

Partial Synformy and Vocabulary Learning: The effect of raising awareness of partial synformy (intra-lingual orthographic similarities of words) on L2 vocabulary perception and production

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Abstract

To investigate the effect of raising awareness of partial synformy on second language vocabulary perception and production, four groups of university students in a general English course were selected. Two of the four groups acted as experimental groups and the other two as control groups. The participants of the experimental groups were made aware of the orthographic similarities and contrasts whereas the control group participants were not. At the end of the experimental period, two of the four groups (one experimental and one control group) were given a multiple-choice test to compare their perception of words. To study the effect of partial synformy on vocabulary production, the other two groups were given a production task. An ANOVA procedure was applied, the result of which indicated meaningful differences between means. The follow-up Scheffe test showed that awareness of partial synformy positively influences both vocabulary perception and production.

Key Words : Partial synformy, intra-lingual, orthographic similarities, vocabulary perception and production.

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Introduction

Over the past few decades, the fortunes of vocabulary teaching and learning have waxed and waned. After decades of neglect, vocabulary teaching and learning has recently received a surge of interest from teachers and researchers, and the field of psycholinguistics has witnessed heated debates over the issue of vocabulary perception and production.

In the changing winds and shifting sands of vocabulary teaching and learning, one of the issues which has had many twists and turns is the issue of the effect of the intra-lingual lexical resemblances on vocabulary learning. According to Zarei (1997: 29), studies on the mental lexicon of bilinguals suggest that words are classified into semantic, phonological, and orthographic networks in such a way that each learnt word interacts with other words in the lexicon on the basis of semantic, phonological and orthographic aspects. Psycholinguistic discoveries have also shown that the acquisition of a new word can be facilitated by the various relationships the learner can make between the word and other familiar words in the target language. These discoveries show that the brain makes use of lexical relationships, but the exact nature of how the brain does this and the extent of the effect of such intra-lingual lexical relationships on vocabulary learning remains to be discovered.

As an example, regarding the semantic relations, Rudzka et al. (1985) hold that studies of the slips of the tongue made by native speakers of English have shown that many wrong words, far from being random mistakes, actually share some aspect of meaning with the intended word. For example:

I have my book and my jigsaw.... I mean crossword.

I really like hate to get up early in the morning.

Similarly in malapropism, one might say ‘*confident*’ for ‘*competent*’ or ‘*widow*’ for ‘*window*’. Such problems are mostly in production. It is very unlikely that native speakers have difficulty recognising these words.

Orthography, however, is a horse of a different colour. Orthographic similarities seem to cause problems in both production and reception. In tests of spelling or writing, orthographic resemblances cause problems in production while in tests of

reading as well as in multiple-choice tests, such similarities generate problems in word perception. In fact, orthography can be held responsible for a variety of problems in the development of not only word knowledge but also the broader language knowledge.

When language learners are exposed to orthographically similar words like '*goal/gaol*', '*moral/morale*', etc. at different times, unawareness of the minute orthographic differences may lead them to ignore such differences. This will have a number of consequences. In the first place, there will be problems in the development of the spelling ability. Even if, at a later stage, they get acquainted with the separate meanings of each of the above-mentioned pairs, they might consider them as homographs since they have a single visual orthographic image of both words. This could cause problems in writing and sometimes even jeopardise the fluent flow of communication because the intended meaning of the writer might be radically different from the one expressed by the misspelled word.

Orthographic resemblances could also affect reception of words. In a multiple-choice or a matching item, for instance, in which testees are required to choose a synonym for a word like '*purpose*' from among a number of alternatives including '*aim*' and '*gaol*', the latter may be selected based on its orthographic similarity to the familiar '*goal*'. Such confusion in word perception could, in turn, cause more severe misunderstandings or misinterpretations in reading and even bring about communication breakdown.

What this argument boils down to is that orthographic similarities, especially when combined with other factors such as phonological and semantic relationships, influence the reception and production of words in reading and writing. Although there are a few studies investigating the effect of the intra-lingual relationships between words (a combination of factors), there is currently a paucity of research on the effect of orthographic similarities alone on vocabulary development.

According to Sadoski (2005), English orthography is graphic and graphophonemic, but it is also morphographemic and morphophonemic, and these distinctions have cognitive consequences not only for reading and spelling but also

for vocabulary learning.

Masterson (1999) identifies several factors that affect a child's spelling development including phonological awareness, orthographic knowledge, visual storage, and morphological knowledge. She defines visual image as the internalisation of mental images or templates of words, morphemes, and syllables in memory. These templates are called 'visual orthographic images' (VOIs). Visual storage is developed lately through experience with print. Orthographic knowledge involves a set of skills necessary to translate language from spoken to written form. According to Masterson, the extent to which these factors affect spelling changes throughout the course of development. The developmental system described by Ehri (1997) emphasized the early influence of phonological awareness. Orthographic knowledge and visual storage become more important during the early school years, whereas morphological knowledge becomes more influential during the later years. However, this view was recently challenged. It was suggested, instead, that young children employ their "budding knowledge" of orthographic rules and morphology quite early.

Also, talking about the importance of orthographic processing as a predictor of reading, Badian (2001: 14) refers to Stanovich (1992), who points out that phonological awareness or sensitivity is a necessary, *but not sufficient* (emphasis added), condition for efficient reading acquisition. There must be at least one other "sticking point" where reading acquisition can flounder. Stanovich suggested that for some problem readers, differences in the ability to form accurate orthographic representations might be the "sticking point".

The importance of establishing automatic orthographic-phonological connections has been stressed by several researchers, and there is evidence that early word recognition is associated with phonological skills, while orthographic skills become increasingly important in later reading and in reading comprehension.

Similarly, Sadoski (2005) maintains that although there is currently no consensual model of spelling development, much research indicates that children use both phonological and orthographic strategies with an age-related progression

from phonological strategies toward orthographic strategies.

It is important to bear in mind that the studies mentioned above had to do with the development of spelling, reading, or word knowledge in children. Orthography plays an even more important role for L₂ learners. Unlike first language acquisition, in which the natural sequence of ‘oral-then-written skills’ determines the precedence of phonology over orthography, in second language learning, both phonological knowledge and orthographic knowledge develop almost simultaneously. Due to the natural difficulties involved in developing the phonological aspect of language, orthography is, indeed, a more immediate recourse or “sticking point” for second language learners.

Compton (2002: 7) examined the relationship between phonological and orthographic skills in relation to the two lexical acquisition systems, that is, word-specific knowledge and sub-word orthographic-phonological connections in children with and without reading disabilities. He holds that acquiring a lexical system of representations that permit word recognition is an essential part of learning to read. As children learn to read, this lexical representation system changes in two important ways (Ehri, 1992; Perfetti, 1992). First, there is a continuous increase in the absolute number of orthographically addressable entries, often referred to as word-specific representations (Brooks, 1997; Ehri & Saltmarsh, 1995). This implies that word-specific representations form relatively rapidly as children develop reading skills. The second change in the orthographic lexicon that occurs as children learn to read is an increase in the overall quantity and quality of sub-word orthographic-phonological connections. These sub-word connections between orthographic and phonological units form what Gough and Colleagues (Gough & Hillinger, 1980; Gough & Walsh, 1991; Gough & Wren, 1998) have referred to as the cipher. The cipher is best conceptualised as a set of abstract context-dependent relationships between orthography and phonology that are “implicit, numerous, and very fast” (Gough, et al., 1992).

Ehri (1997) has hypothesised that children with reading disability lack sufficient “orthographic knowledge” to fully analyse matches between orthographic and

phonological units in order to store complete word-specific representations.

A complementary set of findings comes from correlational studies examining the relationship between the two lexical acquisition systems in children with and without reading disability. It has been argued that in typically developing readers, “orthographic and linguistic codes become more tightly integrated, more highly elaborated and more fully specified units” (Vellutino, et al., 1995 : 77), whereas in children with reading disability, word-specific and sub-word orthographic-phonological connections are thought to be less well “integrated” or “synchronized” (Landerl, et al., 1996; Metsala, 1999). This has prompted some to suggest that orthographic processing skills act in a compensatory manner in children with reading disability, allowing word-reading skill to develop somewhat independent of phonological processing skill (Siegel et al., 1995). Compton (*op. cit.*) concludes that compared to typically-achieving age-matched peers, children with reading disability have underdeveloped orthographic lexicons, much less experience with the print and inferior orthographic processing abilities.

According to Dijkstra (1995), a widely used task in the research on spoken word recognition is phoneme monitoring, in which subjects have to detect phonemes in spoken words. It is generally assumed that this task is performed using phonetic or phonological representations of words only. To test whether an orthographic representation of the words is employed as well, Dijkstra conducted an experiment in which Dutch subjects monitored for phonemes with either a primary or secondary spelling in phonologically matched spoken words and non-words. Phoneme monitoring times were slower when the phoneme had a secondary spelling than when it had a primary spelling. The effect was greater after than before the uniqueness point of the word, and monitoring times were faster for words than for non-words. These findings indicate that an orthographic representation of words is engaged in phoneme monitoring.

Previous research is also indicative of a relationship between orthography and semantics. A summary of evidence from cognitive neuropsychology involving both normal and clinical subjects suggests that there are direct neurological connections

between semantics and orthography. Sadoski (2005) refers to a part of the psychological literature on relationships between verbal orthographic processes and non-verbal semantic processes. As an example, he contends that studies have shown that concrete written words (e.g., *dime*) are more memorable than abstract written words (e.g., *time*) due to evoked non-verbal imagery.

Apart from the above body of literature, which mostly pivots around the relationships holding between orthography and other aspects of word learning, including semantics and phonology, there is at present a dearth of research on the role of orthography alone in language learning in general and vocabulary learning in particular. In one of the rare studies on orthography, and in order to check the orthographic processing of participants, Compton (2002) administered an updated version of the Olson et al. (1985) orthographic choice task. This measure of orthographic processing skill consists of a free-choice decision between a word and a phonetically identical pseudo-homophonic non-word (e.g., *take/taik*). The task requires the participants to recognize the correct orthographic pattern for the word independent from its phonology.

Despite the current paucity of research on the relationship between the orthographic similarities of words and vocabulary learning, two general viewpoints can be identified in this respect. Much like the proponents of the moderate version of the contrastive analysis hypothesis (CAH), advocates of the first view claim that minute orthographic differences between pairs like :

suit/suite *enquiry/inquiry* *dairy/diary*
council/counsel *complement/compliment*

are usually ignored in favour of the greater similarities. Consequently, such pairs or sets are rather confusing, even for the intermediate and upper-intermediate learners. Note, at the same time, that pairs like '*draught/draft*' are not confused in their written form in spite of their identical pronunciation. This is because of the salient difference in their orthographic form. The proponents of this view propose, therefore, that such pairs or sets of orthographically similar words be taught contrastively and that the learners' awareness be raised about the minute

orthographic differences so that such differences are not overlooked.

On the contrary, there are others who advocate the view that by raising learners' awareness about the minute orthographic differences, teachers will do them a disservice. They hold that this way, the minds of the learners will be overloaded with too much detailed information, and this only adds to their confusion and makes the already hard task of vocabulary learning even thornier.

It is the purpose of the present study, therefore, to investigate the nature of the effect of the intra-lingual orthographic similarities of words on vocabulary perception and production.

Method

Participants

The participants of the study were 148 male and female students in a general English course at Imam Khomeini International University in Qazvin. They were in two groups of 38 members each and two groups of 36 members each. Their selection was somewhat random since the researcher had no control over selecting and assigning the participants to the different groups. Selection was based on a general schedule offering the course at various times on different week days in which students could choose the time at their own convenience. So, all groups included students from various fields of study. Another group of 67 students (in two classes) were also used as the peer group students with whom the post-tests were validated.

Materials and Instrumentation

Materials included 140 pairs (and in a few cases, sets) of partially synformous words including the following:

deprave/deprive, retrieve/reprieve rip/rib, moral/morale,
corps/corpe, forge/forage, breach/broach, spouse/espouse,
bonus/bogus, liar/lair, wander/wonder, convert/covert,
flail/flair/frail, etc.

The words were contextualised and presented to the participants along with their usual lessons, which included 16 chapters of the book 'Aroma'.

Altogether, four tests were utilised: an 80-item translation test used as the pre-test to check the participants' initial knowledge of the target words; a 40-item fill-in-the-blank (cued production) task to gauge the production of the target words (post-test A); a 30-item multiple-choice test administered to measure the reception of the target words (post-test B); and the vocabulary sub-test of a 'Michigan Language Proficiency' test that was used as the criterion with which to validate the post-tests.

To determine the validity of each of the post-tests, a correlational procedure was gone through, and to estimate the reliability, the KR-21 formula was applied. A univariate analysis of variance (ANOVA) was used to study the effect of partial synformy on both perception and production of L₂ vocabulary. And to investigate the separate effect of partial synformy on vocabulary perception and production and to compare those effects, a follow-up scheffe test was used.

Procedure

Using a variety of sources including a previously conducted research (Zarei, 1997: 83-88), 140 partially synformous pairs or sets of words were collected. Using the 'Oxford Advanced Learners' Dictionary', each of the words in every pair or set were contextualised to be presented to the participants. Then the four groups of participants with the afore-mentioned characteristics were selected. Groups 1 and 2, with 36 members each, became the control groups and groups 3 and 4, with 38 members each, both acted as experimental groups. Before introducing the treatment, an 80-item pre-test was administered to all groups to ensure that there were no significant differences between the experimental and control groups. Results suggested that due to the novelty of the words, there was similar performance. Except for few items to which few participants correctly responded, the majority of items were unfamiliar to the participants. Still, to stand on the safe side of the river, those correctly responded items were excluded from the post-tests.

Besides their usual lessons, both the experimental and control groups were

presented with the same words but in different ways. All four groups received about 20 words every session. Members of the two experimental groups received the words contrastively in pairs or sets, becoming aware of the orthographic similarities and contrasts while the control group subjects received the same words with an interval of a minimum of three weeks between the presentations of the orthographically similar words. In other words, the participants of the control groups received 20 independent (orthographically unrelated) words each session, and were presented with the corresponding partially synformous word at least three weeks later, hence not becoming aware of such relations.

As the groups were receiving their treatment, a 30-item fill-in-the-blank cued production task (see appendix 1) was constructed. To put the subjects on the spot to produce the intended words and to prevent probable ambiguity and the resultant subjectivity of the items, the Persian equivalents of the intended words were given in parentheses.

The cued production task and an already constructed 30-item multiple-choice vocabulary test (see appendix 2) were then administered to the peer group participants along with the vocabulary subtest of a 'Michigan Language Proficiency' test. The 'Pearson Product Moment' correlation coefficient formula and the KR-21 reliability formula indicated that the validity and reliability of the cued production task were .83 and .87, respectively. In the same vein, the validity and reliability of the multiple-choice test turned out to be .81 and .92, respectively.

At the end of the experimental period, which lasted nearly a semester, groups 1 and 3 were given the cued production task whereas groups 2 and 4 received the multiple-choice test.

A univariate analysis of variance (ANOVA) procedure was utilised to compare the mean scores of the four groups. In the Scheffe test that followed the ANOVA, five different comparisons were made to investigate the separate effect of partial synformy on vocabulary perception and production (it needs to be noted that in order to make interpretations easier, scores on all tests were converted to the scale of 20). The comparisons included the following:

Results

The analysis of the obtained data using the ANOVA yielded the following results:

Table 1: The results of the ANOVA procedure

Source of variance	SS	d.f	MS	F
Between groups	347.15	3	124.7	15.17
Within groups	1184.6	144	8.22	
Level of significance	.05		$F_{crit} = 2.67$	

Since the observed value of F was obviously indicative of significant differences between means, to locate the differences and determine their extent, a post hoc comparison procedure was used in which five comparisons were made. The results produced by the Scheffe test are summarized in table 2.

Table 2: Results of the post hoc comparisons of means

No. of comp.	Groups compared	\hat{C}	T_{obs}
1	1 vs. 3	- 3.11	- 4.71
2	2 vs. 4	- 3.17	- 4.80
3	1 vs. 2	- 0.35	- 0.52
4	3 vs. 4	- 0.41	- 0.63
5	1&2 vs. 3&4	- 6.25	- 6.72
$t'_{crit} = 2.83 (\alpha = .05, d.f. b/w = 3/144)$			

Note : the table containing data needed for the ANOVA procedure as well as the Scheffe test are given in appendix 3.

As it can be seen, the observed t-values are greater than the critical t-value in comparisons 1, 2, and 5.

Conclusion and discussion

The observed value for F in the ANOVA indicates that the null hypothesis can be safely rejected, meaning that the effect of the treatment is statistically significant. As to the Scheffe test, the observed t-value for comparison 1 (group 1 versus group 3) shows that the better performance of the participants of group 3 compared to those of group 1 is statistically significant. Since both groups received the cued production task as their post-test, it is concluded that the contrastive teaching of partially synformous lexical items positively influences the production of words.

Similarly, the observed t-value for comparison 2, comparing group 2 with group 4, shows that group 4 has significantly outperformed group 2. This means that raising learners' awareness of the minute orthographic differences between words positively influences the perception of words too.

Comparison 5 further confirms the results of the above-mentioned comparisons. The observed t-value suggests a statistically significant difference between groups 3 and 4 on the one hand and groups 1 and 2 on the other, proving that awareness of partial synformy positively affects both L₂ vocabulary perception and production.

On the other hand, comparisons 3 and 4 fail to show any statistically significant difference between groups 1 and 2, and groups 3 and 4, respectively. The conclusion to be drawn from these results is that the form of the test alone does not lead to any significant differences between groups.

To summarise, the results of the present study indicate that while the form of tests cannot cause meaningful differences between groups under similar circumstances, awareness of partial synformy does produce such differences not only in production but also in perception of L₂ vocabulary items.

These findings can have implications for syllabus designers and materials developers, language teachers, and language testers. Provided that these results are confirmed by further research, syllabus designers should take care to include in the teaching materials such partially synformous items. Teachers should also see to it that the learners' awareness is raised to the minute orthographic differences between apparently synformous words. Finally, in spite of a general principle in language

testing forbidding the use of a distracter that is too attractive, test constructors may make use of orthographically similar words to test the examinees' awareness of partial synformy.

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Appendices

Appendix 1 – The cued production task

Fill in the blanks with appropriate words

1. James (دست و پا زدن) about in the shallow water. (flailed)
2. A lot of these children have been ... (محروم شدن) of the normal home life. (deprived)
3. He always ... (چاپلوسی کردن) her by praising her cooking. (flatters).
4. They invited ... (همسر) to the company picnic. (spouses)
5. The sails ... (پاره کردن یا شدن) under the force of the wind. (ripped)
6. It took four days to ... (جمع آوری کردن) all the bodies from the crash. (retrieve)
7. The tray slipped and ... (با سر و صدا افتاد) to the floor. (clattered)
8. The ... (شرور) stepmother always beats the child. (wicked)
9. She sipped her lemonade through a ... (نی). (straw)
10. It really ... (آزرده) me when he doesn't help around the house. (irritates)
11. The wood had been ... (سفید شدن) by the sun. (bleached)
12. John and Bob ... (مکمل بودن) each other extremely well. (complement)
13. With a ... (گستاخانه) nod, he turned away and sat down. (curt)
14. She ... (پوزخند زدن) at him as she spoke. (simpered)
15. There were ... (پنهانی) operations against the government. (covert)
16. 'She failed her test again.' 'What a ... (خجالت آور)' (shame)

17. I had a bit of ... (قدم زدن) round the shops. (wander)
18. The water in the lake is used to ... (آبیاری کردن) the area.
(irrigate)
19. In 1776, the US ... (تشکیل دادن) an alliance with France.
(forged)
20. They took measures to ... (کنترل کردن) the spread of the virus.
(curb)
21. Archeologists found ... (تکه هایی) of broken pottery in the area.
(fragments)
22. The ... (نکته اخلاقی) of the story is 'better late than never'.
(moral)
23. She tore open the ... (پاکت) and frantically read the letter.
(envelope)
24. The failed coup caused a dramatic loss of ... (روحیه) within the
army. (morale)
25. We are getting a lot of ... (پرسش) about our new service.
(inquiries)
26. He kept a ... (دفتر خاطرات) during the war years. (diary)
27. Her guilty secret was a ... (ناکامی-لکه سیاه) on her
happiness. (blight)
28. The ... (جسد) was found by the children playing in the woods.
(corpse)
29. My doctor forbade me to use ... (لبنی) produce. (dairy)
30. The old man ... (راه رفتن) out of the room muttering to
himself. (shambled)

Appendix 2 – The multiple-choice post-test

Choose the word that is closest in meaning to the specified word.

1. He was in a *frail* condition when he was ill.
 - a. weak
 - b. serious
 - c. difficult
 - d. sad
2. He was a man *depraved* by bad company.
 - a. deceived
 - b. influenced
 - c. corrupted
 - d. surrounded
3. The knife gleamed *wickedly* in the moonlight.
 - a. brightly
 - b. sinfully
 - c. slightly
 - d. obviously
4. He *retrieved* his suitcase from the left luggage office.
 - a. picked up
 - b. gave back
 - c. looked for
 - d. got back
5. The wings of the bird still *fluttered* after it had been shot down.
 - a. ached
 - b. moved quickly
 - c. bled
 - d. shook slowly
6. Don't *clutter up* my desk; I have just tidied it.
 - a. make noise with
 - b. turn up
 - c. make scattered
 - d. mess up
7. They always *ribbed* him for being shy.
 - a. blamed
 - b. scorned
 - c. teased
 - d. praised
8. She is one of those women who strongly *espouse* feminism.
 - a. depend on
 - b. criticise
 - c. believe in
 - d. support
9. The baby is *enveloped* in a blanket.
 - a. covered
 - b. carried

c. kept d. tangled

10. The old man *shambled* up to me.

a. walked b. laughed
c. spoke d. looked

11. We have received a number of *enquiries* about our new product since putting an advertisement in the newspaper.

a. formal investigations b. recommendations
c. requests for information d. informal invitations

12. She has a regular column in the News describing the various activities of the day. It's called 'Annable's *diary*.

a. column of news b. milk-selling shop
c. book of jokes d. record of events.

13. John Lacks confidence and Mary is a strong person. They *complement* each other very well.

a. praise b. add up to
c. realise d. cover

14. Regular mail and good food are important to maintain the *morale* of soldiers during a war.

a. health b. virtue
c. spirits d. strength

15. Members of the diplomatic *corps* have a special legal status when they are abroad.

a. group b. meeting
c. conference d. organization

16. I was in a dreadful *plight*. I had lost my money and missed the last train home.

a. discover b. sadness
c. bad luck d. bad condition

17. He is a *moral* person who is guided by highest principles.

a. lucky b. punctual
c. serious d. virtuous

18. Why do you strew papers on the floor?
a. scatter b. leave
c. throw d. pour
19. They irrigated desert areas to make them fertile.
a. ploughed b. cultivated
c. planted d. watered
20. There has been a breach of diplomatic relations between the two countries.
a. break b. agreement
c. start d. contract
21. I would like to compliment you on your performance.
a. criticize b. praise
c. congratulate d. consult
22. He tried to curb his anger, but he couldn't.
a. express b. reduce
c. control d. hide
23. She simmered for a minute or two, then began shouting loudly.
a. remained quiet b. tried to hide her anger
c. shouted slowly d. was filled with anger
24. She always covets the status of her cousin.
a. admires b. desires eagerly
c. appreciates d. talks about
25. His love was a sham; he only wanted her money.
a. greed b. plot
c. failure d. pretence
26. We wondered at the speed with which the car arrived.
a. were surprised b. were annoyed
c. were pleased d. were confused
27. It irritates me to have to shout to be heard.
a. forces b. causes
c. annoys d. requires

28. One group left the camp to forage for firewood.

- a. wait
- b. work
- c. ask
- d. search

29. He is rather curt when he is angry.

- a. nervous
- b. abrupt
- c. silly
- d. controlled

30. I heard only a fragment of their conversation.

- a. word
- b. sentence
- c. part
- d. little

Appendix 2

Containing data for the ANOVA and the Scheffe test

	G ₁		G ₂		G ₃		G ₄	
	X	X ²	X	X ²	X	X ²	X	X ²
1	19	361	18.5	342.25	20	400	20	400
2	17.5	306.25	18	324	20	400	20	400
3	17	289	18	324	19.5	380.25	20	400
4	17	289	18	324	19	361	20	400
5	16.5	272.25	17.5	306.25	19	361	19.5	380.25
6	16	256	16.5	272.25	18.5	342.25	19.5	380.25
7	16	256	16.5	272.25	18.5	342.25	19.5	380.25
8	15	225	16	256	18	324	18.5	342.25
9	14.5	210.25	15.5	240.25	18	324	18.5	342.25
10	14.5	210.25	15.5	240.25	18	324	18.5	342.25
11	14	196	15	225	17.5	306.25	18	324
12	14	196	14.5	210.25	17.5	306.25	18	324
13	14	196	14	196	17	289	17.5	306.25
14	13	169	14	196	17	289	17.5	306.25
15	13	169	13.5	182.25	17	289	17.5	306.25
16	13	169	13.5	182.25	17	289	17.5	306.25
17	13	169	13.5	182.25	16.5	272.25	17	289
18	13	169	13	169	16.5	272.25	17	289
19	12.5	156.25	13	169	16.5	272.25	16.5	272.25
20	12.5	156.25	12.5	156.25	16	256	16.5	272.25
21	12	144	12.5	156.25	16	256	16	256
22	12	144	12	144	16	256	15.5	240.25
23	12	144	12	144	15.5	240.25	15.5	240.25
24	11.5	132.25	12	144	15.5	240.25	15.5	240.25
25	11.5	132.25	12	144	15	225	15.5	240.25
26	11.5	132.25	12	144	15	225	15	225
27	11.5	132.25	11.5	132.25	15	225	15	225
28	10.5	110.25	11	121	15	225	14.5	210.25
29	10.5	110.25	11	121	14	196	14.5	210.25
30	10	100	10	100	14	196	14.5	210.25
31	10	100	10	100	13.5	182.25	14.5	210.25
32	10	100	8.5	72.25	13.5	182.25	14	196
33	9	81	8.5	72.25	13	169	13.5	182.25
34	8	64	7.5	56.25	13	169	13.5	182.25
35	8	64	7	49	11.5	132.25	12.5	156.25
36	5.5	30.25	7	49	11	121	12	144
37					10	100	10.5	110.25
38					8	64	10	100
N	36		36		38		38	
Σ	458.5	6141.25	471	6519	602	9804.25	619	10342
(ΣX) ²	210222.25		221481		362404		383161	