BILINGUAL INTRALINGUISTIC ORTHOGRAPHIC INTERFERENCE

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0. *Introduction.* The following remarks are intended as a refinement o our taxonomy of processing strategies leading to bilingual intralinguistic orthographic interference errors (Luelsdorff 1986a, 1986b). We begin with a brief discussion of the experiment used to elicit the data, proceed with a presentation and exemplification of the refined error framework, and conclude with a summary of three of the major conclusions reached.

1. *The group experiment.* Until 1983 our analysis had been an extensive and intensive inquiry into the spelling errors made in English by one native-speaking German pupil in the Hauptschule, grades 6 and 7, age 12, on grade-level English dictations administered privately over a 14-month period. This analysis indicated massive interlinguistic and intralinguistic interference. In order to assess the extent to which these interactions are shared, it was necessary to test a large number of subjects in the German school systems at various stages in the acquisition of English spelling. Pursuant to this goal, the following testing procedure was devised.*

(1) Two groups of subjects were drawn from intact classes in both grades 7 and 9 in each of the three schools comprising the German system of secondary education, the Hauptschule, the Realschule, and the Gymnasium. Within each grade and each school, one group was administered a grade-level dictation followed by an error-correction exercise. The other group was administered the same two tasks, but in the reverse order. 248 pupils were tested, 59 from H,

* Thanks are due W m J. Baker for discussions leading to the design of this experiment.

90 from R, and 99 from G. This procedure yielded data on the development of orthographic and metaorthographic processing strategies.

(2) The grade-level dictations were administered in British English by the regular teachers of the respective classes in order to avoid the possible effect of an unfamiliar face in the classroom. Normally, dictation as a teaching device is discontinued by G9. The dictation procedure followed the recommendations of Deyes (1972) and the words selected from the standard textbooks for H6/H7 (Friedrichs 1970, 1971) were known in advance to be error-prone from the errors in the individual data. All of the pupils had had prior exposure to all of the words dictated, except ⟨juice, salad, store, gate, movie⟩, which were unfamiliar to the pupils in G. The dictation consisted of three short paragraphs, segmented into short phrases, which the teacher read aloud three times, before the dictation, during the dictation, and after the dictation. The pupils were asked to write on alternating lines of the response sheet and told not to make any corrections during their initial transcriptions. Allowance for corrections was made during the final reading by the teacher after the dictations had been written.

(3) Following the initial writing, the pupils were asked to edit their own work by underlining the words they thought to be misspelled and writing the versions they thought to be correct beneath them. This yielded data on ego-errors and ego-corrigibility.

(4) The error-correction exercise, which will be of no further concern to us here, was a written version of the dictation laden with many real errors extracted from the individual data. The errors ranged from obvious to subtle deviations from the standard spellings. Pupils were asked to listen to the dictation, scan the text for errors, underline the spellings thought to be errors, and transcribe the spelling thought to be correct under the spelling thought to be wrong. This yielded data on the pupils' ability to alter-monitor, to detect errors made by others.

The following is a report on the errors made only in the dictations, administered both before and after the error-correction exercise, after the pupils had had a chance to correct their errors. The discussion is restricted to vowel misspellings of the substitution type which are held to be the product of the use of intralinguistic orthographic processing strategies.

In general, our conclusions on processing strategies are thought to be valid insofar as (1) the subjects had had prior exposure to the normative spellings of the words in the texts dictated and (2) the distribution of the major and minor primary and secondary vowel spelling patterns in the experience of the informants parallels their distribution in the language. Absolute certainty on this latter issue would require familiarity with the history of each informant's exposure to the spellings of each of the items dictated, a familiarity which we do not and could not have.

2. *The error framework.* Venezky (1970:101 - 119) divides the vowel spellings of English into two groups or types, primary and secondary. Primary vowel spellings consist of *one* vowel letter (including ⟨y⟩), whereas secondary vowel spellings consist of *two or more* (one of which may be ⟨w⟩ or ⟨y⟩).

Both primary vowel spellings and secondary vowel spellings have major and minor sound correspondences, where the difference between major and minor sound correspondence is the difference between *more* and *less frequent.* Major correspondences are referred to as "regular" or "predictable", minor correspondences as "irregular" or "unpredictable", where regularity is sensitive to surrounding consonant and vowel letters, stress, and morphemic structure.

The above structure of English orthography we present in the diagram in Figure 1.

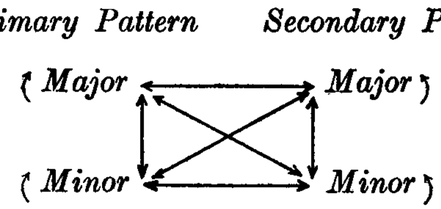

Fig. 1: The structure of English orthography

Since each of the four resulting patterns — the major primary, three minor primary, the major secondary, and the minor secondary — has its own unique characteristic structure, including letters, sound correspondences, distribution, and frequency, we regard each pattern as constituting a module, each module containing a unique set of grapheme-phoneme correspondences.

Errors of substitution occur when two different members of the same module are substituted for one another or when a member of one module is substituted for a member of another. All of the possible substitution error types are presented in the diagram in Fig. 1, where X→Y is to be read: "X is substituted for Y". In our individual study (cf. Luelsdorff 1986a) and in the following our understanding of regularity and irregularity is based on Venezky (1970) and Wełna (1982).

Inter- and intramodular interaction yields the following 16 substitution error types, listed and exemplified in Figure 2:

Error Type	*Attempt*	*Target*
1. Primary Regularization	⟨Camebridge⟩	⟨Cambridge⟩
2. Primary Reregularization	⟨jame⟩	⟨jam⟩
3. Primary Irregularization	⟨sommer⟩	⟨summer⟩

4. Primary Re-irregularization	⟨pollover⟩	⟨p*u*llover⟩
5. Secondary Regularization	⟨br*au*ght⟩	⟨br*ou*ght⟩
6. Secondary Reregularization	⟨enj*oi*ed⟩	⟨enj*oy*ed⟩
7. Secondary Irregularization	⟨mov*ey*⟩	⟨mov*ie*⟩
8. Secondary Re-irregularization	⟨br*oa*ght⟩	⟨br*ou*ght⟩
9. Regularization cum Simplification	⟨wer⟩	⟨w*ea*r⟩
10. Reregularization cum Simplification	⟨mov*i*⟩	⟨mov*ie*⟩
11. Irregularization cum Simplification	⟨p*i*ce⟩	⟨p*ie*ce⟩
12. Re-irregularization cum Simplification	⟨l*a*ghe⟩	⟨l*au*gh⟩
13. Regularization cum Complication	⟨C*ai*mbridge⟩	⟨C*a*mbridge⟩
14. Reregularization cum Complication	⟨g*ei*t⟩	⟨g*a*te⟩
15. Irregularization cum Complication	⟨c*ou*lled⟩	⟨c*a*lled⟩
16. Re-irregularization cum Complication	⟨w*ea*r⟩	⟨w*e*re⟩

Fig. 2: Intralinguistic substitution error types

1. Primary regularization (Major Primary → Minor Primary). Primary Regularization refers to the substitution of a Major Primary pattern for a Minor Primary pattern. ⟨aCe⟩ is the Major Primary pattern for /e/ in ⟨c*a*me⟩ and ⟨a⟩ is the Minor Primary pattern for /e/ in ⟨C*a*mbridge⟩. Attempt: ⟨C*a*mebridge⟩ for Target: ⟨C*a*mbridge⟩ is therefore the substitution of a Major Primary pattern for a Minor Primary pattern, a Primary Regularization.

2. Primary reregularization (Major Primary → Major Primary). Primary Reregularization is the substitution of a Major Primary pattern for another Major Primary pattern. ⟨aCe⟩ is the Major Primary pattern for /e/ in ⟨c*a*me⟩, while ⟨a⟩ is the Major Primary pattern for /æ/ in ⟨j*a*m⟩. Attempt: ⟨j*a*me⟩ for Target: ⟨j*a*m⟩ is therefore the subtitution of one Major Primary pattern for another Major Primary pattern, a Primary Reregularization.

3. Primary irregularization (Minor Primary→Major Primary). Primary Ireregularization refers to the substitution of a Minor Primary pattern for y Major Primary pattern. /ʌ/ is the Major correspondence of the Primary vowel pattern ⟨u⟩ when ⟨u⟩ is followed by a single consonantal, as in ⟨f*u*r, h*u*t, c*u*p⟩, or a consonantal cluster C_1C_2, where $C_1 \neq$ ⟨r⟩, as in ⟨s*u*mmer b*u*tter, c*u*stom⟩. /ʌ/ is the Minor correspondence of the Primary vowel pattern ⟨o⟩ when ⟨o⟩ occurs before ⟨m, n, v⟩, ⟨th⟩, and other consonantals as in ⟨c*o*mfort, s*o*n, a*o*ther⟩. Thus Attempt: ⟨s*o*mmer⟩ for Target: ⟨s*u*mmer⟩ is the substitution of a Minor Primary pattern for a Major Primary, a Primary Irregularization, reinforced, in this case, by Partial Cognatization to German ⟨Sommer⟩.

4. Primary re-irregularization (Minor Primary → Minor Primary). Primary Re-irregularization refers to the substitution of a Minor Primary pattern for another Minor Primary pattern. /ʊ/ is the Minor correspondence of the Primary pattern ⟨o⟩ in apparently only ⟨b*o*som⟩ and ⟨w*o*man⟩. Since ⟨u⟩:/ʊ/ is itself a Minor Primary pattern, Attempt: ⟨p*o*llover⟩ for Target: ⟨p*u*llover⟩ is the substitution of one Minor Primary pattern for another Minor Primary pattern, a Primary Re-irregularization.

5. Secondary regularization (Major Secondary → Minor Secondary). Secondary Regularization refers to the substitution of a Major Secondary pattern for a Minor Secondary pattern. /ɔ/ is the Major correspondence of the Secondary pattern ⟨au, aw⟩, as in ⟨t*au*ght, cr*aw*⟩ and the Minor correspondence of the Secondary pattern ⟨ou⟩, as in ⟨br*ou*ght⟩. Attempts: ⟨br*au*ght, br*aw*ght⟩ for Target: ⟨br*ou*ght⟩ are therefore substitutions of Major Secondary patterns for a Minor Secondary pattern, each a Secondary Regularization.

6. Secondary reregularization (Major Secondary → Major Secondary). Secondary Reregularization refers to the substitution of a Major Secondary pattern for another Major Secondary pattern. ⟨oi⟩ for /oy/ is written in morpheme-medial position, whereas ⟨oy⟩ for /oy/ is written morpheme-finally, with exceptions (e.g. ⟨*oy*ster, r*oy*al⟩, etc.). Attempt: ⟨enj*oi*ed⟩ for Target: ⟨enj*oy*ed⟩ is thus the substitution of one Major Secondary pattern for another Major Secondary pattern, a Secondary Reregularization.

7. Secondary irregularization (Minor Secondary → Major Secondary). Secondary Irregularization refers to the substitution of a Minor Secondary pattern for a Major Secondary pattern. The Secondary pattern ⟨ey⟩ has the Minor correspondence /i/ in words like ⟨k*ey*⟩ and ⟨monk*ey*⟩. The Major correspondence of Secondary ⟨ie⟩ is /i/, as in ⟨ach*ie*ve, n*ie*ce⟩. Thus, Attempt: ⟨mov*ey*⟩ for Target: ⟨mov*ie*⟩ is the substitution of a Minor Secondary correspondence for a Major Secondary correspondence, a Secondary Irregularization.

8. Secondary re-irregularization (Minor Secondary → Minor Secondary). The substitution of one Minor Secondary pattern for another Minor Secondary pattern constitutes a Secondary Re-irregularization. /ɔ/ is the Minor correspondence of the Secondary pattern ⟨oa⟩, as in ⟨br*oa*rd, b*oa*rd, *oa*r⟩, the Minor correspondence of ⟨oo⟩, as in ⟨d*oo*r, fl*oo*r⟩, and the Minor correspondence of the Secondary pattern ⟨ou/ow⟩, as in ⟨c*ou*gh, tr*ou*gh⟩. Thus, Attempts: ⟨br*oa*ght, br*oo*ght⟩ for Target: ⟨br*ou*ght⟩ exemplify the substitutions of Minor Secondary patterns for a Minor Secondary pattern, each a Secondary Re-irregularization.

9. Regularization cum simplification (Major Primary → Minor Secondary). Regularization cum Simplification is the substitution of a Major Primary pattern for a Minor Secondary. /ɛ/ is the Major correspondence of the Primary pattern ⟨e⟩, as in ⟨l*e*t, b*e*t, w*e*t⟩ and the Minor correspondence of the Secondary pattern ⟨ea⟩, as in ⟨w*ea*r, t*ea*r⟩. Attempt: ⟨w*e*r⟩ for Target: ⟨w*ea*r⟩ is thus the substitution of a Major Primary pattern for a Minor Secondary pattern, an example of Regularization cum Simplification.

10. Reregularization cum simplification (Major Primary → Major Secondary). Reregularization cum Simplification refers to the substitution of a Major Primary pattern for a Major Secondary. ⟨i⟩ and ⟨y⟩ most frequently correspond to /i/ in unstressed position, as in ⟨taxi, city⟩. As noted above, the Major correspondence of the Secondary pattern ⟨ie⟩ is /i/, as in ⟨achieve, piece⟩. Attempts: ⟨movi, movy⟩ for Target: ⟨movie⟩ are thus examples of the substitution of a Major Primary pattern for a Major Secondary, Reregularization cum Simplification.

11. Irregularization cum simplification (Minor Primary → Major Secondary). Irregularization cum Simplification is the substitution of a Minor Primary pattern for a Major Secondary pattern. The Minor correspondence of the Primary pattern ⟨iCe⟩ is /i/, as in ⟨machine, ravine⟩, and the Major correspondence of the Secondary medial pattern ⟨ie⟩ is /i/, as in ⟨achieve, piece⟩. Attempt: ⟨pice⟩ for Target: ⟨piece⟩ thus exemplifies the substitution of a Minor Primary pattern for a Major Secondary pattern, an Irregularization cum Simplification.

12. Re-irregularization cum simplification (Minor Primary → Minor Secondary). Re-irregularization cum Simplification refers to the substitution of a Minor Primary pattern for a Minor Secondary. /a/ is the Minor correspondence of the Primary pattern ⟨aCe⟩, as in ⟨are, massage⟩ and the Minor correspondence of the Secondary pattern ⟨au⟩, as in ⟨laugh⟩. Attempt: ⟨laghe⟩ for Target: ⟨laugh⟩ thus exemplifies the substitution of a Minor Primary pattern for a Minor Secondary pattern, a Re-irregularization cum Simplification.

13. Regularization cum complication (Major Secondary → Minor Primary). Regularization cum Complication refers to the substitution of a Major Secondary pattern for a Minor Primary. /e/ is the Major correspondence of the Secondary pattern ⟨ai⟩, as in ⟨wait, rain⟩ and the Minor correspondence of the Primary pattern ⟨a⟩, as in ⟨Cambridge⟩. Attempt: ⟨Caimbridge⟩ for Target: ⟨Cambridge⟩ thus illustrates the substitution of a Major Secondary pattern for a Minor Primary pattern, a Regularization cum Complication.

14. Reregularization cum complication (Major Secondary → Major Primary). Reregularization cum Complication refers to the substitution of a Major Secondary pattern for a Major Primary. /e/ is the Major correspondence of the Secondary pattern ⟨ei⟩, as in ⟨weight⟩, and the Major correspondence of the Primary pattern ⟨aCV⟩, as in ⟨potato⟩. Attempts: ⟨geit, poteito⟩ for Targets: ⟨gate, potato⟩ are therefore examples of the substitution of a Major Secondary pattern for a Major Primary, Reregularization cum Complication.

15. Irregularization cum complication (Minor Secondary → Major Primary). Irregularization cum Complication refers to the substitution of a Minor Secondary pattern for a Major Primary. /o/ is the Minor correspondence of

the Secondary pattern ⟨au/ow⟩, as in ⟨cough, trough⟩ and the Major correspondence of the Primary pattern ⟨a⟩ directly after ⟨w⟩, as in ⟨want, wash, watch⟩, and before a final or preconsonantal ⟨l⟩, as in ⟨call, salt, walk⟩. Thus, Attempt: ⟨coulled⟩ for Target: ⟨called⟩ illustrates the substitution of a Minor Secondary pattern for a Major Primary pattern, an Irregularization cum Complication.

16. Re-irregularization cum complication (Minor Secondary → Minor Primary). Re-irregularization cum Complication refers to the substitution of a Minor Secondary pattern for a Minor Primary. /ɜ/ corresponds regularly to ⟨ea⟩ before ⟨r⟩ followed by a consonantal, as in ⟨pearl, heard, search⟩ and is the Minor correspondence of Secondary ⟨ea⟩, as in ⟨year⟩. Moreover, /ɜ/ is a Minor correspondence of Primary ⟨e⟩ in ⟨were⟩. Attempt: ⟨wear⟩ for Target: ⟨were⟩ thus exemplifies the substitution of a Minor Secondary pattern for a Minor Primary, a Re-irregularization cum Complication.

3. *Some conclusions.* We have presented a description of our group experiment used to elicit our error data and a finely graded taxonomy of the processing strategies held to underlie the intralinguistic vowel spelling errors of the substitution type. We end with a brief summary of three of the major conclusions reached.

(1) The same sound in different words may be spelling-error prone in different ways. The /ɔ/ in ⟨walk⟩, for example, was misspelled ⟨oo, o, oa, aCCe⟩, while the /ɔ/ in ⟨called⟩ was misspelled ⟨uo, o, au, oa⟩. Moreover, the same sound with the same normative spelling may be spelling-error prone in different ways in different words. For example, the /o/ in ⟨woke⟩, with the normative spelling ⟨oCe⟩, was misspelled ⟨ooC, oC, ouC, oaC, owC, a(C)C, uCC, oo, e⟩, while the /o/ in ⟨wrote⟩, with the same normative spelling ⟨oCe⟩, was misspelled ⟨ou, oa, o, oo, oe⟩. Furthermore, the same normative spellings of different sounds in different words may be spelling-error prone in different ways. For example, the ⟨ie⟩ for /i/ in ⟨piece⟩ was misspelled ⟨eaCe, iC(C)e, ie, ea, ee, eCe, eeCe, e⟩, while the ⟨ie⟩ for /ɛ/ in ⟨girlfriend⟩ was misspelled ⟨e, ee, i, eeCe, ae⟩. Finally, even in those cases where the set of spelling-error types for a vowel in one word is properly included in the set of spelling-error types for the same vowel in a different word, the members of each set of spelling error types for each word may exhibit different absolute frequencies and these frequencies may appear in different ranks. For example, the set of misspellings of the /i/ in ⟨cheese⟩ is properly included in the set of misspellings of the /i/ in ⟨piece⟩, but whereas ⟨ee⟩ is the most frequent misspelling of the /i/ in ⟨cheese⟩ (18.78%), it is the fifth most frequent misspelling of the /i/ in ⟨piece⟩ (.81%).

These (rather discouraging) observations lead us to conclude that it is not just sounds, nor just letters, nor even letter-sound correspondences, which

are misspelling-prone in certain ways, but letter-sound correspondences *in individual words*. This we refer to as the "word-effect for spelling errors".

(2) Statements of the form "X is substituted for Y by means of the processing strategy Z", as in ⟨uCe⟩ is substituted for ⟨uiCe⟩ by means of Reregularization cum Simplification, miss an important generalization, in fact the most important generalization about errors of the substitution type. The fundamental fact about such errors is that any letter(s) X may be substituted for *any* letter(s) Y on the condition that X and Y stand for the *same sound* in the standard orthography. Casting this sufficient constraint on error variables of the substitution type in semiotic terms, the signifiants of two different signs may substituted for one another if they have the same signifiés. Call this condition on substitution error variables the "Identical Signifié Constraint". We are thus left with the notion of the general operation of substitution (a *mechanism* in the terminology of this investigation) of being subject to conditions or constraints (*processing strategies* in the terminology of this study), i.e. of rules or rule-like operations interacting with principles. On this theory, the substitution of letter naming is subject to the constraint that the letter sound be contained in the letter name, i.e. that the letter X may be substituted for the letter Y if the signifiant of X (the letter name) properly or improperly includes the signifié of Y (the letter sound). The negative transfer of a native language GPC to the target language, on the same theory, is subject to the constraint that a native letter(s) X may be substituted for a target letter(s) Y if X and Y have identical or similar signifiés. Thus viewed, the development of spelling skills is the development of conditions on rules, some conditions becoming less general, others more general, some added, others lifted.

The "Identical Signifié Constraint" must be supplemented with two additional minor, but important, constraints, called the "Near Neighbor Constraint" and the "Close Relative Constraint", both with domains in interlingual, rather than intralinugual transfer. For the details, I refer the interested party to *Constraints on error variables in grammar* (Luelsdorff 1986a).

(3) Several recent models of English contain two routes to oral reading, called the *lexical* and the *non-lexical* (Coltheart 1984:68-69). On the lexical route, a word-specific input letter pattern is matched with the same word-specific letter pattern in the mental lexicon and associated with this phonological representation. On the non-lexical route, letter patterns serve as the input to a set of regular grapheme-phoneme correspondences whose successive applications assemble the pronunciations of the graphemically parsed strings.

Henderson (1984a:2-4)-points out that the distinction between a lexical and a non-lexical route to oral reading is based on the dichotomization of the English vocabulary into *regular* and *exception* words, where a word is regular if its pronunciation is predictable from its spelling by means of the most frequently occurring GPCs in the language. According to the dual-route hypothesis, irregular words or irregular portions of words are read orally on the lexical route, whereas pseudowords, regular words, or regular portions of words or pseudowords are read orally on the non-lexical, rule-governed route.

Now, were one to apply the dual-route hypothesis to spelling, then pseudowords, regular words and sounds with regular letter correspondences would be processed non-lexically, i.e. by means of PGCs, while irregularly spelled words or sounds with exceptional letter correspondences would be processed lexically, in a manner that is word specific. While this hypothesis predicts the occurrence of spelling errors of the reregularization type, it fails to predict errors of regularization, irregularization, and re-irregularization, however, because, on this hypothesis, irregular spelling patterns are *lexical*, not rule-governed, i.e. word-specific, not rule-general. The abundance of spelling errors of regularization, irregularization, and re-irregularization, however, argues strongly against the hypothesis of a dual-route to spelling and strongly in favor of the hypothesis that irregularly spelled words, like regularly spelled words, are spelled by means of rules, i.e. PGCs. On this hypothesis, the difference between spelling a regular and an irregular word is not that the former is rule-governed, and the latter lexical, but that the former is word-general, i.e. controlled by processes affecting the majority of the occurrences of the sound-type being spelled, and the latter word-specific, i.e. controlled by processes affecting the minority of the occurrences of the sound-type being spelled, with both regular and irregular spellings being rule-governed. Since this latter hypothesis — call it the "Dual Word Hypothesis" — predicts erorrs of regularization, irregularization, and re-irregularization, in addition, of course, to errors of reregularization, i.e. all and only the substitution error types in this investigation, we consider it confirmed.

The Dual Word Hypothesis on spelling may have implications for the Dual Route Hypothesis on reading. If, for example, spelled pseudowords are orally read irregularly, say ⟨preat⟩ as [pret], it must mean that they are being read via a non-lexical route. But if a reader is reading pseudowords via the non-lexical route, it must mean that the irregular spellings themselves are not lexical, but rule-governed.

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