capability is of particular interest to computer graphics. For example *level of detail* (LOD) is important in any 3D rendering system and essential to real-time rendering applications [16]. The concept behind LOD is to use more simple versions of an entity if it contributes less to the final rendered image. So for an object that occupies only 4 pixels in the final image, 10,000 polygons are not required and a basic representation using 10 polygons would be sufficient. The multi-resolution nature of procedural techniques allows the possibility of automatically generating models at multiple levels of detail [23].

Concise descriptions for generated objects are possible and can often be expressed in the terms of a few simple parameters. These small descriptions can be used to create large amounts of detailed textures and geometry, this effect is known as data amplification [23] and provides developers with the means to create an entire game world that is easily distributable over low-bandwidth network connections. The conciseness of procedural techniques are exploited by *Demo Scene* creators who create and distribute scenes that are complex and rich in detail in the form of tiny executable files as small as 2KB [26].

The flexibility and control provided by procedural techniques give the designer a platform for artistic freedom and experimentation. New visual effects and original objects can be created by experimenting with parameter values that exceed normal boundaries. [27]

Typically procedural algorithms are implemented in software; however recent advances in graphics hardware have opened up the possibility of executing them directly on the GPU. For example, complex procedural techniques like volumetric textures that were previously impossible to run real-time can now be implemented in this manner [15][22]

We now go on to describe a number of fundamental procedural techniques and algorithms that have been successfully employed within the domain of computer graphics.

2.1 Fractals

Natural shapes are not easily described by conventional geometric methods. Clouds are not spheres and mountains are not cones. Natural shapes tend to be irregular and fragmented and exhibit a complexity incomparable to regular geometry [5]. However these shapes can be described using a branch of mathematics called *fractal* mathematics. Benoît Mandelbrot, regarded as the 'father of fractals', coined the term fractal in 1975 [5] from the Latin *fractus* meaning broken.

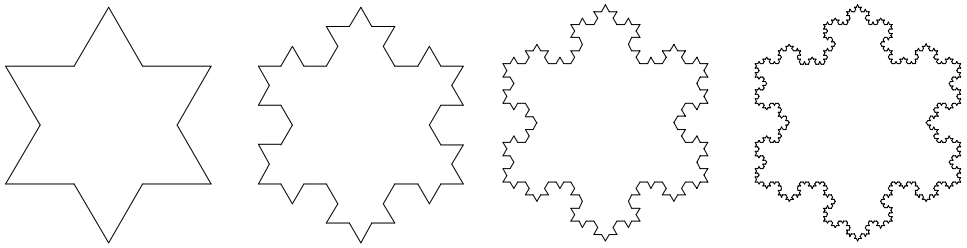

Figure 1: The first four iterations of the Koch snowflake

The basic concept of fractals is that they contain a large degree of *self similarity*. This means that they usually contain little copies of themselves buried deep within the original like the stars embedded in the Koch Snowflake[23] shown in Figure 1. Also, fractals possess infinite detail, so for any given fractal the closer we look at it the more detail it can reveal. [14]

Like any procedural technique, a fractal shape is defined by an algorithm for generating the shape. In the case of fractals these algorithms are recursive and successive recursions yield more detailed versions of the basic shape. The example of the Koch snowflake in Figure 2 shows four such recursions. Self-similarity is achieved by generating the same shapes or patterns at smaller and smaller scales as the recursion progresses, a property often referred to as scale invariance. There is no theoretical limit to the amount of recursion that can be done and hence infinite levels of detail exist within the shape.

Visualizing fractals manually is repetitive, tedious and limited and therefore computer-based implementations of fractal algorithms have been present from the start. Mandelbrot utilized computers while an employee at IBM to visualise complex fractals including the Mandelbrot Set [5] (see Figure 2).

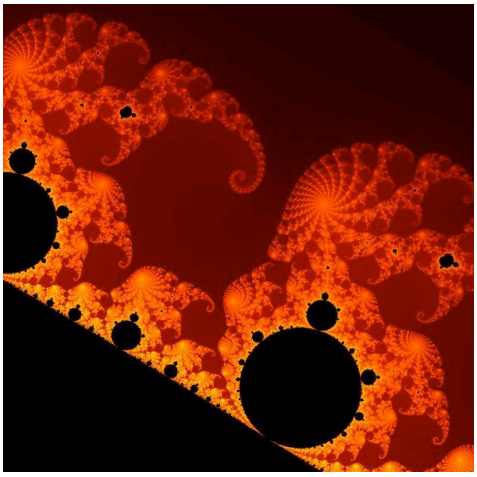

Figure 2: Mandelbrot Set.
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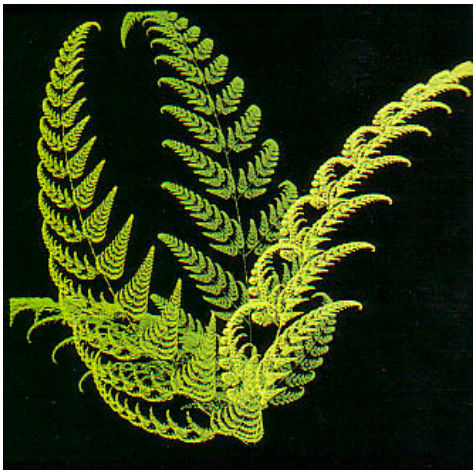


Figure 3: IFS Fractal Ferns [9]

Fractal-like shapes such as trees or ferns can be procedurally generated using relatively simple recursive algorithms. In fact a wide range of natural structures from simple plants to terrain can be generated in this manner [9]. Fractal algorithms provide effective abstraction from the structural complexity of the natural objects they represent and can utilize recursion to provide varying levels of detail. These techniques also provide the key property of data amplification in that complex models can be generated from the recursive application of simple equations.

Fractals are limited however to self similar structures and the objects we are seeking to model may not necessarily contain this self-similarity. They are superseded in many contexts by other more flexible algorithms like formal grammars such as L-systems.

2.2 L-Systems

Lindenmayer systems, or L-systems for short, are a formal grammar devised by biologist A. Lindenmayer as a mathematical theory for biological development. L-systems were originally developed to study bacteria replication and the growth patterns of simple organisms such as Algae described by Lindenmayer in the *Journal of Theoretical Biology* in 1968 [2]. The system and its applications have evolved and are now applied in the field

of computer graphics and in particular to the generation of fractals and the realistic modelling of plants.

The central concept of L-systems is that of rewriting [7]. In general, rewriting is a technique for defining complex objects by successively replacing parts of a simple initial object using a set of rewriting rules or productions. The components of an L-system are as follows:

- **V** (the *alphabet*) is a set of symbols containing elements that can be replaced (*variables*)
- **S** is a set of symbols containing elements that remain fixed (*constants*).
- **ω** (*start*, *axiom* or *initiator*) is a string of symbols and constants that define the initial state of the system.
- **P** is a set of *rules* or *productions* defining the way variables can be replaced with combinations of constants and other variables. A production consists of two strings - the *predecessor* and the *successor*.

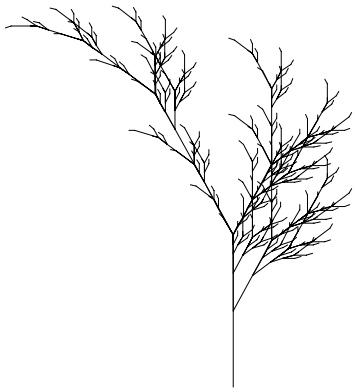
An initial state or axiom, **ω**, is provided which is then rewritten using a series of rewriting rules or productions, **P**. The productions are applied iteratively, allowing large complex objects to be defined using a simple set of productions.

$$
\begin{array}{ll}
\boldsymbol{V} = \{a, b\} & \omega : \quad a \\
\omega = a & n=1 : ab \\
\boldsymbol{P}_1 : a \rightarrow ab & n=2 : abba \\
\boldsymbol{P}_2 : b \rightarrow ba & n=3 : abbabaab
\end{array}
$$

Figure 4: **The Thue-Morse *system***

L-systems can be used to visualise structures by embedding graphical symbols within the string that can be used later to render it. Turtle commands can be used to describe and visualize a wide range of L-systems including Koch's snowflake, plants and branching structures. The concept behind Turtle Graphics is that the 'turtle' is given instructions relative to its current position and as it moves it leaves a pen line mark behind it. Using turtle graphics: shapes, drawing and structures can be defined in the terms of a L-system.

Using a bracket extension to Turtle Graphics, L-systems can support the branching structures such as trees that are predominant in nature. [2] Figure 5 illustrates the application of such an L-system used here to recreate a complex tree.



F : forward 1 unit	$\mathbf{n} = 5,\ \delta = 22.5^\circ$
+ : turn left δ degrees	ω = X
- : turn right δ degrees	$\mathbf{P}_1$: X→F-
[: push the current state of the turtle onto a FILO stack	[[X]+X]+F[+FX]-X
] : restore the state of the turtle from the stack	$\mathbf{P}_2$: F→FF

Figure 5: Tree formation generated with via the turtle graphics L-system interpreter. [8]

L-systems were designed to define and visualize sophisticated plants and other natural structures. As academic research has continued into their application in botany it has also continued in the realm of procedural generation. Significant advances have been made and packages are now available commercially that apply L-systems to generate rich landscapes of detailed flora covering a wide range of different species.

Figure 6: **Speed Tree [32] screenshot demonstrating procedurally generated and real-time rendered trees.**

L-systems are a good example of procedural techniques for a number of reasons. They allow complex models and organic structures to be defined, modelled and visualised using a concise set of productions. A varying level of complexity can be supported by parameters such as the recursion level of the L-system [21]. The algorithms can be defined in a compact and intuitive manner and can effectively abstract the recursive structure of many natural phenomena. L-system generation can be adjusted easily via external parameters and are extensible by nature similar to other formal grammars.

2.3 Perlin Noise

Perlin Noise was initially developed to help create more "natural looking" textures. The technique was developed by Ken Perlin for use in the film Tron in 1982. As a result from his work in Tron, Dr. Perlin received an Academy Award for Technical Achievement in 1997 [10]. Noise is created by first using a pseudo random function to generate a series of values which are then interpolated into coherent noise. Several layers of this coherent noise are then composited together using different ratios to create a "natural looking" texture with fractal like detail.

Noise Function

A noise function generates random data. So each time the function is called a new number is returned. This is useful however does not allow control of the results obtained. In order obtain **parametric control** from the noise generator a seeded random function is used.

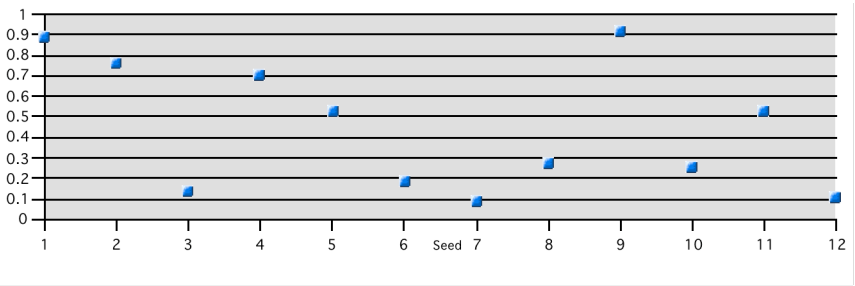


Figure 7: A seeded random generator will produce the same result when given the same input number or seed but still produces numbers in a random pattern.

Interpolation Function

Interpolation is a process of curve fitting in which a function is constructed that intersects exactly through the data points. This function can generate new data points given known data points, in this case the input points are those generated by the noise function. For a finite set of data points a function can be generated that allows us to obtain an infinite range of points. Several different algorithms are available to perform this interpolation. The algorithms vary in the number of data points they take as input, the accuracy they provide, their computational complexity and the smoothness of the curve that they generate. The graphs below demonstrate just two of the many different methods used for interpolation using data from Figure 7. Figure 8 shows the most basic linear interpolation and Figure 9 the more complex cubic interpolation.

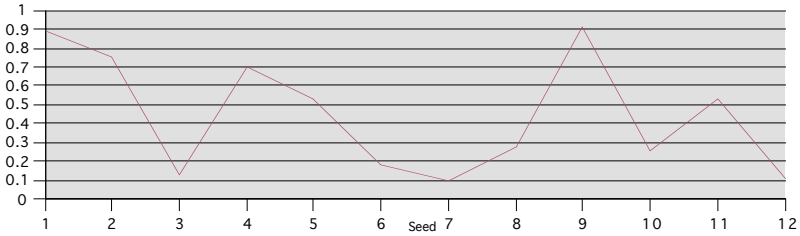


Figure 8: Linear interpolation is one of the simplest methods used and is often selected when speed is important and quality is of secondary importance. Linear interpolation only takes two points and the interpolant is calculated using the weighted mean.

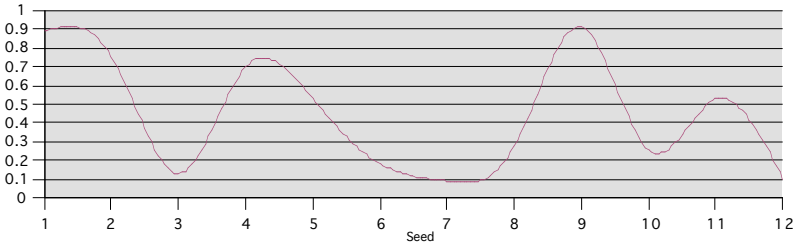


Figure 9: Cubic interpolation is quite computationally intensive. It is used when quality not speed is of particular importance and it outputs a continuous curve unlike linear interpolation. Cubic interpolation requires four points.

Turbulence

Results produced from interpolated noise have random properties but appear quite artificial rather than natural. In nature, there are many different scales of detail present. For example take a mountain range: large details are present with giant peaks and troughs, medium scale details are present through the smaller hills and crests, small details present through boulders and rocks, etc.

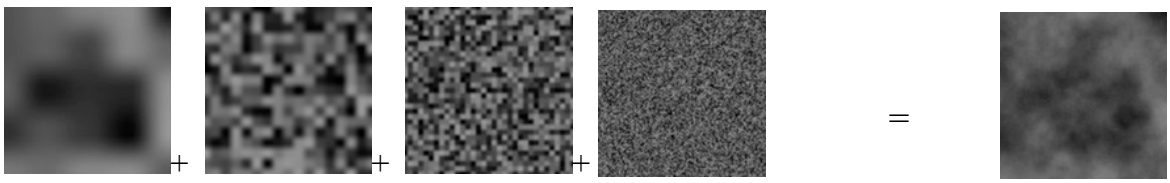


Figure 10: Combination of several layers of noise.

To provide a more useful texture source that resembles nature more *turbulence* is applied by combining several noise textures of differing scales. Each layer of noise is referred to as an *Octave* and layers are combined with

different amplitudes and frequencies. The variation of amplitude and frequency can be expressed a *Persistence* value. *Persistence* can help describe the effect successive octaves have on the previous iterations by defining the amplitude between octaves as a fraction. Perlin Noise generated with a low ratio of persistence is typical smooth with very fine detail; Perlin Noise generated with a high persistence is more jagged with less fine detail.

Figure 11: Photo realistic scenery and rendered using Terragen with procedural geometry generation and procedural texturing. © 2003 M. GIULI Terragen Artist.

Terragen[25] uses the Perlin Noise algorithm to generate photo realistic terrain, clouds and seas. Figure 11 showcases the details and scale of output that can be achieved using the Terragen procedural generation software. Parametric control is vital to the procedural generation process as it allows the generation to be easily managed and enables vastly detailed scenes to be defined in the terms of a few parameters. The Perlin noise algorithm also provides a mechanism by which the height for any point or region can be calculated on the terrain without the need to store the massive terrain geometry data.

Figure 12: Marble vase textured with a Perlin procedural volumetric texture[10]

In addition to 2D textures, Perlin Noise can be used to generate 3D textures, often referred to as volumetric or solid textures. Volumetric texture differ from conventional 2D textures in that they do not require bindings to geometry coordinates but allow objects to be virtually carved from the texture as if they were a solid block [10]. The

example shown in Figure 12 shows a vase carved out of a volumetric marble texture created using Perlin noise. The texture manages to replicate the veins running through the marble and achieves a higher level of realism than is possible using 2D texturing techniques.

Volumetric textures are computationally expensive to render, but the real barrier for their widespread use is their memory and storage requirements. Compression such as S3TC can partly alleviate the memory problems of 3D textures but do not go far enough. Perlin Noise requires minute storage due to its procedural nature thus removing any storage burden, and can even by used to render volumetric textures in real-time using the pixel-shader hardware on recent GPU's [15].

As a procedural generation technique Perlin Noise provides a comprehensive set of benefits. Parametric control provides the developer with flexibility to control the output through high level parameters. Reproducible geometry and textures created using the algorithm have minimal storage requirements, can be generated efficiently and can be defined in the terms of a few simple parameters. Textures of any size and detail can be produced providing an innate level of detail. The output created is tile-able, allowing seamless joins suitable for techniques like repeating and layering which are common place in multi-texturing. It can also be used as method to enable real-time volumetric textures on modern graphics hardware. [15] Perlin Noise has proven to be one of the most useful procedural techniques and is beneficial in wide range of computer graphics applications.

2.4 Tiling

Tiling is one of the most basic procedural techniques and has traditionally been applied in game development. It is used in many classic games including titles such as Sonic, Mario and R-Type. Originally tiling was used by creating small sections of 2D graphics that could be repeated on screen and assembled together to create the virtual world. Games such as the *Shoot Em Up Construction Kit* [31] released in 1987 by *Sensible Software* allowed the user to construct and edit game maps using a library of tiles and a simple interface.

More recently tiling techniques have evolved and are used in the form of *multi-texturing* to create highly detailed and varied textures from layers of base textures. New materials are created by combining a set of detailed textures, colour maps and blending maps. Using this technique terrain can be procedurally textured by applying several layers of detailed tile-able textures.[25] Examples of texture layers could include rock, grass, sand and snow. These texture layers can be combined with varying degrees of influence on the final texture. Textures are applied to the terrain according a variety of specified parameters, they can be selected according to height, slope or specified explicitly using an image map. This solution allows vast areas to be textured in detail which is not possible using a single high resolution texture.

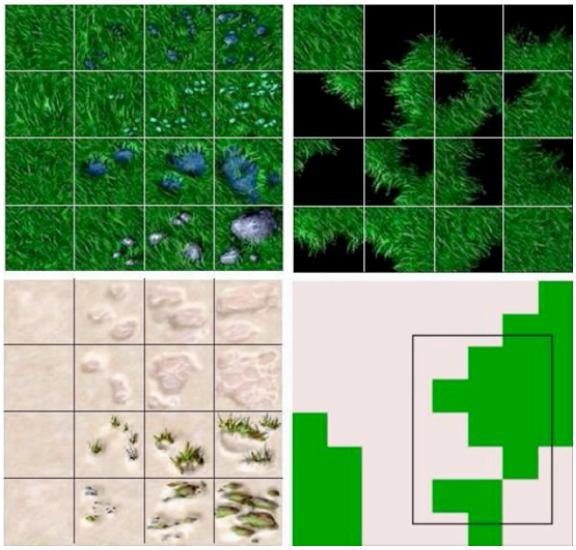


Figure 13: Warcraft® III uses stochastic information to procedurally generate Textures. © 2002 Blizzard Entertainment

Extended algorithms exist that use stochastic information such as probability distribution maps to procedurally texture landscape. An image map for the terrain area is supplied that stores the probability of using various tiles. Constraints can be specified to state which tiles can be joined under what conditions and whether they may be joined directly or require transitional tiles. Using a pseudo random function thousands of different permutations of worlds is possible from a single probability map. Each possible world can be stored and recalled by simply taking note of the seed used to create the world [20].

Tiling systems provide several advantages for graphics applications. Vast and detailed landscape or terrain for virtual worlds can be created from stochastic information and small set of texture tiles. These maps and game worlds can then be easily distributed for on-line gaming which is of particularly useful for massively multi-player on-line role-playing games (MMORG) and other on-line applications where game resources are shared. Storage and memory requirements are minimised so it is possible to optimally store and render worlds of vast dimensions in real-time on commodity hardware. Tiling is a good example of how a simple procedural technique can be applied and extended to provide benefits for graphics applications.

2.5 Voronoi Texture Basis

Voronoi diagrams were demonstrated as a method of procedural generation by S. Worley in his paper titled 'A Cellular Texture Basis Function', in which he detailed an algorithm that partitions space into a random array of cells creating cellular looking textures. The technique was devised to complement existing procedural techniques such as Perlin Noise and provide a method of procedural generation for cellular surfaces such as skin or bark. Voronoi diagrams have long preceded their application in procedural generation and have traditionally been used in a wide range of scientific applications including spacial analysis, planning, urban settlement analysis, geology, robotics and ecology.

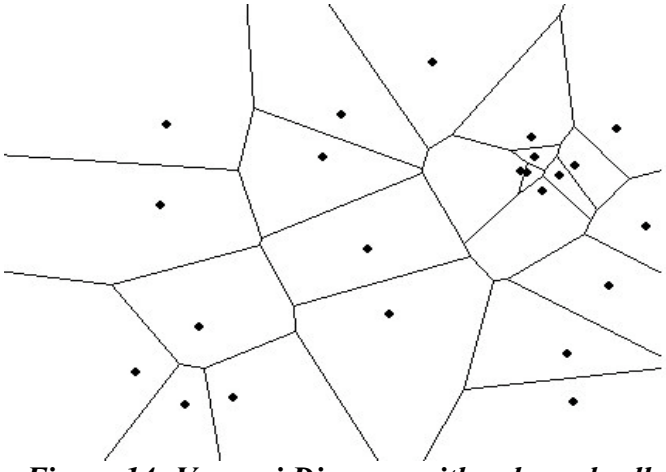


Figure 14: Voronoi Diagram with coloured cells

A Voronoi diagram is the decomposition of some metric space determined by distances to a specified discrete set of objects in the space. Figure 14 shows

an area partitioned into cell by lines which are plotted using the points on the map. Each boundary line is positioned equidistant between each pair of neighbouring points. The resulting Voronoi diagram is a result of the position of the original points. A wide range of cellular patterns can be created by using different configurations to place the points used to create the diagram, also this data can be interpreted and rendered in many different ways for different effects.

Figure 15: Photo-realistic surfaces procedurally created using Worely's cellular basis algorithm. [30][23]

The Worley algorithm achieves effective abstraction for the generation of cellular surfaces by providing a small set of parameters termed the 'Worley constants' that can control of the algorithms operation yet allow great variance of the output. [30] Natural surfaces such as paper, skin, cobblestone, tree bark and sun baked mud are prime targets for this algorithm and can be recreated effectively with little input data required. [23] Figure 15 shows examples of Worleys algorithm applied to procedurally generate natural textures. The algorithm has been used successfully in procedural generation creating a variety of richly detailed cellular surfaces which can be concisely defined in the terms of a few simple parameters.

3 Procedural City Generation

The procedural methods outlined in the previous section have largely been applied to the generation of natural objects and textures. Only recently have researchers turned their attention to their application in the context of generation of man-made phenomena such as an urban area. In this section we shall review and evaluate research that has been carried out on procedural generation of cities. City generation is achieved through a series of stages that

each uses a number of techniques to create roads, lots, building structure and building faces.

Road networks are a key aspect of city character and identity. Road networks are difficult to generalize since they are an interwoven component of a complex system. When viewing road networks from a map or city plan a number of patterns can be observed. It is these patterns that are key for procedural generation as they encode the structure of the road network. There are numerous road network patterns deployed in cities ranging from the tightly structured grid plan network with perpendicular roads in a regular chequerboard structure to the hierarchical network with sprawling secondary and tertiary roads feeding into arterial roads in a branch like system. The patterns applied within a city are a result of numerous factors including location, geography, cultural influences, planning trends, etc. Cities can be categorised by the road patterns they contain: modern US cities like New York are arranged in a chequerboard or raster pattern, some European cities like Paris are structured with a radial or concentric pattern most evident. However most cities contain a number of patterns, with different patterns prevalent in different regions or neighbourhoods within the city. [1][3]

City buildings are difficult objects to procedurally generate because of their individuality. The buildings present in a modern city display a diverse range in both function and style. Buildings as functional units serve a specific purpose or role within each neighbourhood, borough, district and city. The number of roles for buildings is many and combined with the geographic composition within a city make for an extremely complex system. Such a complex system is difficult to model, but a simplified solution can be used, similar to that used in statistical analysis, that uses classes or groups to model building function. Usage groups such as commercial, residential and industrial can be used as select generalizations for the numerous building roles and a simple mechanism for modelling function within cities. The style of a building and in particular its geometry and materials are often the result of numerous architectural and cultural influences. Such a complex form is difficult to model and an approximation or substantially reduced model is needed to limit the complexity of the generation system.

To effectively evaluate the generation systems we have identified a number of key criteria:

1. **Realism** – Does the generated city look like a real city?
2. **Scale** – Is the urban landscape at the scale of a city?
3. **Variation** – Can the city generation system recreate the variation of road networks and buildings found in real cities or is the output homogeneous?
4. **Input** – What is the minimal input data required to generate basic output and what input data is required for the best output?
5. **Efficiency** – How long does it take to create the examples shown and on what hardware are they generated? How computational efficient is the algorithm?
6. **Control** – Can the user influence city generation and receive immediate feedback on their actions? Is there a tactile intuitive method of control available or is the control restricted? To what degree can the user influence the generation results?
7. **Real-time** – Can the generated city be viewed in real-time? Are there any rendering optimisation techniques applied to enable real-time exploration?

An overview will be presented of each of the city generation systems and an insight provided into the functioning of the techniques and algorithms applied in the systems. Following each outline of the system we discuss and evaluate each system according to our criteria. Realism, Scale, Variation, Input, Efficiency, Control and Real-time optimisations.

3.1 Grid Layout & Geometric Primitives

Stefan Greuter et al.[13][19][24] outline a solution to procedurally generate a city in real-time. The techniques applied to generate the city are discussed in a number of papers and demonstrated in a virtual city application titled *Undiscovered City*. The application creates a road network using a simple grid layout upon which it can place buildings generated using a combination of simple geometric primitives. The research is specifically targeted for real-time applications and the *Undiscovered City* serves as a proof of concept running in real-time at interactive frame rates.

Road Network: Grid Layout

The roads of the city are created in the pattern of a uniform grid in a similar fashion to the centre of a modern planned American city like New York. The grid is regular and size of each block is constant but can be adjusted globally.

Figure 16: Screen shot at street level in the Undiscovered City demo

Figure 17: Screen shot from the Neverland demo

The grid based road network generation has been improved in the Neverland demo, a more recent work from Greuter et al., shown in Figure 17. This system extends some of the buildings over more than one grid block creating a more disjointed road network and giving the city a more realistic appearance. A paper detailing the Neverland demo has yet to be published.

Buildings: Geometric Primitives

The building generation system uses the location of buildings in the form of a grid coordinates as a seed for building generation. The appearance of each building is determined by this seed including properties such as height, width and number of floors. Generating buildings using a similar set of numbers such as neighbouring grid coordinates can result in similar looking buildings,

so to overcome this a hashing function shown in Figure 18 is implemented in order to provide more random distribution.

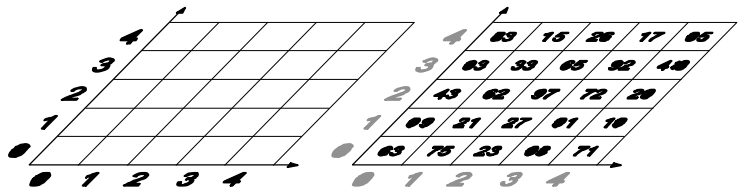


Figure 18: Grid Layout Coordinates & Hashing [19]

Building geometry is generated using the concept of combining geometric primitives to form building sections. Each building section is constructed using a different floor plan. The top most section of buildings are created by extruding a three dimensional volume from the most basic of floor plans, composed from only a few primitive shapes. In subsequent sections below, another primitive shape is added to the previous floor plan and a three dimensional volume is extruded in the same fashion. Figure 19 illustrates how the creation of consecutive sections is combined to form the complete geometric model of a building. Figure 20 shows the generated buildings with their textured *faces* which are not procedurally generated but are selected from a set of 10 building window textures.

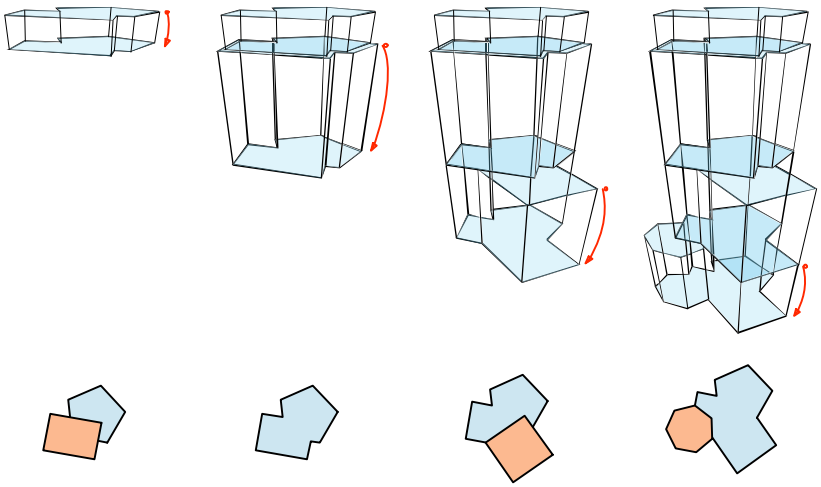


Figure 19: Floor Plan Generation [19]

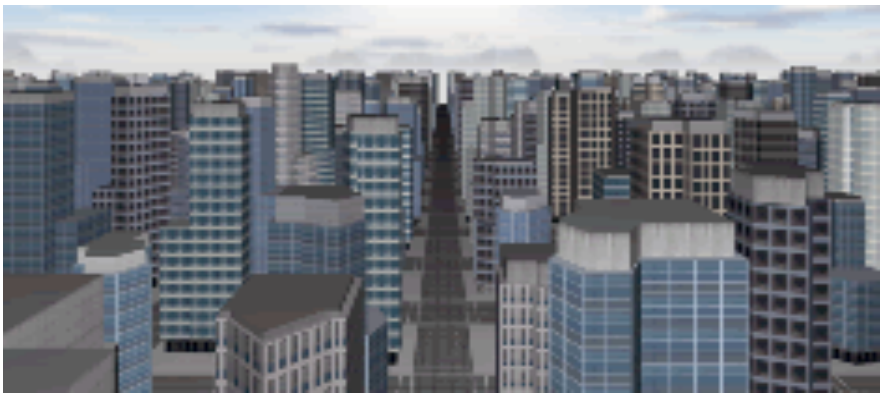


Figure 20: Screen shot from the Undiscovered City demo

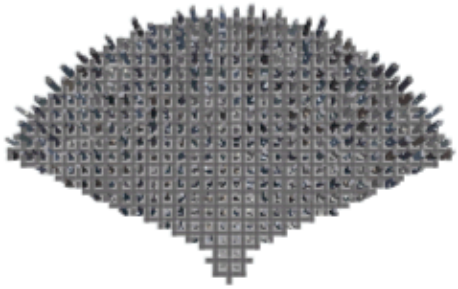


Figure 21: View frustum filling. [19]

The *Undiscovered City* is designed with real-time applications in mind and implements optimisations such as a geometry caching and view frustum culling. The culling technique, referred to as *View Frustum Filling* [19], renders only the buildings visible within the view frustum as shown by Figure 21. By loading and rendering a reduced set of buildings the amount of memory required to store the scene and the graphical processing power required to render the scene are minimised enabling the real-time rendering of a large data set like a city. The regular grid road network allows easy detection of building visibility within the view frustum and hence provides a computationally efficient method to cull superfluous buildings from view.

In addition to culling building geometry, a building cache is also implemented. Buildings are generated in advance and defined as OpenGL display lists that can be stored in the building cache. The cache employs a LRU(least recently used) algorithm: recently accessed buildings are kept in the cache while older less recently accessed items are replaced. As a result of using the building cache memory use is optimized and buildings can be recalled from cache for display an order of magnitude faster (up to 8x) than they can be generated from scratch.

Discussion

1. **Realism:** The single grid pattern used does not reflect real cities that are constructed from a number of patterns and the resulting road network appears artificial and homogeneous. Buildings appear angular and modern and are somewhat realistic but unconvincing. Simple windowed *faces* are used and the buildings are not geometrically detailed.

2. **Scale:** The grid layout system can create road networks on a very large scale and is limited only by the size of the integer based coordinates. At 2^{32} cells wide, the size is not a practical restriction for city generation.

3. **Variation:** The road network provides little variation, a single regular grid pattern is used and only the grid spacing can vary from city to city. The grid system is required for the real-time optimizations and so is largely inflexible. Only a single building type is constructed, an office skyscraper with 10 different window textures, no other type of building is supported. Although the geometry for each building is different the amount of variation insufficient to emulate a real city.

4. **Input:** No input maps or geo-statistical data is required. No external image maps are required and the application is standalone.

5. **Efficiency:** Road network and building generation take place in real-time and figures are provided for the generation and rendering of the *Undiscovered City.*

6. **Control:** Grid spacing can be adjusted using short-cut keys in the application and the changes can be viewed in real-time. The building generation process is not interactive and all buildings are generated using a random seed created using a set of building coordinates from the road grid network.

7. **Real-time:** The system is designed for real-time applications and can render views of large scale cities in real-time on commodity hardware from 2003 at interactive frame rates. [Performance for numbers of buildings being displayed on screen: 200 buildings @60fps, 500 buildings @20fps, 1000 buildings @5fps].

3.2 L-systems

Parish and Müller[11] presented the CityEngine in a paper titled Procedural Modeling of Cities at SIGGRAPH 2001. The CityEngine consists of a suite of components including road generation, building construction and building *face* creation that unite to form a pipeline for city generation. L-systems are selected as the key technique for procedural generation in the *CityEngine*. Lindenmayer-systems have traditionally been used to model natural phenomena but are also suitable for the generation of cities due to their concise nature, computational efficiency and data amplification properties.

Road Network: L-systems

L-systems have been used to model natural phenomena and the generation of plants and other branching structures provide some similarities to the generation of road networks. The CityEngine uses an extended form of L-systems titled Self-sensitive L-systems to construct road networks in a manner which takes existing growth into account.

Input is taken in the form of 2D image maps. Geographical information on elevation, vegetation and water boundaries is required and additional socio statistical image maps can also be included specifying information such as population density, land usage, street patterns and maximum building heights. A road network generation application, shown in Figure 23, is used to manage the generation of roads and allow the operating user to specify extra parameters such as the smoothing angle of road network edges, road width, etc. Although only a geographical input map is required the examples included in the paper, such as Virtual Manhattan in Figure 27, utilize a number of different input maps.

Road generation is accomplished through the use of two rule sets: the *Global Goals* and the *Local Constraints*. Road segments are initially plotted according to the Global Goals which are similar to the goals that a city designer may have. These tentative plans are then refined by the Local Constraints which reflect the practical constraints of the real world and the state of the existing road network.

Global Goals

- There are two different types of roads: highways or major roads connect population density centres which can be identified from the population density map supplied at input, small roads connect to the nearest highway.
- Streets follow some super imposed **geometric pattern**.
- Streets follow the path of least **elevation.**

Local Constraints

- Road segments are pruned to fit inside a legal area: line segments extending into water are pruned.
- Roads are rotated to fit inside a legal area: a road to the coast bends around the coastline like a coastal road.
- Highways are allowed to cross an illegal area of a certain distance: a highway approaching a limited span of water will cross over it like a bridge.
- Roads segments are checked to see if they intersect with existing roads or if they come within a certain distance of an existing road junction: Figure 22 shows how proposed road segments are modified to satisfy the self-sensitive rules.

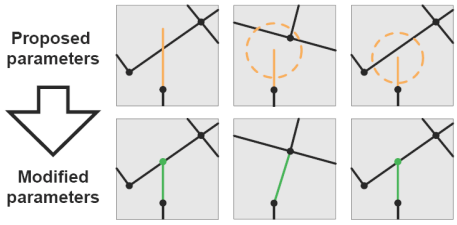


Figure 22: Self-sensitive road L-system [11]

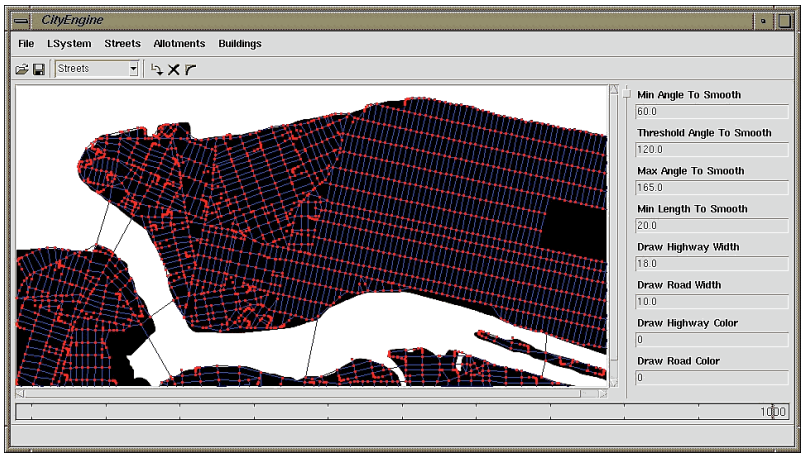


Figure 23: CityEngine GUI displaying Virtual Manhattan after 100 steps. [29][11]

Buildings: L-systems

The CityEngine constructs buildings on the road network in a series of distinct stages: define building allotments, create building geometry and generate textured faces. To define *building allotments t*he CityEngine utilizes data from the previous road network generation stage. Figure 24 outlines the stages of allotment generation. Allotments or lots are calculated by first extracting blocks from the road network using the roads of the network as the dividing borders. Each basic extracted block is then divided into a series of potential lots via randomized subdivision. Lots that are too small or have no immediate street access are culled and removed from the system. The final lots generated by the CityEngine are shown in the right-most image of Figure 24 and appear both varied and practical.

Figure 24: Lot Division Stages [11]

Building geometry is generated through the use of a parametric L-system. Several different building styles are implemented including: skyscrapers, commercial and residential with each type using a different set of L-system productions. The building type is determined from a zone map which can be passed in as an image map input.

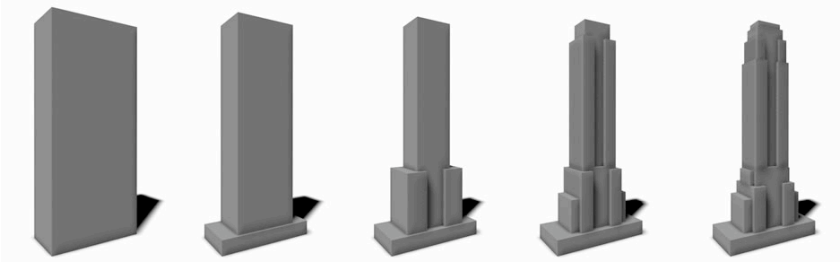
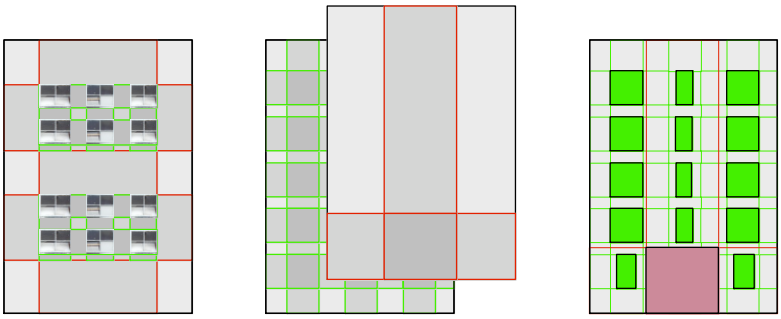


Figure 25: L-System building refinement from bounding box of the Empire State Building [29]

The initial state or axiom of the building L-system is a bounding box generated from the lot footprint and a building height image map if available. L-system operations consist of transformations (scale and move), extrusions,

branching and termination, and the use of geometric templates for roofs, antennae, etc. L-systems allow for the addition of more productions and provide an extensible solution. A basic level of detail implementation is possible since each iteration of the building L-system is a refinement of a basic building bounding box as shown above in Figure 25.



Building *faces* are created procedurally by generating textures using an over-laid series of grid-like structures. Several layers of grid-like structures are used with functions that define how the layers are combined. The functions dictate which cells from what layer are selected to create the final *face* and can use conditional and statistical information to select cells. *Cells typically contain doors or windows but can contain any building face feature. Shown in Figure 26 is the construction of a face: the red layer influences the selection of cells from the green layer. The resulting face is a conditional combination of multiple layers.*

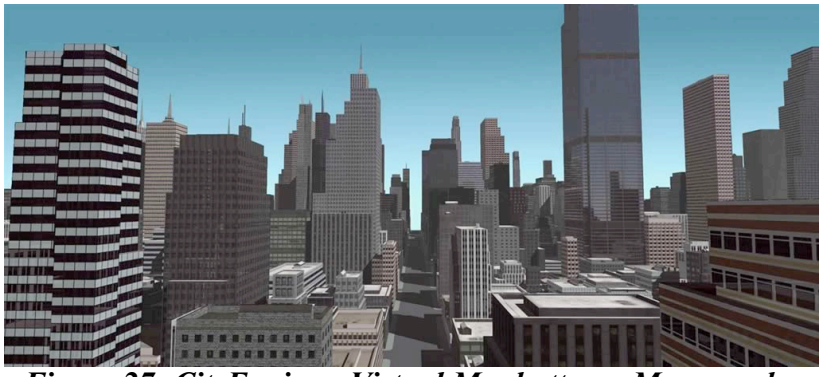


Figure 27: CityEngine - Virtual Manhattan – Maya render

The CityEngine produces data that can be imported into Maya, a commercial 3D package, for final rendering. The sample shown in Figure 27 illustrates such a rendering from Maya, in this case a showcase of Virtual Manhattan.

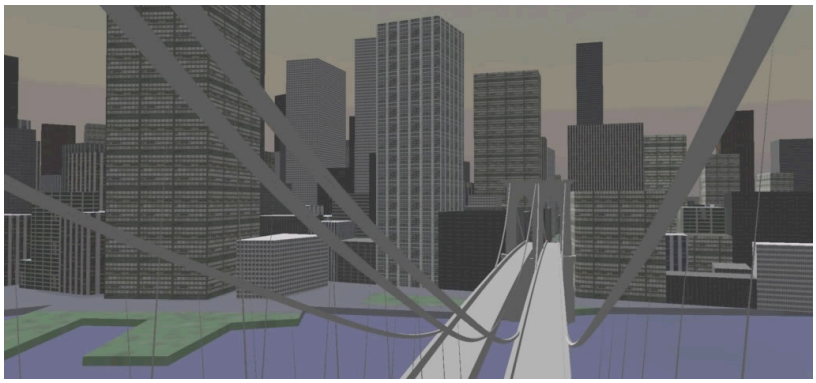


Figure 28: CityEngine - Virtual Manhattan – DV/reality

A real-time implementation is available utilizing *DV/reality* software from *Dimension*. DV/reality is a large scale visualisation tool designed to run on super computers and distributed rendering applications. There are no real-time rendering features such as level of detail or geometry culling discussed and from the screen-shot of *DV/reality* in action in Figure 28 it is clearly evident that a reduced complexity model is being displayed. (Notice how the buildings appear more similar to the left most image of Figure 25 in contrast to the right).

Discussion

1. **Realism:** The CityEngine can create a complex and detailed road network through the use of extended L-systems. The sample shown in Figures 23 demonstrates the generation of a realistic road network, but does utilize real statistical data making the capabilities of the system difficult to assess. The blocks from the road network are divided into realistic and practical lots upon which buildings can be constructed. L-system building generation provides an effective method of generating a realistic cityscape although the resulting buildings are quite basic. Several different types of buildings including skyscrapers, commercial and residential buildings can be created and green areas are also displayed. Overall a good visual balance is achieved with practical positioning.

2. **Scale:** Scale does not appear to be a limiting factor for the system and is possibly restricted only by the size of the input data maps.

3. **Variation:** a good range of road networks can be created and examples of

different generated cities are shown including Paris – Circular, New York – Grid and San Francisco – Terrain wrapping. Buildings vary in shape and scale and a range of building types are catered for, but only limited range of style is demonstrated. In Virtual Manhattan a convincing clone of New York is shown but it may be more difficult to generate other cities where a different architectural style would be required.

4. **Input:** the minimum input required is a geography map however all of the samples shown utilize numerous input maps and include statistical data from real world cities. A dependence on real-world data would require the acquisition of geo-statistical data to begin using the system which is not desirable. Also, from a practical point of view the system is more difficult to evaluate since it is difficult to determine which patterns are created by the L-systems and which are created as a result of the input data. Although only one input map is required, all of the samples shown in [11] utilize numerous maps to create realistic output like that illustrated in Figure 27

5. **Efficiency:** Road network generation is very efficient, the large road network of the Manhattan sample shown in Figure 27 is created in under 10 seconds. The next stage of generation the building stage takes longer to complete: Virtual Manhattan requires approximately 10 minutes to sub-divide the road network into lots, construct buildings and create textured *faces*. It is important to note that although the generation time is documented the time required for Maya to render Virtual Manhattan is not disclosed and would likely take substantially longer than both combined.

6. **Control:** It is unclear how much user interaction is required and no interactive features are specifically documented. L-systems are by their very nature iterative and it appears that the number of iterations used by the system to generate output of an acceptable realism and detail is determined by the user trying different values on a trial and error basis. Other values are also specified manually such as the angle of deviation. Control of building generation appears to be limited to the numerous image maps that can be passed as input.

7. **Real-time:** A real-time demonstration is available using the *DV/Reality*

software shown in Figure 28 that displays a simplified version of Virtual Manhattan. *DV/Reality*[DVR] is a visualisation tool designed to provide real-time rendering though the use of high powered graphics workstations and distributed rendering. No documentation on any real-time features in the CityEngine are provided and without features like geometry culling or LOD real-time rendering applications like gaming are not possible. It may be possible to easily add some optimizations such as a simple level of detail implementation based on the principle that each L-system iteration produces a more detailed building version refined from a simple cuboid primitive as illustrated in Figure 25.

3.3 Agent Based Simulation

Watson et al. [18] apply an agent based technique to generate cities in their solution titled *CityBuilder*. The system is built on the NetLogo™ platform which is a multi-agent programmable modelling environment based on the Logo programming language and is designed to provide users with a platform to explore emergent phenomena. The city generation is implemented by simulating cities using a set of agents that can model specific city entities such as developers, planning authorities and road builders. The *CityBuilder* system models not only the road network and buildings but also simulates the growth and development of the city over time.

Road Network: Agent Based Simulation

Roads are created from road segments that are assembled according to a grid pattern. Deviation from the pattern is allowed and can be specified via a parameter. A deviation value of zero will result in a strictly uniform grid like road network; a deviation value near one would result in an organic like network. The interconnectivity of the network can also be altered via constants that dictate the road density and the distance between road intersections.

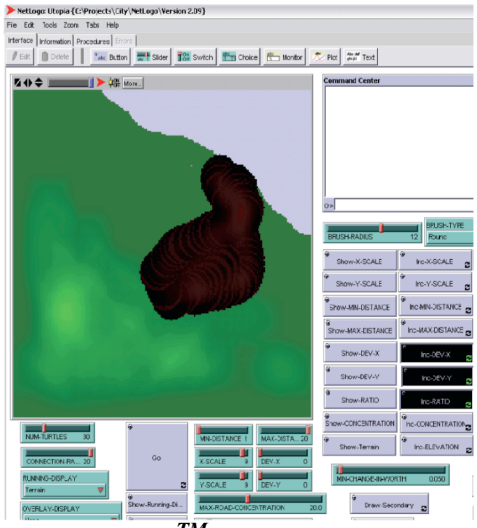


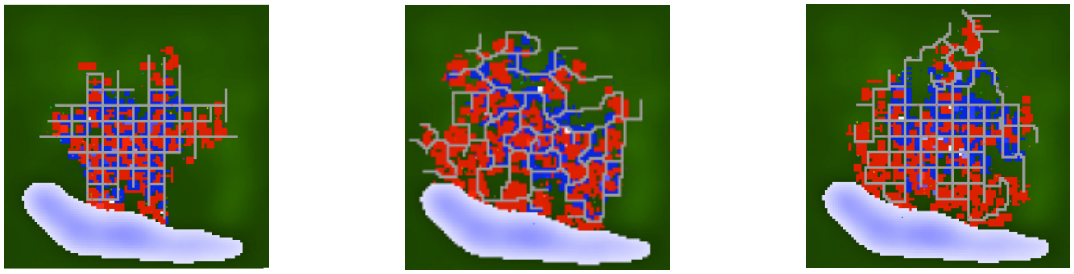
Figure 29: NetLogo™ City Builder Interface [18]

Input in the form of a terrain height map is required along with a specified water level to determine the legal area in which roads and buildings can be placed. Extra parameters such as road density, grid spacing and deviation from grid can be adjusted using sliders in the interface shown in Figure 29 to alter the behaviour of the agents. Additionally users can specify certain parameter values for specific areas by painting on the map using a brush similar to that in a simple paint application.

The road segments are created by two types of agents – extenders and connectors:

- *Extenders* roam around terrain near to existing developments to search for land that is not serviced by the road network. Once that area of land has been discovered, it is assessed according to road density, proximity to existing junctions, and deviation from the start point. Roads follow parcel boundaries and try not to make large changes in elevation.

- *Connectors* roam over the existing road network sampling the distance taken to travel to a point within a given radius using a breadth first search of the road network. If this distance is too long the connector will propose a road segment between the two points, the proposed segment is subject to the same checks as extenders.



a) b) c)

Figure 30: Example output of differing city structures: a) Gridded, b) Organic & c) Mixed Gridded and Organic [18]

Road networks can be viewed evolving in real-time, and the examples shown were created in 15 to 30 minutes. Figure 15c) shows one of the main strengths of the agent based system by effectively blending between raster and suburban road styles.

Buildings: Agent Based Simulation

The generation of land usage for buildings is completed via the interaction of a number of agents but is primarily due to the work of *Developer agents*. Developer agents perform the role of urban developers and have similar goals: buy land, request planning permission, build and sell. A rectangular grid of patches represents the world and each patch may be occupied by a building or road. Patches are grouped into parcels under the ownership of the building agent. The building agent determines the zoning information of each parcel and tracks attributes of the buildings.

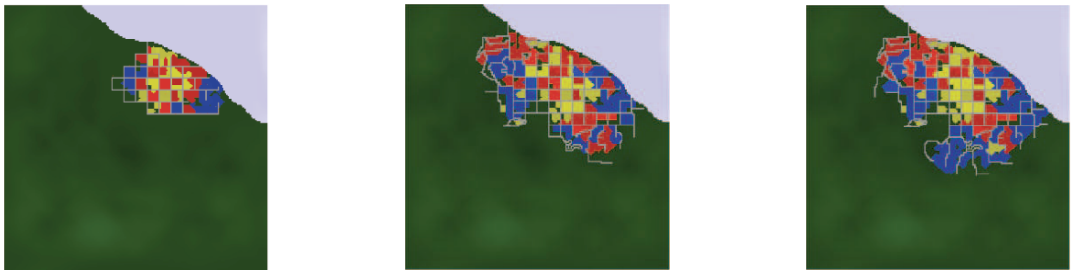


Figure 31: Development Sequence. Yellow is residential, red is commercial, blue is industrial. Roads are grey. [18]

Three distinct developer types are defined: residential, commercial and industrial. All developers seek to increase the value of their land and each

developer type evaluates the value of land differently and uses a different set of rules to complete its goals. For example: residential developers seek land near the less busy areas of the road network in contrast to commercial developers who look for the busiest sections of the road network. Property is reviewed and a site is chosen. A proposal is then prepared that satisfies the clients needs and meets and the city's restrictions. The proposal must then be reviewed by the city. A developers' proposal is only successful if it passes the city regulations and makes a net positive impact on the community by providing a service or increasing the value of the land. After this process is complete the developer agent starts again looking for more property. Shown in Figure 31 are three snapshot images of the evolution of a small city from left to right.

The *CityBuilder* system creates a road network and defines land use that is then used to determine building types but does not generate actual building geometry and textures. The visualization of the city buildings is not a feature of the system but takes place externally in the proprietary SimCity game engine.

Discussion

1. **Realism:** The road network is appears realistic and has the ability to effectively transition between different road patterns, particularly the transition from central urban areas to less dense suburban areas. No buildings are generated but the land usage map appears realistic resembling real statistical data similar to that showcased in the chil.us [28] project.
2. **Scale:** The output created from the system and example shown in Figure 31 is limited in scale and is of a comparable scale to that of a village or small town rather than a city.
3. **Variation:** Different zones are supported with commercial zones using rigid block like road structures and residential areas using sprawling roads. Three different land usage and building types are defined commercial, residential and industrial. It is impossible to judge the variation achieved by those categories as the visualisation is performed by the SimCity engine which is outside of the system.

4. **Input:** A terrain height map and a water level input are required to determine the legal areas in which buildings can be placed. Other input can be specified by the user through the interactive application.
5. **Efficiency:** CityBuilder models not only the structure of a city but also its evolution and as a result of the added complexity the algorithm is computationally intensive and time consuming. A city of only limited scale similar to a village can be generated over a period of approximately 15 minutes not including the generation of any building geometry or textures.
6. **Control:** An innovative feature is available in the form of a paint tool that can be used to paint parameter values on the map. Numerical parameters such as road concentration, deviation and scale can be specified via an interactive application using the various sliders and widgets of the GUI.
7. **Real-time:** There are no real-time considerations or even a three dimensional model of the city. Visualization is provided via an external system, the SimCity engine, that uses a flat bitmap tile based game view.

The system could be easily expanded but with an algorithm of high computational complexity and it is not suited for procedural generation and could be more suitable for simulation applications.

3.4 Template Based Generation

Sun, Baciu et al propose an alternative approach to creating cities in their 2002 paper *Template-Based Generation of Road Networks for City Modeling* through the use of a collection of simple templates and a population adaptive template [12]. The basic concept of the system is that a road network template is applied to a geographic map as a plan and then the roads are deformed subject to local constraints.

Road Network: Template Based Generation

Several inputs are required in the form of 2D image maps. A colour image map which contains geographical information on land/water/vegetation is required. A grey-scale height map image to specify elevation is required. A

population density map is required for the population-based template and is used to determine the varying road network density.

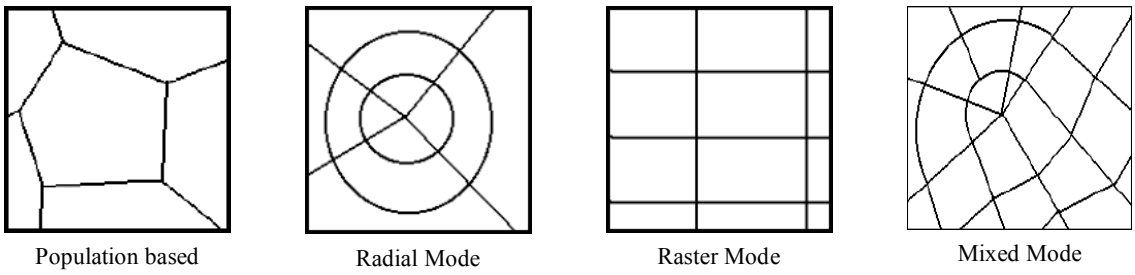


Figure 32: Road Patterns [12]

The population-based template is implemented using a Voronoi diagram. A road system is created that is representative of the population distribution. Road networks are suitably dense in highly populated areas and sparse in less populated areas. This is made possible by extracting density points from the population density input map and using the points as input sites for the Voronoi diagram. The edges or cell boundaries from the resulting diagram are used to create the interconnected road network. The other templates use procedural patterns to create the road network. The Raster Mode, Radial Mode and Mixed Mode templates serve as simplistic growing patterns, with roads starting from a defined centre point and growing in an iterative process toward the edges of a bounded area. The Mixed Mode is simply a compound of one or more of the other basic templates.

Templates define only the desired road pattern and just as road planners must respond to practical constraints, so must the pattern. Roads deviate from the supplied pattern changing direction rapidly to avoid obstacles such as water and curve gradually to avoid large changes in elevation. Roads are created in short steps, at each step the system emits several fixed length radials and selects the radial with the least variation in elevation that is in a legal zone. In the case of a tie between two radials the path of least deviation from the original path is chosen. The angles at which the radials are drawn is restricted by a freedom factor, F, which limits the maximum angle of deviation for each radial. The final shape of the road is a result of terrain deviation and the selected pattern is followed only as strictly as the freedom factor dictates it to be followed.

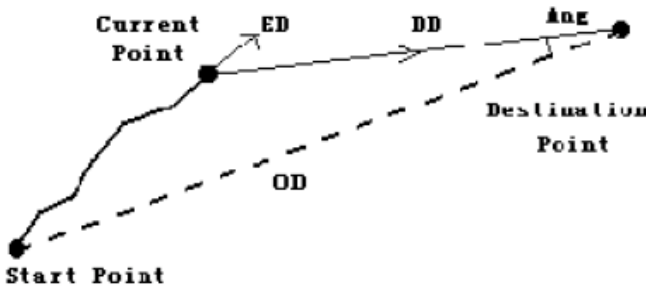


Figure 33: Lot Division Stages [12]

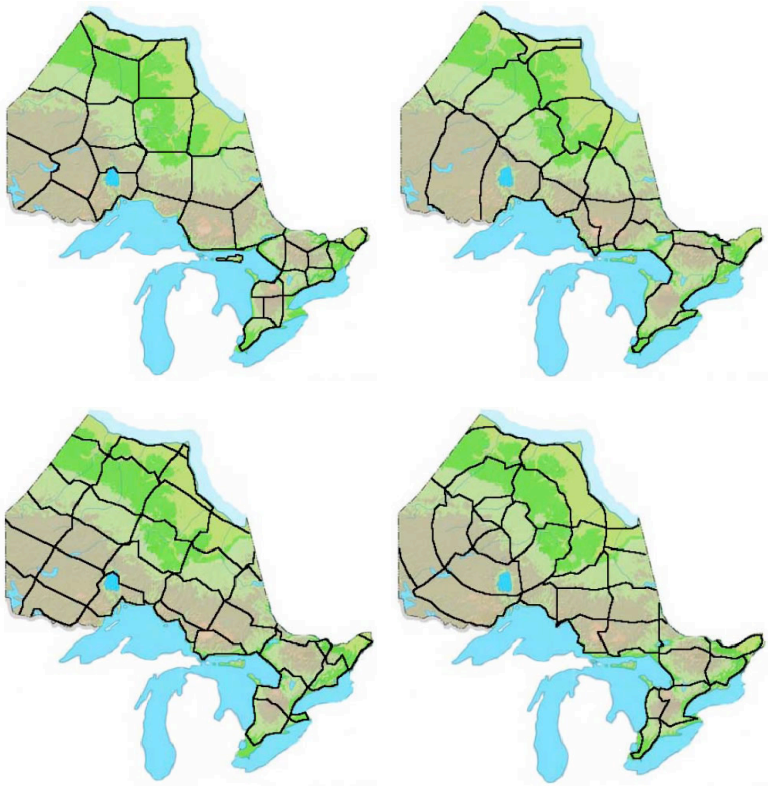


Figure 34: Results clockwise: Population-Based Template, Radial Mode, Raster Mode and Mixed Mode. [12]

Discussion

1. **Realism:** The applied template technique reflects the patterns found in cities but the results do not achieve the complexity and scale of real city road networks. The compound pattern aims to overcome the simplicity of the single patterns by combining a number of patterns, similar to a real city, but only combines two which is insufficient for the complexity of modern cities.

2. **Scale:** The examples shown in Figure 34 demonstrate limited complexity and are insufficient in scale to be classed as city scale road networks.

3. **Variation:** A choice of four templates is demonstrated and each can be deformed by the random terrain providing limited though varied output.

4. **Input:** Several inputs are required including geo-statistical data such as terrain height maps, a standard geographic map and a population density maps for the population based template.

5. **Efficiency:** No information is provided on the performance of the generation process.

6. **Control:** A reliance on statistical data and no indication of any user interaction to control the road network generation would imply that this solution is very rigid and inflexible.

7. **Real-time:** No real-time features or rendering optimisations are discussed.

3.5 Split Grammars

The *Instant Architecture* solution presented by Wonka et al. at Siggraph 2003 describes the generation of realistic buildings through the use of a new type of formal grammar called split grammars. These grammars are based on the concept of shape [17].

Buildings: Split Grammars

Split grammars are based upon the previous research and principles of shape grammars pioneered by Stiny[4]. A shape grammar is a formal grammar not unlike L-systems but it is based on the fundamental primitive of shapes rather than letters or symbols. Rules or productions map a shape or number of shapes to be replaced by another shape or number of shapes. An initial set of shapes is supplied to start with and the rules are applied in an iterative manner.

The basic building blocks of the system and the objects that the grammar manipulates are simple attributed, parameterised, labelled shapes called *basic shapes.* A large number of rules or productions are required to transform the shapes. For the examples shown in the paper a database of around 200 rules

and 40 attributes was assembled. Figure 30 shows an initial state and simple set of sample rules.

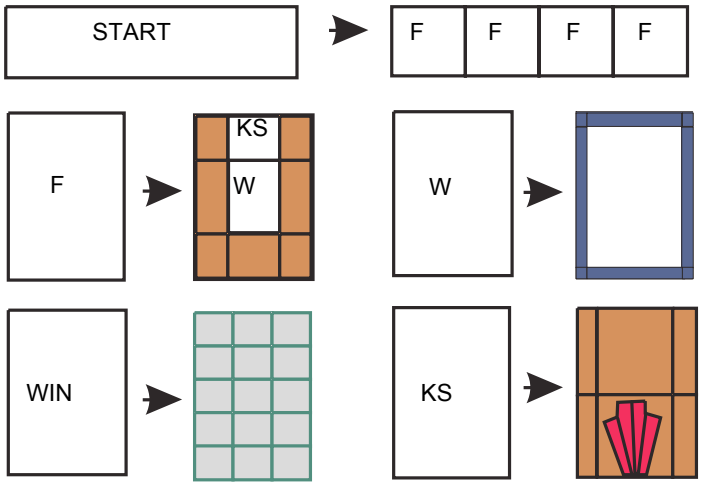


Figure 35: An example of split grammar. [17]

An initial starting state is provided and then transformed in an iterative process using rules from the database. The rules split buildings into faces, faces into structural sections, structural sections into components such as windows and so on, as shown in in Figure 30 with the end result shown of the completed derivation in Figure 16.

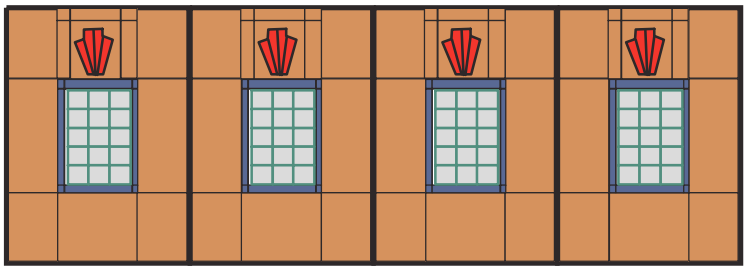


Figure 36: Completed derivation of the grammar in Figure 30 [17]

Attributes assigned to shapes are propagated from the initial state down through the system. The attributes store information about the building like its symmetry, age, use and visual properties. These are later used to render the building but are also used to help match transformation rules and find relevant replacements. In addition, a control grammar is applied that can change the attributes of basic shapes in order to apply spatial design concepts, such as setting the first floor of a building to be a shop or applying a vertical detail to a column of shapes. The resulting building models produced by the instant architecture system contain detailed local details

such as window sills but also distinctive building features such as vertical details on the edges of buildings.

Figure 37: Screen shot of Instant Architecture [17]

Discussion

1. **Realism:** The split grammar technique produces very realistic buildings even going as far as to effectively recreate different styles of architecture.

2. **Scale:** The examples shown in Instant Architecture are limited in scale, they demonstrate the strengths of the system by creating a small group of buildings in a town square or centre. A high level of variation is shown in the examples but the number of buildings is limited and is not of city scale.

3. **Variation:** Building style varies greatly helping to produce very realistic output, however it is not clear how many different buildings types can be produced.

4. **Input:** The system requires substantial initial input with samples like those shown in Figure 37 requiring a database containing approx. 200 rules and 40 attributes, and took around two weeks to assemble. From this database a variety of buildings of different styles could be created and the data could be distributed with the system without requiring the user to assemble their own dataset.

5. **Efficiency:** The algorithm although complex is quite efficient creating buildings of up to 10,000 polygons in around 3 seconds on an Intel Pentium 4 at 2Ghz.

6. **Control:** No interactive editor or GUI is described but the split grammar rules can be edited in the database manually. This process is described as non trivial and requires a level of expertise and experience using the split grammars. It could well be a barrier to extending the system. There may also be constraints on the size of the system and the number of rules that it can manage with a reservation expressed that some derived designs may not even make sense if more rules are added.

7. **Real-time:** The detailed buildings that the system produces can be explored in real-time however the number of buildings on display at any one time is limited. It is clearly a limit of the system with such a high polygon count. Level of detail support would be essential to use the system for real-time applications.

The Instant Architecture solution produces realistic and detailed buildings but may require a level of expertise to operate that restrict it to an academic audience.

4 Future Research

In Section 3 we reviewed previous research into the procedural generation of cities. It is important for us to recognise the areas that can be improved in this research and to identify suitable candidates for further research. To evaluate the existing research we studied each city generation technique and assessed the systems performance according to a common set of criteria: Realism, Scale, Variation, Inputs, Efficiency, Control, Real-time provisions. After completing this analysis, we have found that previous research efforts have made good progress on a number of difficult goals by achieving a high level of variation, realism and scale. However, city generation research is by no means complete and we identified a number of areas which can be improved on by future research.

An accessible city generation system is difficult if the operation of the system requires a high level of expertise or if complex input such as geo-statistical data is a prerequisite to using the system. The City Engine system [11] is capable of producing visually sound results but the road network and buildings are generated using a complex set of rules, images maps and geo-

statistical data. The Split Grammars technique proposed by Wonka et al.[17] requires the creation of a large set of complex architectural rules before building generation can begin. The agent based simulation technique also uses a large and complex set of pre-determined behaviours to specify how the agents act. Varied results can be obtained without strictly requiring changes to the city generation systems. But in order achieve results of a similar quality to some of the examples shown a level of expertise and in-depth knowledge of each system is required that is not possible for the general user.

The existing city generation solutions do not provide interactive, tactile or close control over the generation process. The grid layout system proposed by Greuter et al.[13] is very restrictive allowing only the grid spacing to be adjusted by the user. Growth based algorithms such as L-systems[11] or agent based simulation[18] are difficult to control due to their evolutionary nature. Both growth based generation solutions use a system of image maps to provide incentives for growth in certain areas of the city. An additional layer of control is specified in the form of numerical parameters that influence factors such as road branch distance, road branch angle, etc. The template based approach uses a selection of basic procedural templates to create a road network. The templates cannot be edited by the user and no user interaction is documented.

A city is a large and complex model and cannot be rendered easily in real-time on commodity hardware. In order to render such a complex model, optimization systems such as level of detail, culling or paging are necessary. Out of the city generation solutions studied only Greuter's system provides real-time optimisations via the use of view frustum filling and geometry caching.[19] The view frustum filling technique is possible by using a simple regular grid road network but is not applicable in its current form to more complex road networks.

We have reviewed the city generation systems and discussed some of the areas that warrant further research. From this discussion we have obtained a key list of goals for our city generation solution to build and improve upon existing work.

- Accessible – input data such as geo-statistical data or complex architectural rules should not be required to use the system.
- Interactive – the system should be capable of fully autonomous generation but also facilitate interactive control.
- Real-Time – for efficient rendering optimisation techniques like culling, paging and level of detail should be implemented.

To summarize, the goal for our research is to create a city generation system suitable for real-time applications that is capable of creating realistic, varied and large scale cites in an efficient manner while remaining accessible to non-expert users. Our current design comprises of three major components: *primary road generation*, *secondary road generation* and *building generation*. All three components are united within a standalone application providing interactive control over the city generation process.

The primary road generation component utilises procedural templates Sun et al. that encapsulate common city road network patterns such as raster, radial, hierarchical and cellular. In addition to the previous template based solution the templates are dynamically editable and form only the high level roads. Each road network template can be applied to a terrain as an interconnected graph with edges of the graph, the roads, automatically deformed by terrain characteristics such as gradients, water levels and other obstacles. The resultant road network graph is editable using an interactive 3D interface. Streets can be added, deleted and moved using junctions as control points for easy manipulation. Editing the control points affects not only the primary road network but also the secondary roads within providing a tactile method to control all road generation.

Cells resulting from the division of the city by the primary road network form the basic units upon which the secondary road generation component operates. A technique similar to that used in [11] based on L-systems can be applied inside the cell although several different algorithms including agent based approaches, and simple procedural templates can be applied within a single city. Global and local parameters are adjusted to specify the behaviour

of generation algorithms in a citywide and/or local cell scope. To optimize rendering of the city we propose to page cells similar to terrain paging, the primary road network forms a skeleton and the secondary road network cells within can be pre-emptively generated and loaded on demand using a cell adjacency model.

Buildings can be placed on the lots created from the secondary road network and can be constructed using a generative grammar such as L-systems. Several different building usage types will be supported including commercial, industrial, and residential. Building structures are generated at run time and can thus provide a substantial reduction in memory usage by storing simple generation data and generating large complex geometry only when required. This geometry generation can be applied to construct several variants of buildings depending on the instantiation parameters used. L-systems refine a basic model into a complex model by applied a series of productions iteratively. A range dependant level of detail can be provided by including an instantiation parameter that specifies the number of L-system iterations proportional to the distance between the camera and building.

At present an interactive application has been built that implement the primary road generation component and partial secondary road generation enabling basic road network manipulation and interactive editing. Current work involves implementing complete secondary road generation and generative grammars for building generation. Real-Time rendering provisions including *cell paging*, *runtime geometry generation* and *L-system level of detail* are currently catered for and we would like to further explore and test these optimisation schemes.

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Working towards an inclusive model of practice: E4 project training in an institute of technology.

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Abstract

The paper hypothesises that third level tutors are not required to and do not generally possess teaching or disability awareness qualifications and that the institute of technology involved would benefit from a collective approach towards more inclusive practice. The collected data confirms the hypothesis whilst also highlighting recommendations to be incorporated into future planning. The aim of this paper is to examine the effectiveness of a Continuing Professional Development Module on inclusive teaching and learning in a third level institute of technology; it is then intended to derive appropriate lessons for future development of such training. The E4 Project builds on the learning of previous projects examining the learning behaviours of students with a range of needs. The Inclusive Learning through Technology Project used e-learning and Assistive Technology to develop skills in the classroom. The Partners Collaborating in Training for Individuals with Specific Learning Difficulties provide awareness raising training to teachers and employers and offered multi-disciplinary assessment and support to individuals who had issues around Dyslexia, Dyspraxia, Asperger's Syndrome and AD(H)D. The differentiated instruction methodologies used in the E4 Project include the de Bono six Thinking Hats and Cognitive Research Trust Thinking Tools. The training sessions were offered to staff who might be working with students in the E4 project in September 2006. Lecturers contributed to a research questionnaire and evaluated the training. This data was incorporated in the discussion and formed part of the recommendations for further training.

1. Introduction and Context

The aim of this paper is to examine the effectiveness of a Continuing Professional Development Module on inclusive teaching and learning in a third level institute of technology; it is then intended to derive appropriate lessons for future development of such training. The framework for the paper is as follows:-

Set the context for this CPD within the E4 project
Explain the methodologies used
Describe the training process
Evaluate the outcomes of the training
Determine recommendations

The paper hypothesises that third level tutors do not generally possess teaching or disability awareness qualifications and that the institute of technology involved would benefit from a collective approach towards more inclusive practice. The collected data confirms the hypothesis whilst also highlighting recommendations to be incorporated into future planning.

Legend

CAF: Consider-All-Factors: one of the CoRT Thinking Tools
CPD: Continuing Professional Development
CoRT: Cognitive Research Trust (Edward de Bono)
CRC: Central Remedial Clinic
DIT: Dublin Institute of Technology
DP: Development Partnership (of E4)
E4: Education 4 Employment: an Equal 11 EU funded collaborative project
HEA: Higher Education Authority
ILT: Inclusive Learning Techniques: A Differentiated Teaching Approach EU Project
ITB: Institute of Technology Blanchardstown
KIFE: Killester College of Further Education
NLN: National Learning Network
OPV: Other-Peoples-Views: one of the CoRT Thinking Tools
PACTS: Partners collaborating in Training for individuals with Specific Learning Difficulties: an Interreg 3a EU funded initiative between Ireland and Wales.
PMI: Positive-Minus-interesting: one of the CoRT Thinking Tools

Having passed five pieces of legislation focussed on access and equality in the past eight years, the Republic of Ireland is still in the process of creating frameworks, structures and systems for the implementation of these acts. The five acts are:-

1998 Education Act
2000 Equal Status Act
2002 Employment Equality Act
2004 Education for Persons with Special Educational Needs Act
2005 Disability Act

The passing of this legislation has contributed greatly to increased social awareness of the education and employment of members of society belonging to marginalised groups including people with disabilities.

Recent progress in higher education can be traced back to 1996 when, in a report commissioned by the Higher Education Authority (HEA), Professor Malcolm Skilbeck identified educational barriers met by members of nine marginalised groups (Skilbeck and O'Connell 1996). While the HEA acted on Skilbeck and O'Connell's report with a consultative process leading to an action plan for funding for under-represented individuals (HEA 2005), the progress of such initiatives is always slow, and there remains a present and continuing need for an infrastructure to re-address the inequalities identified by the legislation of the past decade. The pressing need for implementation in respect of the two most recent acts, the Education for Persons with Special Educational Needs Act 2004 and the Disability Act 2005 is most keenly felt in the area of transition; second level students who may have experienced a variety of supports and intervention in their education to date now find themselves back at the beginning of the identification of needs process when applying for further and higher education courses.

As a result of this legislation there is an increasing social awareness around the individual's right to continuing and lifelong education and third level institutions are now experiencing applications from a far broader spectrum of learning than previously (HEA 2005).

2.0 Education for Employment Project (E4): Project Description

The Education for Employment (E4) Project (www.E4.com) is an EU funded initiative and builds on the development of the inclusive learning methodologies developed by specialist and mainstream service providers. The E.4 application was commenced in 2004 by Dr Ger Craddock who is the head of Client Technical Services in the Central Remedial Clinic. Craddock's own research work focuses on user-friendly assessment of needs in the area of assistive technology for the purposes of transition (Craddock 2003).
The project's aims and objectives (see Appendix 1) focus on the fact that many individuals are passing through Irish education institutions without being able to demonstrate or achieve their optimal potential. Consequently, in seeking subsequent progression there is difficulty both in finding employment and in securing employment at an appropriate level.

Despite the fact that the socio-economic conditions which have prevailed in Ireland in recent years have greatly increased employment opportunities, many marginalised populations including people with disabilities continue to find it difficult to achieve access to and progression within the labour market.

In attempting to redress this imbalance the E4 Project aims to create pathways through further and higher education with the aim of increasing access to employment for members of marginalised groups. The following extract from the Development Partnership Agreement lists the six partners:

> The members of the E4 Development Partnership (DP) have not previously worked together as a group although some have been in collaboration on other projects previously. The development partners are:
> - Central Remedial Clinic
> - Killester College of Further Education CDVEC
> - Institute of Technology Blanchardstown
> - Dublin Institute of Technology Kevin Street
> - National Learning Network
> - Centre for Independent Living

2.1. E4 Tutor and Lecturer Training

Learning from historic projects, PACTS and ILT, has shown that the effects on the individual from marginalisation, disability and social disadvantage cannot be addressed by working solely with the individual in terms of identification, intervention and support; the environment must also be considered as must the types of teaching and learning methodologies employed.

Two of the E4 objectives focus on this specifically by addressing teaching and learning methodologies and by supporting teaching and lecturing staff with CPD:

> To develop new teaching and learning methodologies that will facilitate the learning process for students from the target groups.

> To enhance the teaching and training skills of educators and trainers in the partner organisations by providing them with training in these teaching and learning techniques.

It in addressing these two objectives that the E4 Development Partnership created a training module for lecturers and tutors who will be implementing the programmes of study undertaken by the students in their educational institutions admitted to the E4 project.

This module was first trialled in an initial continuous professional development training session with Killester College staff in Year 1 of the E4 project in September 2005. The learning from this first trial enabled the DP to tailor and adapt the initial CPD module for delivery in the Institute of Technology, Blanchardstown. It is this adapted CPD module which is the subject of this paper.

Having now set the context for this paper and subsequent research study, it will be useful briefly to describe some of the methodologies utilised by the project.

3.0 Methodologies Utilised by the E4 Project

The innovative overall methodology proposed by the E4 DP attempts to create a paradigm shift from historic uni-dimensional teaching methodologies to more inclusive methodologies. The historic model of teaching is one where the teacher stands at the front and talks and the students listen and take notes. This traditional teaching method is successful for those students who have good auditory processing skills but does not address the diversity of learning channels and styles that are naturally found within the social spectrum. This is particularly relevant to students with specific learning difficulties (SPLD) such as Dyslexia, Dyspraxia, Asperger's Syndrome, or ADHD who represent about 10% of the population. These categories of students have been documented as failing in education (Skillbeck and Connell 1996, HEA 2005, McCarthy 2004).

3.1 Prior Research

The E4 project DP brought research on learning diversity to the project from three past projects:

1. Disability: Central Remedial Clinic Inclusive Learning through Technology (ILT)
2. Learning Styles : DIT Damian Gordon PHD research
3. SPLD : National Learning Network Partners Collaborating in Training for Individuals with Specific Learning Difficulties (PACTS)

It will now be useful to give a brief summary of each of these three projects.

3.1.1 Inclusive Learning through Technology (ILT) Project

Differentiation instruction is the basis of a project, the Inclusive Learning through Technology (ILT) project, underway in two special and two mainstream schools in Ireland for the past three years. ILT has harnessed the convergence of educational technology, technical infrastructure and Edward de Bono's Cognitive Research Trust (CoRT) thinking techniques to generate a student-led collaborative project. One of the core aims is to develop models of classroom practice that teachers and educators can identify with and incorporate into their pedagogical practice. Results of the project have shown evidence of significant gains in students' higher-order thinking skills, self-awareness and motivation
(E4 DP agreement 2005)

The six CoRT Thinking Tools were designed to develop lateral thinking skills and have been extensively used in the ILT project with great success. The three tools presented in this training module are:

PMI: Positive-Minus-Interesting
CAF: Consider-All-Factors
OPV: Other-People's-Views

3.1.2 Learning Styles

Many people have used instruments to identify different learning styles and channels; the doctoral thesis of Damian Gordon (DIT) documents the range

and effectiveness of available instruments and describes their use in third level teaching methodology. His work identifies that learning diversity exists naturally in society

Gordon has also further explored the Edward de Bono Six Hats Thinking Techniques (Gordon, Craddock and Lynch. 2004) as a learning styles model as described below:

> *A large number of learning styles models exist to assess the strengths and weaknesses of the individual learner. Many models share a common origin, for example, some can trace their origins to the work of Carl Jung, others to Kurt Lewin's Learning Cycle, still others are based on models of hemispheric dominance. This paper looks at a new model of learning styles based on the work of Edward de Bono and his thinking technique called "The Six Thinking Hats." This technique was developed to facilitate harmonious communications within groups and identifies six ways of thinking which are necessary for solving problems by allowing the problem to be viewed from a number of perspectives. The technique is adapted easily to a learning styles model where the six roles become the six dimensions of a learning styles model. These dimensions can be viewed as strengths and weaknesses that can be visually represented on a hexagrid.*
>
> Gordon, Craddock and Lynch 2004 p.1

De Bono's CoRT have now been re-examined in an educational context in this project and Damian Gordon has contributed the results of his research on learning styles to the development of the ILT teaching methodologies by including the examination learning styles that have led to such improved outcomes for participating students.

3.1.3. PACTS Project

This Interreg 3A cross-border EU funded project(www.pactsproject.com) brought partners together from the east coast of Ireland and the west coast of Wales to collaborate in service development and training around the area of specific learning difficulties.

Dr Amanda Kirby had set up the Dyscovery Centre in Wales, which provides collaborative interdisciplinary teams for SPLD identification, support and intervention. The National Learning Network and the Institute of Technology Blanchardstown joined with the Dyscovery Centre to set up the first adult assessment centre for identifying specific learning difficulties in Ireland. In addition accredited training on SPLD was developed for the Republic of Ireland.

As part of the project the newly set up National Learning Network Assessment Service, profiled individual students for learning styles and preferences as well as for potential difficulties with SPLD in one of the main four areas: Dyslexia, Dyspraxia, ADHD and Asperger's Syndrome. The Assessment Service also profiled students and tutors from course groups which were felt may attract individuals with unidentified SPLD. This led to the development of teaching and learning strategies which would best meet the learning preferences and strengths of an identified group. It is this area of continuing research that the PACTS project brings to the E4 Project (ref McCarthy and Duffin 2004, McCarthy 2005).

3.2. Development of an Inclusive Model of Education

It has been the traditional view that people with disabilities have learning problems. The E4 project, in light of the research highlighted above, chose instead to perceive people with disabilities as possessing 'learner difference'. In this inclusive model professionals are required to make a paradigm shift in their teaching methods; to view of disability as part of the natural continuum of learner difference within society and to acknowledge that it is the teacher's responsibility to address learner difference in the classroom as a whole, rather than just in respect of those students with disabilities.

3.3. Lessons learned about tutor training from year 1 of E4

The progress of the E4 project during year one is extensively documented in the E4 annual report (ref) and contains reference to: E4 students enrolling on the FETAC level 4 course in Killester College, supports and accommodations required by the students, staff training in the college, and the manner and nature of support offered to students and tutors by the project. During the

first year of the project a number of lessons were learned about the original tutor training module. It became apparent over time that incorporation of new methodologies into teaching delivery was not something that could be accomplished speedily. While tutor feedback showed that the underlying theoretical perspective of the training was welcomed, it emerged that practice, support and teamwork was needed to integrate the learning tools into daily teaching practice. With this in mind the initial training module was restructured (see appendix 2) to focus, consecutively, on the following three elements of the training:

1. Cognitive Information Processing
2. Teaching Tools
3. Practical Application in Lesson Planning

This revised training module was delivered to the staff of ITB over two days in May 2006.

4. CPD Module Delivery in ITB for E4 23rd and 24th May 2006

The Institute of Technology Blanchardstown opened in September 1999 with a brief to accommodate 'non-standard students' and since then has been working in a number of inclusive planning initiatives to encourage the broadest possible spectrum of entry. These include:

Student Access Services
Student Support Services
Assessment Services
Access Programmes
Equality Assessment Procedures
Examination Accommodations

The three strand framework timetable described above was developed from the feedback and experiences of the PACTS training and of specific training days in order to enable participants to move from theory to implementation in the classroom.

4.1. Hypothesis

Whilst many individual lecturers in third level are delivering good practice methodologies as a collective group they are not articulating an overall

organisational policy of inclusive education. It is hypothesised now that the majority of third level employees may not have benefitted from specific training in teaching or in addressing disability in the classroom. Three research questions were addressed in order to support the hypothesis:

1. What percentage of third level lecturers possess specific teaching qualifications or have completed part-time courses related to developing teaching skills and methodologies?
2. What percentage of third level lecturers possess specific qualifications related to disability or diversity?
3. What do third level lecturers believe to be the most critical influence they bring to their students?

In posing question these questions the research study attempts to determine the lecturers qualifications and to identify their personal perception of the lecturers role in terms of student interaction. This paper will also describe the two day training and will discuss the lecturers' evaluations of the components of the training as well as their evaluation of the overall module after they had completed it. It is intended to return to the lecturers at a later date for request feedback on the subsequent impact of the module on their teaching.

4.2 Preparation for the Module

A few weeks prior to the one and a half day training module, a meeting was held in ITB for all staff who might be involved in the E4 project and then, in the week before the training information regarding time table and the techniques was sent to all staff; this included two papers (Gordon and Craddock 2004 and Gordon, D., Craddock, G. and Lynch, B, 2004).

4.3. The Aim and Objectives of the training module

Aim: To enable participants to continue to move towards an overall best practice inclusive model of teaching for curriculum delivery

Objectives:

1. To allow third level lecturers to reflect on their own practice and experience
2. To establish that diversity in learning occurs naturally

3. To demonstrate that learning styles can be useful in understanding individuals' approaches to learning
4. To demonstrate that multidimensional teaching approaches are the most effective response to diversity in learning
5. To identify learning and teaching tools for individuals to incorporate into their teaching and lecturing delivery
6. To create the opportunity to practise using these tools in lesson and curriculum planning.
7. To create a forum for discussion on inclusive teaching and learning

4.4. Description of the Training Module

It has already been stated that in my own experience in providing training on facilitating students with disabilities and diverse needs, that the best methodology for working in this area is a combination of theoretical input, practical tools and pragmatic workshops. I have found that this allows participants the opportunity to frame or reframe their perspectives on teaching and learning. The process of moving into a model of differentiated instruction is slow and needs time for reflection; the tutor also requires tools to apply in the classroom or lecture theatre.

As the majority of lecturers do not possess domain expertise in education they often do not perceive the benefit of the theoretical element until some time has been spent in the process of application. This presents a challenge in presenting the theoretical materials when lecturers have correctly identified the need for strategies. Without the theory to frame the practice the lecturer is unable to apply the tools to his or her own teaching and lecturing and is only able to use the tools as they have been demonstrated rather than taking from them what is needed. Consequently the timetable for the one and a half day training was structured to include presentations and discussion on the following topics:

Day 1. Theoretical Element:

Completion of questionaire

General Discussion on teaching and learning

Interactive presentation on cognitive information processing.

Day 2. Practical Tools Element:

Presentation on learning styles in respect of student and lecturer
Presentation on Introduction to De Bono's Teaching Tools:
CoRT and 6 Hats (with practical examples).

Pragmatic Element:
Lesson Planning in discipline group
Group workshop
Individual feedback

During the workshop, participants were introduced to three of the six CoRT Thinking Tools (PMI, OPV and CAF) which are used in developing critical thinking. There was a group practical exercise on each of the three tools.

4.4. Construction of Questionnaire

The questionnaire (see appendix 3) was developed by the author in collaboration with the E4 DP. The aim of the questionnaire was to collect both qualitative and quantative data so the design included the following devices:

Method of Data Collection	Objective of Data Sought
Tick boxes:	to collect accurate and specific data on qualifications and role
1-10 scale:	to capture the individual perception of job satisfaction
Closed question:	to investigate motive for working in higher education
Open ended question:	To elicit personal perspectives on lecturer impact on students

Table 1: Rationale for Construction of Pre-Training Questionnaire

It was difficult to construct the open ended question to capture most accurately lecturer perceptions on the efficacy of their student interaction. It was important to use a neutral construction to allow participants to respond openly. The questionnaire was accompanied by a consent form which stated the collected data would be used anonymously but would be recognised as having come from the training coded E4 2324. It was important that the questionnaire be completed before any training began so that the results would not be adulterated by the content of the training.

5. Results

5.1. Results of Questionnaire

On day one of the training, participants were invited to complete a questionnaire (see appendix 3) before the training began; out of 22 participants 13 completed the questionnaire and signed the accompanying consent form. Of the 13 participants 11 described their roles as that of 'lecturer' and two as 'administration'.A total of 15 participants returned for day two of the training and of these, 8 completed the final evaluation form (see appendix 4). Eight of the lecturers have a Masters Degree, two have PhDs and one has a primary degree. Two lecturers have additional specific qualifications in teaching and one has an additional specific qualification in the area of special education. When asked to reflect the current level of job satisfaction on a scale of Number 1 to 10 (10 representing the highest satisfaction), it was clear that most people were enjoying high levels of job satisfaction. Six participants gave a score 8, two gave 9 and one gave 10. Only one lecturer expressed current job dissatisfaction by giving a score of 3. The responses to the question on 'Motivation for working in Higher Education' varied as can be seen from the following summary (Table 2).

Motivation Identified	Includes	
Teaching	Fulfilling Subject Lifestyle Most suited job Hours	7
Working with students	Convey knowledge and skills Help others to enjoy education Help others Enjoy dynamic in labs/lecture theatre	4
Lifestyle	Teaching People focused	4
Education	Continue own education Interested in education	2
Research	Computer supported learning	2
Dissatisfied with previous work	Commercial industry	1

Table 2: Responses from participants to Pre-Training Questionnaire Q6: *What was your primary motivation in first applying for a career position in Education?*

Collectively the tutors identified 20 separate items of motivation. The identification of 'teaching' as a primary motivation was high (7), especially

when added to the number of people who identified 'working with students' (4). An interest in education and research was also identified (2). One lecturer identified the choice of teaching as a career as being directly related to the '*hours'.* When lecturers were asked to describe their 'contribution to student success', responses fell largely into two categories:

- Their interaction with their students
- Their delivery of the curriculum

The factors which emerged are set out in the following table (Table 3):

Student interaction	**Manner of Contribution**	
	Approachability	6
	Support students (inc those with difficulties)	4
	Availability	3
	Guidance and Advice	3
	Feedback	2
	One to one contact	2
	Empathy with students	2
	Communication skills	2
	Listen to students	1
	Interacting	1
	Enabling self -learning	1
	Understanding needs	1
	Good instruction	1
	Interest in student learning	1
	Developing strengths	1
	Encouragement for students	1
	Supply of teaching materials	1
	Good relationship	1
	Make sufficient and appropriate learning resources available	1
	Sub-Total of Contributions involving Student Interaction	**35**
Delivery	Differentiated instruction	4
	Presenting material in a straight forward and commonsense manner	3
	Teaching/lecturing	3
	Small group contact	1
	Supply of teaching materials	1
	Facilitator	1
	Well planned relevant lectures and practical sessions	1
	Emphasis on making practical work correspond closely to theoretical work and visa-versa	1
	Make learning outcomes required for assessment clear and applicable	1
	Link to industry	1
	Enthusiasm for subjects	1

	Make it challenging	1
	Make it enjoyable	1
	Setting of goals as targets	1
	Give explanations	1
	Sub-Total of Contributions Involving Teaching Delivery 22	**22**
Other	Be flexible to staff	1
	Hard worker	1
	Sub-Total of Other Contributions	**2**
	Total Contributions	**59**

Table 3. **Responses from participants to Questionnaire Q7:** ***At the interface of tutor and student what do you believe are the main ways in which you contribute to student success?***

5.2 Results of Group work on Applications of CoRT Thinking Tools

5.2.1 PMI: Positive-Minus-Interesting

This exercise aims to prevent the taking up of a positional view and develops lateral thinking. Two minutes is given to recording thoughts, factors or elements of a topic in each of the three areas in the sequence of PMI. Participants may only write under the heading currently being considered. The participants produced the following applications of a PMI in lecturing:

- First class of year (After training)
- After lecture – Practical exercises **PMI** relating to theory covered
- Determines existing knowledge
- Expectations – Do they relate to real world
- Learning temperature gauge
- Evaluation of services/resources
- Assignment planning
- Assessment /End of Semester
- Individual view
- Student's can use for their own planning
- Peer Review
- In the teaching of Sorting Algorithms

Table 4: Responses from participants to use of PMI CoRT Thinking Tool

5.2.2. CAF

Consider-All-Factors is a method of developing an elliptical perspective on a particular subject by identifying all possible elements. This is done by

identifying the number of responses required of the student.The participants produced the following applications of a CAF in lecturing:

• Factors in Choosing final year project • Making a decision on a sorting algorithm • What are the critical success factors in your own learning • Get student's to do it • Justify what programming language to choose, product, service, technique

Table 5: Responses from participants to use of CAF CoRT Thinking Tool

5.2.3. OPV

Other-Peoples-Views is a tool for developing lateral and elliptical thinking skills and encourages empathy with different perspectives by considering what perspective different individuals may have on a topic. The participants produced the following applications of a OPV in lecturing:

E4 Project: Management committee Organisations involved Tutors Students Employers
Continuous Assessment
Final Project: In Peer review context
Review of Services
Report writing Use in class OPV Lectures, students own group public
Web Design Organisation, staff, linkage to computers

Table 6: Responses from participants to CAF CoRT Thinking Tool

These tools were also included in the lesson planning session in the afternoon of Day 2 and the work produced by the participants in groups included further development of the CoRT tools applications (Appendix 5).

5.3 Result of Group Feedback on Lesson Planning Session

After the group sessions for lesson planning feedback was given on a number of areas where the CoRT tools might be used in lesson planning and is summarised below:

- Overlapping issues being a computer college (Global Issue)
- Student Motivation
- Passing from year to year
  - C. A. and exams
- Problem based learning System:
  - Looking at incorporating technology
  - Looking at learning styles to create group dynamics
  - Show advantages of methodologies
  - Use for assessing group progress
  - PMI – give student framework
  - PMI – from tutor to give feedback
  - Algorithms
  - General discussion about techniques
  - Use PMI
  - Create samples

Table 7: Feedback from participants on group workshop sessions

5.4. Result of Group Exercise on the Day 2 Group Workshops.

The two days finished with a PMI group exercise on the group workshops:-

Positive	Minus	Interesting
Well Presented	No table of contents	Opportunity for change
Debate good	E4 larger Context	Shared views
Opportunity for change	Lack of Awareness re organization	Common views
Examples given	Not practical enough	Wanting Practical
Relevant content	Frustration	
Education techniques welcomed	Micro – teaching needed	
Awareness raising	Macro – planning needed	
Very informative	Time constraints re course material for September	

Table 8: Responses from participants to PMI CoRT Thinking Tool on the two day CPD training

5. 5. Results of Participant Final Evaluation Forms

Eight participants completed the evaluation form and a summary of all comments can be found in Appendix 4. Some of the significant responses to the questions are listed below:

'Did you gain new knowledge?'

All 8 participants who completed the evaluation found the training sessions of interest and said that they had gained new knowledge. One person wrote in answer to the question 'Some, but much of the material has been covered previously'.

'If you have gained new knowledge, how relevant is it to your work?'

The responses were all very positive save one 'haven't tried it yet' and ranged from 'Very relevant' (5) to 'reflect on how we teach and what can do better' (1). The Cort Techniques and 6 thinking hats techniques were positively identified as bringing new knowledge (1).

'Factors that encouraged your contribution?'

Two participants expressed a desire to improve existing skills; one person specifically mentioned *the lack of training in teaching and learning techniques* and one person mentioned *lack of knowledge*. Two participants named their forthcoming participation in the E4 project as

a factor. Two people indicated that the HOD had instructed them to participate.

'Factors that inhibited your contribution?'

Four participants answered 'no' and two identified the fact that it was exam week. One person was unclear about his/the ITB involvement in the E4 project and one person found it 'sometimes difficult to get a word in edgeways'.

Do you think the materials will be useful to you in your work?

One person identified the fact that although the materials covered some known ground it gave the opportunity to reflect by putting 'formality on it'. One person said 'Yes' and two said 'Yes hopefully'. One participant thought *'some (of the materials)* will be of use', one participant said 'not sure, probably' and one was 'not clear of our involvement in the project'.

Overall facilitation of training?

Two participants gave 'excellent', one gave 'good', one gave 'fine', one gave 'instructive' and two gave 'ok' , one of whom added 'but I feel I have done this before. More specific less theory'.

Would you suggest we do anything differently?

One person said 'no', one person felt more time was needed, '3-4 days', and one person felt the scheduling should be at a less busy time. Another participant felt more staff should have been included and acknowledged this was a HOD issue.

The other feedback comments from the remaining 4 participants were as follows:

'less list of techniques, more on actual teaching, provide comprehensive document about techniques'

'more practical work'

'Pace of certain aspects could be increased'

'include more sessions on practical examples with Damian'

All the training sessions were interactive and excited much discussion. Throughout the two days it became clear that, in addition to the fact that all participants were already committed to marking exam scripts and carried heavy workloads, a number of participants had neither heard of the E4 project, nor were aware that they may be teaching students in the project in the forthcoming academic year.

6.0. Discussion of Results from Training Module

6.1 Introduction

Overall the results from the two-day training event demonstrate that a number of environmental as well as individual factors must be taken into consideration in attempting to provide this type of training. I will first discuss the results individually before identifying common themes or factors, and then I will use one of the tools, the 'OPV', to illustrate the perspectives of all the different individuals involved before going on to draw conclusions and make recommendations to be taken into consideration before planning further training.

6.2 Pre-Training Questionnaire

Although the lecturers who responded to the questionnaire (11) were all highly academically qualified, only two lecturers had qualifications in respect of teaching and one lecturer possessed a qualification in respect of special education. This is a higher result than expected as the over-riding criterion in the employment of lecturers is domain expertise. This means that the majority of participating lecturers would not have been given any training or support in how to teach or lecture, manage laboratory work, manage classes, develop inclusive curricula or presentation skills. If further data collection of this nature in the E4 project provides results consistent with these, it will conclusively demonstrate that third level lecturers do not generally undergo formal training in their chosen career. The majority of the group (9) expressed a level of job satisfaction of 8 or above. The number of people (5) who identified lifestyle as a part of the primary motivation in first applying for a career position in education was surprisingly high.

The responses to the closed question, *What was your primary motivation in first applying for a career position in Education?,* identified 20 different items as being primary motivators in first applying for a career position in education. Teaching came out as the top motivator (7), followed by working with students, lifestyle, and one's own education and research (4 each). Only one person expressed the choice of teaching from a default point of view in terms of dissatisfaction with previous work. In general the lecturers say they are happy with the career choice they have made and are clear about their reasons for making it.

In responding to the question, *At the interface of tutor and student what do you believe are the main ways in which you contribute to student success?,* lecturers collectively provided 59 responses 35 of which related to student interaction and 22 of which related to teaching delivery. The other two responses identified were working hard and having flexibility with staff. It is not surprising that the responses grouped as *student interaction* formed the largest group as the question referred to students specifically but what is surprising is that only one person included the first person (I) in the reply and that the questions appeared to be answered in passive voice in terms of acknowledged good practice and not in particular overt references to their own practice.

A large number of noun forms were used such as: empathy, encouragement, guidance, advice, feedback, support, and explanations. Only one verb appeared in these responses (make) and one adjective (available). In the teaching delivery section I would have expected more active verb forms and found only: presenting (1), make (3), making (1), give (1), link (1) and setting (1) none of which is very specific to teaching. Interestingly, one very important noun in inclusive practice, 'flexibility', was applied to relationships with staff but not to interaction with students.

6.3. Participant Evaluation

6.3.1 Introduction

The participant evaluation falls into two categories; comments on the materials and teaching tools and comments on the training itself. The comments on the teaching tools themselves were centred on the potential use

of the CoRT techniques by ITB lecturers. Two types of evaluation of the training itself were used; one was given by the participants as a PMI from the group after the lesson planning sessions and is reproduced in full in the results section (Table 6: Feedback from participants on group workshop sessions) and the other is the participant evaluation form which is summarised in Appendix 4.

6.3.2 CoRT Thinking Tools Group Examples

The lecturers were very specific in the group CoRT tools exercises where, after an explanation and example of each of the three tools (Positive Minus Interesting, Consider All Factors and Other People's Views) the lecturers were invited to call out possible applications in their own discipline. Here, with all three CoRT tools there was a balanced mixture of general and specific applications. This was also reflected in the feedback from the group work in the afternoon of day two.

6.3.3 Feedback

The **Positive** feedback here indicated that the training had been well received and was considered relevant. In the context of E4 the most pertinent comments for the DP are: 'opportunity for change', 'awareness raising' and 'informative' which demonstrate not only that new information has been received but that its application can be perceived as extending beyond the confines of the project.

The **Minus** feedback also highlighted the need for inclusive practice in a larger context and perhaps reference to 'organisational lack of awareness' and the' time constraints' reflect a growing awareness of the large body of work the institution will need to do in the future. The feedback also contains a reference to a lack of 'table of contents the timetable had been circulated but possibly was not received by all. Another point also raised was that the two days were not practical enough even though it had been explained that a certain amount of theory was not only necessary but essential.

The **Interesting** feedback also raises the desire for 'practical' as well as identifying the 'opportunity for change' and, most importantly, highlighting the 'shared' and 'common' views.

6.4. Evaluation Forms.

The evaluation responses demonstrate whether the participants found the module of relevance and value both in terms of E4 and in terms of future overall planning. It is clear that all participants found the sessions of overall benefit and that the one person who already had considerable previous knowledge in the area found that 'formalising' the process gave the opportunity to reflect on practice. This theme of reflection on practice leading to future improvement was also echoed by other participants.

The evaluation analysis also shows that the communication received by individuals about the E4 project was not homogenous and that their understanding of how it related to their next year's teaching load varied from having no knowledge at all to having a good understanding of the project's intentions. Two particularly useful items of feedback highlight the perception that attendance was not voluntary and that the timing of the training delivery in the academic calendar was not optimal and these two factors impacted on the delivery of the training in a number of ways. This will be discussed further in the findings section.

At the beginning of the session the trainers assumed that all participants were aware of the E4 project and it soon became apparent that this was not the case. One of the administrative staff arranged for the Head of School to come in at the start of the next day and speak to the participants. This duly took place and went some way towards re-framing the second day. Twenty two people arrived on the first day and 13 of these voluntarily completed the questionnaire. On the following day there were 15 participants but a few needed to leave early and did not complete evaluations.

6.5 Inclusive policy

One of the most difficult tasks in delivering inclusive training is trying to contextualise the training within the current climate of the educational institution in question where a number of variable factors exist. In this instance, the perspectives of the E4 project DP members, the trainers, the participants and ITB administrators all tended to differ and each stakeholder, whilst articulating the overall aim of student achievement, had a different experience of lecturing, training in lecturing and of equality issues. Ideally

the inclusive ethos of any institution should be stated and implemented from the top down, but the resources required including all staff members are significant both in terms of the finance and time required.

6.6. Stakeholder perspectives

I have used one of the CoRT tools, Other People's Views, to demonstrate a possible range of perspectives within this current environment.

E4 DP	• Responsible for meeting project objectives • Needs to keep project on schedule • Fully aware of gap between needs and resources • Concerned about E4 student success
ITB Administrator	• Concerned about student retention and success rates • Desires best practise ethos • Constrained by resources
Head of School ITB	• Wants project to perform well in his department • Wants staff to benefit from training module • Knows individual staff members well
Head of Department	• Responsible for project in ITB • Wants staff to benefit from training module • Wants project to perform well in ITB • Wants students to succeed
Trainer	• Has expertise in inclusive education, both theoretical and practical. • Wants training to be meet its objectives • Wants participants to enjoy the experience • Wants participants to gain new and relevant knowledge
Participant	• Wants to gain new and relevant knowledge • Has heavy exam workload • Did or did not volunteer to attend • Has considerable lecturing expertise • Wants students to succeed
E4 Student	• In new environment • Fearful of failure • Excited about progression • Past experience of education negative

Table 9: OPV: CoRT Thinking Tool to show different perspectives toward CPD 2324 in the E4 Project.

7.0. Findings

The findings relate to the three areas described in this paper:

The two objectives identified by the E4 project

The three research questions to meet the hypothesis

The aim and objectives of the training module

7.1. E4 Objectives

The two identified objectives concern the implementation of some of the teaching and learning methodologies brought to the E4 project by previous project research:

> To develop new teaching and learning methodologies that will facilitate the learning process for students from the target groups.

This objective has been met by combining the collective outcomes from the projects described in Section 3. The training module described in this paper is a prototype for this and other work in third level colleges and institutions and was generally well received as a vehicle for enhancing classroom delivery as can be seen by the feedback given by participants:

> To enhance the teaching and training skills of educators and trainers in the partner organisations by providing them with training in these teaching and learning techniques.

The participant feedback indicated that there are applications for the CoRT tools in ITB and also identified the fact that there were a number of external pressures on the lecturers at the time the module was scheduled.

7.2. Research questions to meet the hypothesis

The findings in respect of the hypothesis are as follows:

1. What percentages of third level lecturers possess specific teaching qualifications or have completed part-time courses related to developing teaching skills and methodologies?

2. What percentage of third level lecturers possess specific qualifications related to disability or diversity?

82% of the participating lecturers had no qualifications in teaching skills and methodologies and 91% had no specific training in special needs or disability. As this was a small group of 11 lecturers further data will need to be collected to reach a definitive conclusion.

3. What do third level lecturers believe to be the most critical influence they bring to their students?

The participating lecturers responded in terms of teaching and lecturing skills that were either student or delivery focussed. In light of the finding that most of them had no training in this area there was a very positive response to the value of the skills identified. What is significant though, is the fact that all these responses are based on the individual's notions of what teaching and lecturing entail. It is possible that tutors teach the way they were taught themselves or the way they would like to be taught (that is, in sympathy with their own learning styles). There is no homogenous link between the skills identified by individuals and the manner in which they are collectively delivered within the institution.

7.3. The Aim and Objectives of the training module

Aim

To enable participants to continue to move towards an overall best practice inclusive model of teaching for curriculum delivery

Objectives

1. To allow third level lecturers to reflect on their own practice and experience
2. To establish that diversity in learning occurs naturally
3. To demonstrate that learning styles can be useful in understanding individuals' approaches to learning
4. To demonstrate that multidimensional teaching approaches are the most effective response to diversity in learning
5. To identify learning and teaching tools for individuals to incorporate into their teaching and lecturing delivery
6. To create the opportunity to practise using these tools in lesson and curriculum planning.
7. To create a forum for discussion on inclusive teaching and learning

The above objectives cannot easily be met in a single training event and a considerable amount of follow up has be done to verify whether or not there is a move towards best practice of teaching delivery. The training module did provide a forum for discussion and did give the opportunity to use new tools and practise new skills. Feedback indicated that participants were also reflecting on their practice. It will not be possible to answer the other questions until further feedback is gained to determine what application has been made of the information and materials given out at the training module. Notwithstanding the difficulties involved in longitudinal data collection studies, a number of general observations can be listed under two categories: those relating to planning and policymaking at an organisational level and those relating to the support and development of lecturing staff.

1. *Planning and policy making*

- There was poor communication about the E4 project and which lecturers would be involved
- The lecturers attending the training were under exam marking pressure at the time of the training and could not give a full time/attention commitment to the training
- All the lecturers had different perspectives regarding their lecturing
- The participants had little expertise in disability or equality issues
- The lecturers' perception of the value and relevance of the training was diverse

2. *Training and development of lecturers*

- Lecturers are largely domain experts not teachers
- Teaching and lecturing skills were varied and largely experiential
- Understanding of teaching methodologies was diverse
- Knowledge around diversity in learning was fragmented

7. Conclusions

The conclusions also relate to the three areas described in this paper:

The two objectives identified by the E4 project

The three research questions to meet the hypothesis

The aim and objectives of the training module

The two objectives identified by the E4 project

Although the feedback was generally positive this is too small a cross section of lecturing staff from which to draw any definitive conclusions and a great many similar studies must be undertaken for confirmation. The response and workshops concerning the CoRT tools were evaluated positively as was the training module in general. There is a need for a follow up questionnaire to determine what impact the training module may have had on teaching delivery.

The three research questions to meet the hypothesis

Overall, the results of the questionnaire show that although the teachers have made specific choices to go into education primarily to teach and interact with students it does not seem to appear anomalous to them that their primary qualifications are not specifically in these fields. It is possibly because of lack of overt reflection on this situation that we met some resistance from the participants initially, although it cannot be denied that the majority of lecturers acquired skills in teaching experientially.

The aim and objectives of the training module

One important preconception that emerged from the overall feedback is the idea that the training should have been more practical with less theory, and the idea that the practical element is the important one to focus on is a common mis-perception amongst educational professionals. In the classroom the difficulty always comes to matching a strategy to a particular student and it is the lecturer's theoretical knowledge around processing and learning that distinguishes whether a good match will be made between the way the student learns and the types of strategy required. This is as opposed to having a *hit and miss* approach, hoping that one of a long list of strategies will work. It is certainly true that there is a need for further and continuing practical sessions where theory and tools are applied to individuals, firstly in hypothetical case studies and secondly in terms of actual practice, but this can only be done, in my view, by allowing sufficient time for a programme of CPD that will develop teaching and lecturing skills in situ.

In conclusion, I wish to state that individual student or environmental supports are not fully effective without lecturers and all staff being fully informed, involved and committed to the process of inclusivity and that it is essential for E4 to continue research institutional, departmental and individual teaching and learning profiles and to consider the perceptions of all involved. It is critical to the project that lecturers are informed and committed and that the training developed for this project's move into third level institutions should in no way imply that the project is bringing techniques and tools to **replace** current practice, but rather that it is offering an opportunity to enhance and develop it.

8.0. Recommendations

8.1. Recommendations to the E4 Development Partnership:

1. Continue to collect data from 3rd level lecturers and staff as the learning from this is essential to both the E4 project and to the development of best practice models of inclusivity in third level institutions.
2. Revise the questionnaire in an attempt to elicit more specific responses related to the individual lecturer's perception of how his or her specific skills impact on individual students.
3. Focus more overtly on a good relationship with the heads of the 3rd level institutions. In the CDVEC/NLN Disability Support Service, a partnership collaboration between the National Learning Network and the City of Dublin Vocational Education Committee (www.nln.ie), the colleges where the greatest success in terms of identification and self-referral of students needing supports, were those where there was a clear policy set by the Principal to commit his or her support through the resourcing of staff, resulting in a college wide ethos of inclusivity that puts students into a community where it is 'normal' to identify either short-term of long-term support needs in education.
4. When working with established professionals in education it is essential that the training experience is a contributory one; one that allows the reframing of existing knowledge in the context of inclusivity

and offers information, tools and broader contexts to support what is already known and enhances the good practice that already exists.

5. Where training is provided for a group of staff, create a good communication structure so there is better sharing of information in all areas: from the raising of awareness on the E4 project through to circulating the information and timetable prior to the event
6. Timing of training should involve seeking optimal periods in the academic year when lecturers can give full attention.
7. Alternative models of delivery should be considered, for example:
   - Launch a comprehensive Information and Resource Handbook to provide support and direction to lecturers when they wish to seek it.
   - Present materials as being tools that may be useful in general teaching as well as to some of the E4 curriculum.
   - Provide training sessions on request in response to invitation from groups or departments.

8.2 Recommendations to Third Level Institutions.

In promoting strategic planning towards inclusive policies two main areas are identified; overall planning and policymaking and continuing professional development for all staff. Key points under each heading are listed below for information and interest.

1. Planning and policy making
   - Overall policies leading to embedded inclusive practice
   - Ethos of inclusive practice
   - Effective communication system
   - Structure to free staff for development
   - Equality training for all staff

2. Training and development of lecturers must address
   - Teaching and lecturing skills
   - Teaching methodologies
   - Diversity in learning
   - Practical solutions
   - Lecturer support

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Appendix 1

E4: Project Aim and Objectives

The aim of the E_4 Project is to increase the employability of people from marginalized groups (people with disabilities, educationally disadvantaged, ex-offenders) by training them to work as Technical Support Officers in Information & Communication Technologies (ICT) and Assistive Technologies (AT) through the development and implementation of new innovative educational programmes. The objectives of the E4 project are:

- To develop a new and innovative partnership which will build on the success of the regional learning partnership created by the Institute of Technology Blanchardstown (ITB).
- To expand this partnership to incorporate rehabilitation service providers (Central Remedial Clinic (CRC) and the National Learning Network (NLN)), support organisations, Centres for Independent Living (CIL) and Industry (through the Irish Business & Employers Confederation (IBEC), DELL, Microsoft, Delcran, Quinn Direct and others).
- To establish a lifelong learning pathway to employment for participants through the development and provision of foundation courses at the CRC and Killester College, progression to NQF Level 5 and 6 programmes at Killester College of further education (St Peter's College, Killester) and on to NQAI Level 7 at Institutes of Technology (ITB and DIT Kevin Street).
- To develop new teaching and learning methodologies that will facilitate the learning process for students from the target groups.
- To enhance the teaching/training skills of educators/ trainers in the partner organisations by providing them with training in these teaching and learning techniques.
- To lobby for the adoption of these new teaching and learning techniques throughout the training/ education sector.
- To provide internships and work experience placements for participants at critical periods during their training/ education through partnership with industry (DELL, Microsoft, Delcran, Quinn Direct and liaising with IBEC).
- To include the sustainability and development of the Re-use Technology concept as a means of providing technology to students and organisations and to provide employment for graduates of the above mentioned educational programmes as Technical Support Officers in ICT and AT.
- To provide supports to students both in the area of learning (including the use of Assistive Technology, organisational skills, study skills etc.) and more personal areas. This support will ultimately focus on supporting the student while in the learning environment and preparing them for the workplace through the development of work related social skills and pro-active job seeking behaviours. This support will be available to students during internships, work experience placements, on to employment where appropriate.

Appendix 2

E4 Teaching and Learning : Training in ITB. Dublin.

24th and 25th May 2006

Timetable - Day 1

13.45 -2.00	**Coffee**
14.00 – 14.45	Teaching, Lecturing, Tutoring and Training Exercise and Discussion Dawn Duffin
14.45 – 15.00	**Break Tea and Coffee**
15.00 – 16.30	Processing in the Context of Learning Dawn Duffin,
Homework	**PMI**

Timetable – Day 2

09.00	**Tea/Coffee**
Collect in homework	
9.15- 10.15	Learning Styles (understanding oneself and others and applying that knowledge to teaching) Damian Gordon
10.15- 11.15	Learning Diversity within the Social Spectrum Dawn Duffin
11.15 – 11.30	**Break**
11.30 – 12.45	Teaching Tools: Cort and 6 Hats Georgina Lawlor
12.45 – 13.45	**Lunch**
13.45 – 14.30 **14.30**	Lesson Planning Georgina and Grainne Examples Template **Practical Session on using CoRT Tools for lesson planning**
15.00	**Break (working break)**
  15.45	**Practical Session cont'd** Individual Feedback
16.15 – 16.30	**Evaluation and Close**

Appendix 3

E4 Tutor Questionnaire 1 Code 23240506

Information supplied in this questionnaire will be treated under the ethical guidelines outlined in the consent form you have signed.

1. What level of post-secondary education qualification have you achieved? Please tick all that apply.

No post-secondary qualification	☐
Third level	☐
Primary degree	☐
Masters	☐
Ph. D.	☐
Other: Please say which	☐

_____

2. What (if any) teaching, training or tutoring qualifications do you have? Please tick all that apply.

Certificate of Education. (B Ed).	☐
H. Dip or PGCE	☐
Diploma in continuing Education	☐
Other: please say which	☐
_____	
None	☐

3. What (if any) qualifications do you have in Special Education
   Please tick one.

   SEN diploma ☐

   CATA ☐

   DATA ☐

   Other: please say which ☐

   _____

   None ☐

4. Which of the below best describes your present job?

   ☐

   Teacher
   Lecturer ☐

   Head of Department ☐

   Head of School ☐

   Researcher ☐

   Other: please say which ☐

   _____

5. On a scale of 1 (very dissatisfied) to 10 (very satisfied) please indicate the level of satisfaction you experience in doing your current job ?

   ☐

6. What was your primary motivation in first applying for a career position in education?

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7. At the interface of tutor and student what do you believe are the main ways in which you contribute to student success?

1.

2.

3.

4.

5.

Appendix 4

E4 Tutor Training IT - National Learning Network Assessment Service

Summary of Participant Evaluation - 23rd - 24th May 2006

Did you find the sessions of interest?	Did you gain new knowledgge	If you have gained new knowledge, how relevant is it to your work	Factors that encouraged your contribution	Factors that inhibited your contribution	Do you think materials will be useful to you in your work	Overall facilitation of training	Would you suggest we do anything differently
Yes	Yes	Very relevant	Improve my work practices as a lecturer	No	6 hats very useful in teaching methodology and understanding student profile better	Satisfactory	Include more of staff in sessions (dept. head isssue)
Yes	Yes	v. relevant as I am beginning my lecturing career	Improve lecture presentation	No	Yes hopefully	instructive	no
Yes	Some, but much of the material has been covered previously	PMI , critical factors 6 hats etc	Participation in E4	Exam corrections	some will be of use	Ok, but I feel as if we have done this before. More specific less theory	timetable in too busy period.
Yes	Yes	havent tried it yet	Whip from HOD	Exam marking week should be no meetings	Not clear of our involvement in project	fine	less list of techniques more on actual teaching, provide comprehensive document about techniques
Yes	Yes	Very	did'nt know anything about E4 until asked to come along by head of school	no	Yes hopefully	good	more practical work

Yes	Yes	Reflect on how we teach and what can do better.	booked on workshop by dept. head	No	Ideas behind method used to a certain extent/ things we do already but some formality on it makes on ereflect and think wfhat can be done better	Ok,	Pace of certain aspects could be increased
Yes	Yes	Extremely	Member of E4 team	Not clear of our involvement in project	Yes	Excellent	more time 3/4 days
Yes	Yes	Very	Lack of training in teaching and learning techniques	sometime difficult to get a word in edgeways	Not sure probably	Excellent	Include more sessions on practical examples with damian.
Completed Questionnaires 8							
No. attended workshop							

Appendix 5

CAF and OPV examples produced by two participants during and after workshop.

What are the factors involved in choosing Final Year Project? (engineering)?

- How interested am I in the subject area?
- How much prior knowledge have I of this area?
- How accessible is information in this area?
- Have there been previous publications/research in area?
- Do I get on with supervisor?
- Has supervisor published in this area?
- How well thought out is the project brief? If not well thought out this could result in changes at a later date i.e. goal posts moved…
- How much time will project take up?
- How difficult is the subject area?
- How much work is involved?
- What type of output will there be? For example will the output of the project have a more analytical/statistical bent or will I be concentrating on design i.e. on producing a prototype/working model.
- How difficult will it be to write a report/thesis on this?
- How relevant is the project to the area I envisage myself working in when I leave college?
- Is this a 'cool' subject area? (peer pressure)
- Can I work on project at home?
- Will I be constrained to specific labs?
- Is the equipment required for project already in college?
- Will I need to start ordering more equipment?

Example of using OPV in an Engineering Context: Writing a technical report for a multi-disciplinary audience.

In Engineering on of the key skills is to be able to write technical reports that can be read (and be of value to) may different stakeholders including other Engineering discipline Engineers, managers, sales staff, the wider Engineering community, etc. As an example of using OPV we choose a classroom exercise whereby we would present a complex problem to the class that can be broken down into distinct sub-problems. The class would then be broken into small groups each of which would address a single sub-problem. Each group must then present their results to the rest of the class in the format of a report. Each report will then constitute the class notes for that particular problem/learning outcome. Each report will be graded by the lecturer and the mark achieved awarded to each group member. In writing the report the students are encouraged to identify the key stakeholders whose views they must address in the report. This is effectively PBL (Problem Based Learning) style learning. An example could be:

Stakeholder	Viewpoint
Lecturer	• Looking for good content, good presentation and addressing of key topics in terms of a grading structure. • Students would be encouraged to try and view the final report as if they were a Lecturer and imagine what the Lecturer might be looking for from the report.
The other members of the sub-group	• The sub-group team are themselves are a stakeholder. They must analyse what they want from the document. They will probably want a good clear record of what they have done such that they can come back in the future and re-create whatever it was the had done.
The rest of the class outside the sub-group	• Looking for clear, well structured, carefully constructed description. Students are asked to imagine how they want the reports from the other groups presented and to apply this to their report. The other groups will share some domain knowledge as they are also involved in the umbrella problem so these readers will be somewhat familiar with the technology and will be looking for concrete answers and details. They will also be looking for details and asking questions as to how this sub-part fits into the overall problem and how it might impact the other sub-problems.
Next year's students or students in another class	• The group will be asked to consider how the report reads from the perspective of someone who is not involved in the umbrella problem/project. • These people will be looking for a good conceptual description presented with a good description of the over all context. Again they will have some technical background.
The public	• Finally the group will be encouraged to consider how the report will read to other students or others in general who do not have any technical background. • These readers will be looking for a well constructed, well written document including good clear language and perhaps humour or other "interesting" hooks such as "relevance to them" to keep them engaged.

Student should learn that while it is impossible to meet the needs of all stakeholders simultaneously that it is important to keep these different viewpoints in mind while producing their document. One thing that often occurs in industry is that multiple versions of the document may be required to address different groups of stakeholders.

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