Structured Word Inquiry

<stuct> matrix from Real Spelling

struct + ure/ + ed → **struct**ured

in + **struct** + ion → in**struct**ion

Instruction which *builds* understanding of word **structure** as a tool for investigating the the interrelation of spelling an meaning.

Integrating Morphology and Inquiry as Guiding Principles for Reading, Vocabulary and Spelling Instruction

Reconciling the Common Core Standards with Reading Research

Handout for Peter Bowers' presentation for Symposium:

Wednesday, Oct. 24, 2012, Baltimore

Teachers who comprehend the origins of the English language along with the primary structural patterns within words can improve their assessment skills, enhance their understanding of reading and spelling curricula, communicate clearly about specific features of language, and effectively teach useful strategies to their students."

Marcia Henry, (2010, p. 39)
"Unlocking Literacy: Effective Decoding & Spelling Instruction"

A Basic Assumption of Literacy Instruction:
Learners deserve instruction that represents how their writing system works.

Common Core State Standards stress the importance of…
"fostering students' understanding and working knowledge of...the basic conventions of the English writing system" (p. 15)

*Becoming literate means... "learning how to use the conventional forms of printed language to obtain meaning from words." It logically follows that...***"the child learning how to read needs to learn how his or her writing system works** *[emphasis added]."*

Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001, p. 34

Purpose
This talk, and our article in Perspectives (Bowers & Cooke, 2012), are designed to help educators deepen their understanding of morphology and its central role in the English spelling system.

This is one means to help teachers meet the goals of the *Common Core State Standards* and the consensus of research literature. *Instruction should make sense of the basic conventions which govern the workings of our writing system.*

Generative learning/teaching
A central goal of literacy instruction is that it produce students who are independent word learners and problem-solvers about words, their meanings and their spellings. To meet this goal teachers need to provide more than facts about spelling. We need to model the process of acting as word learners and problem-solvers ourselves. If we want transfer from what we teach, we should teach how that transfer is achieved.

Fundamental learning/teaching tools
Learning to analyze and synthesize the morphological structure of words deepens teachers' and students' understanding of how the spelling system works to represent meaning. The word sum and the morphological matrix (www.realspelling.com) are linguistic tools that guide scientific investigation of our spelling system. The word sum is a necessary tool for testing morphological structure.

A morphophonemic language (Venezky, 1999; C. Chomsky, 1970)

"The simple fact is that the present orthography is not merely a letter-to-sound system riddled with imperfections, but instead, a more complex and more regular relationship wherein phoneme and morpheme share leading roles."

Venezky, 1967, p. 77

"…[T]eachers and students who do not understand [morphology] are not fully equipped to make sense of how the writing system works."

Bowers & Cooke (2012, p. 31)

The science of spelling: Scientific inquiry about the conventions of English spelling provides plenty of evidence that our spelling system is an extremely reliable and ordered system for representing the meaning of words to English speakers. (e.g. Carol Chomsky, 1970).

There is obviously much more to spelling than morphology. However, scientific analysis of English spelling makes it clear that we cannot make sense of our spelling system *without* morphological understanding.

Orthographic morphology

Orthographic morphology is the conventional system by which spoken morphemes are written.

Members of an orthographic morphological family share a base element (a written base). The spelling of that element remains consistent even where its pronunciation varies; (e.g., **sign**: **sign**al, de**sign**). Hence, the base element marks the meaning connection between the base and all the words in its family.

Word sums and the morphological matrix (www.realspelling) reveal the underlying interrelated structure of orthographic morphological families.

Relationships among word sums, surface spellings and pronunciations, and the underlying lexical spelling of the base in members of the please *word family shown in <please> matrix.*

Word sums for members of the *please* family	Surface spelling of base	Surface pronunciation of base	Underlying lexical spelling of base
please/ + ing → pleasing	pleas	/pliːz/	please
please/ + ant + ly → pleasantly	pleas	/plɛz/	please
un + please/ + ant + ness → unpleasantness	pleas	/plɛz/	please
please/ + ure/ + able → pleasurable	pleas	/plɛʒ/	please
dis + please → displease	please	/pliːz/	please

|		ing	
un	**please**	ure	able
dis		ant	ly
			ness

The matrix above was built with the minimal number of morphemes needed to represent the members of the orthographic morphological family of the base <please> represented in the word sums at left.

Like word sums, the matrix represents the underlying lexical spellings (Carol Chomsky, 1970) of the morphemes in orthographic morphological families. The word sums signal any surface spelling changes due to suffixing conventions.
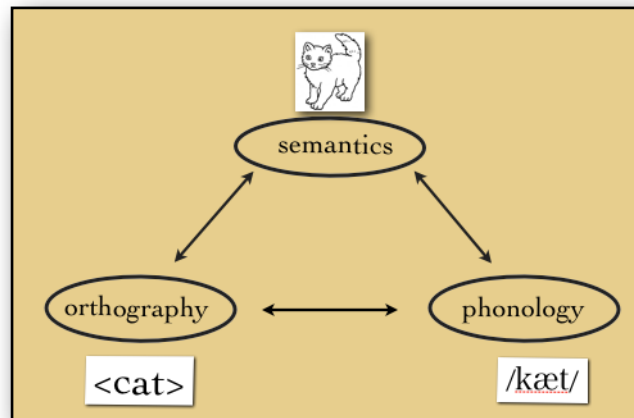
Standard "Triangle Model" of reading
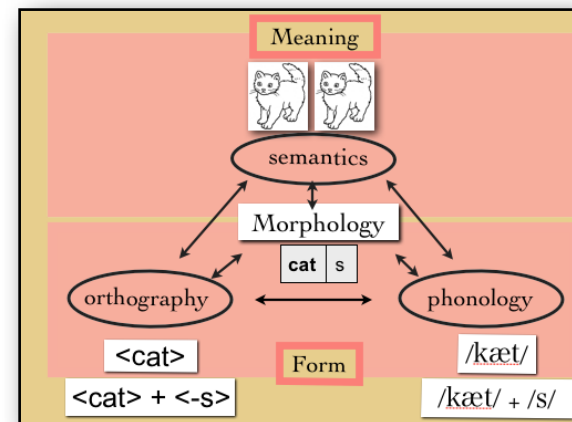
Modified "Triangle Model" of reading signalling morphology as the one linguistic feature that links to each of the other elements of this triangle. (Based on model first presented in Kirby, Bowers, & Deacon (2009, August). See also in Bowers and Cooke (2012).

Word Sums and the Morphological Matrix

These are essential tools for analyzing and synthesizing the underlying structure of orthographic morphological families. These linguistic tools provide concrete representations of the abstract concept Carol Chomsky (1970) described as *lexical spellings*. See the table on the previous page to compare the consistent underlying lexical spelling of the base for the <please> family despite the varying phonological and surface spelling of this base across related words. Read more about the link between Chomsky's concept of lexical spelling and the word sum and the matrix in Bowers and Cooke (2012).

Morphophonemic Instruction

Instruction can direct the attention of learners to this concrete representation of the meaning structure of words. Students can use morphological knowledge gained through instruction to define words they were not taught, but which are morphologically related to words that they were taught. (Bowers & Kirby, 2010). However, teaching morphology is not only about showing learners how bases and affixes can be used to learn new vocabulary. Understanding morphology is a *necessary* component of understanding how phonology is represented in print.

The importance of instruction about grapheme-phoneme correspondences is well established(e.g., Rayner et al., 2001). However, because the morphology and phonology of English spelling are interrelated, we cannot fully understand grapheme-phoneme correspondences without understanding the role of morphology.

Learning grapheme-phoneme correspondences should be facilitated by a fuller *understanding* of how they operate within the morphological framework.

See examples of structured word inquiry based instruction of investigating the morphophonemic properties of English spelling from kindergarten to Grade 7 on the next page.

Meta-Analyses of Morphological Instruction

Authors	Findings	Journal
Reed (2008) 7 studies	• Benefits overall • Especially less able (not statistical meta-analysis).	*Learning Disabilities Research & Practice*
Bowers, Kirby & Deacon (2010) 22 studies	• Benefits overall • Largest effect for less able • Effects for Pre-School to Gr. 2 ≥ Gr. 3 -8	*Review of Educational Research*
Goodwin & Ahn (2010) 17 studies	• Significant effects for less able (studied children with learning disabilities)	*Annals of Dyslexia*
Carlisle (2010) 16 studies	• Benefits overall even with youngest students.	*Reading Research Quarterly*

☐ Integrative review

☐ Statistical analysis (analysis of effect sizes for outcomes across studies.)

Some guiding principles for moving forward...

1) Morphology fundamental to oral and written English

- Adding morphemes to curriculum ≠ teaching the morphology system
- Teach **interrelation** of **morphology** and **phonology** from the start.

2) Teach the transfer

- Not just morphology -- but how to apply morphological knowledge to spelling, vocabulary, reading situations.

3) Student learning dependent on teacher knowledge

- Students as independent morphological problem-solvers?
- Teachers need knowledge & tools to act as independent morphological problem-solvers.

Is <does> really an irregular spelling?

Typically instruction leads children to believe that <does> is one of many irregular spellings they have to memorize. In contrast, the word <goes> is treated as regular.

See how the matrix and word sums below make sense of these spellings by providing a concrete representation of the interrelation of structure and meaning of the <do> and <go> word families.

A morphological matrix for <do> and <go>

do go	ing es ne

Word Sums for <do> and <go>

do + ing → doing   go + ing → going
do + es → does   go + es → goes
do + ne → done   go + ne → gone

With these linguistic tools, children can be introduced to <does> as an ingenious spelling because it marks its meaning connection to its base <do> with a consistent spelling. The spelling structure of these word families is a brilliant opportunity to show children why it is useful that most letters (graphemes) can represent more than one pronunciation. Only in this way could the spelling of <do> and <does> use the same spelling of the base!

Instead of adding it to a list of irregular words, teachers who understand morphology can use the spelling of a word like <does> to introduce children to the ordered way their spelling system works.

"Teachers who consider English a chaotic and unprincipled writing system likely foster a similar view among their students. Such pupils may not look for patterns in the system because they believe that few exist to be discovered. Teachers who appreciate the writing system can help students find its patterns, fostering a positive attitude about spelling"

Treiman and Kessler (2005, p. 133)

Screen shots from classroom videos
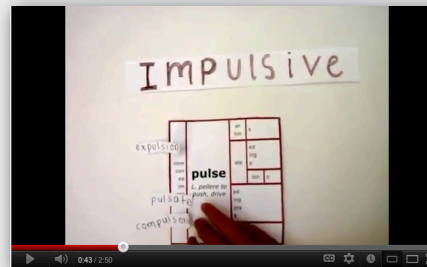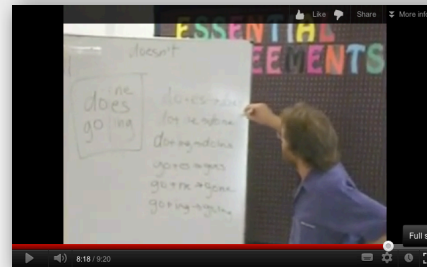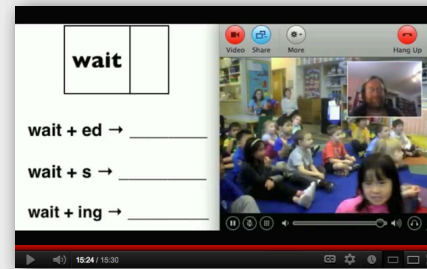
Links to classroom videos

Click here for a lesson introducing kindergarten students to the word sum and the matrix.

Click here for a lesson investigating the spelling system through word sums and matrixes for <do> and <go>.

Click here for a Grade 7 presentation of learning about Greek mythology via morphological and etymological analysis.

Click here for a Grade 7 student explaining his understanding of the political world through morphological and etymological analysis of the word <dissent>.
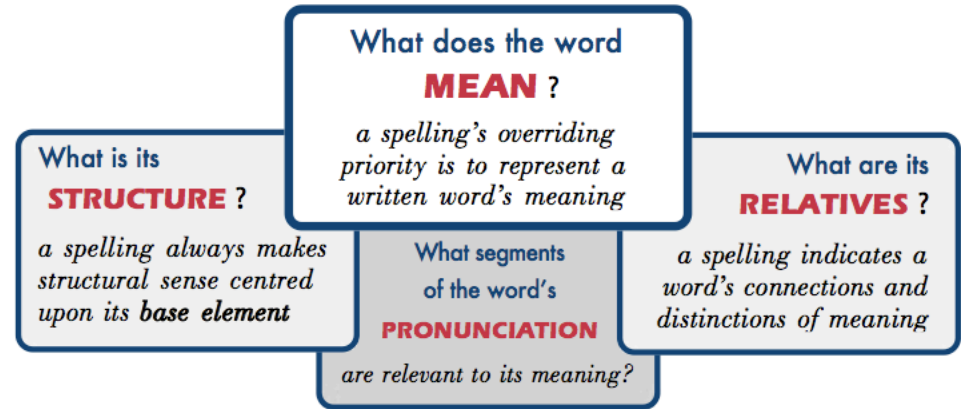
Explore a large bank of videos of structured word inquiry in classrooms at this YouTube page.

Guides for Structured Word Inquiry

Core Ideas Guiding Structured Word Inquiry

Once teachers develop a basic understanding of English spelling and they begin to take on the structured inquiry approach (Bowers & Kirby, 2010), they should be able to identify how any instruction of the written word reinforces one, two or or all of the following "big ideas."

1. English spelling is a highly ordered system for representing meaning that can be investigated and understood through scientific inquiry.

2. Scientific inquiry seeks the most elegant solution -- the deepest structure that accounts for the greatest number of cases. (See this example)

3. Analysis of word structure for meaning cues can be used to deepen understanding of concepts and terms in any subject area (Science example, Humanities example & video).

What does the word MEAN ?
a spelling's overriding priority is to represent a written word's meaning

What is its STRUCTURE ?
a spelling always makes structural sense centred upon its *base element*

What segments of the word's PRONUNCIATION are relevant to its meaning?

What are its RELATIVES ?
a spelling indicates a word's connections and distinctions of meaning

Above figure from www.realspelling.com

Process of "Structured Word Inquiry"

1) Catch learners with an interesting spelling question. (e.g., why <g> in <sign>?)

2) Strategically present a set of words that makes the relevant pattern more salient.

3) Help learners hypothesize a solution from carefully presented evidence.

4) Guide testing of learners' hypotheses and identify the precise pattern.

5) Practice the identified pattern with appropriate tools (e.g., word sums, flow charts).

See more on structured word inquiry, and the difference between "teacher-led inquiry" and "inquiry-led teaching" at this link.

Stuck on a Spelling?
Investigate with these questions...

(1) What does the word mean?

(2) How is it built?
   (Can you identify any affixes with a word sum?)

(3) What other related words can you think of?
   (Can the Word Searcher help you make a matrix?) → morphological connections?
   (Can a word origin dictionary help you?) → etymological connections?

(4) What are the sounds that matter?
   (What grapheme/phoneme correspondences can you find that fit in your hypothesized morphemes?)

The word matrix
(www.realspelling.com)

un in re con	**quest** *Latin Root* *quaerere* '*ask, seek, gain*'	s ing ed
		ion	s able ing

The **word matrix** marks the only feature of an orthographic morphological family that is stable - the underlying orthographic representation of its morphemes. These representations correspond to what Carol Chomsky (1970) called "lexical spellings."

The pronunciation and connotation of a morpheme can vary across members of a family. The lexical spelling of a morpheme -- that is captured by word sums and matrices -- remains stable.

## The morphological matrix is a map of the interrelation of *structure* and *meaning* of written word families

The word matrix represents members of an orthographic morphological word family. Such word families share a connection in *both* **structure** and **meaning**. (See tutorial film & resource from Real Spelling here.)

• *structure*: common underlying spelling of the base
• *meaning*: common ultimate etymological origin of the base

Inclusion of a word in a matrix is tested with a word sum. The word sum isolates the constituent morphemes (bases and affixes) on one side of the rewrite arrow (marking all morphological suffixing conventions) and on the other, the realized surface structure of the word.

An "echo" of the denotation of the root meaning of the base of any word represented by a matrix can be detected in the connotation of that realized word. The denotation of the root meaning of a word is checked with an etymological reference (e.g. etymonline.com).

Interrelation of graphemes and morphemes
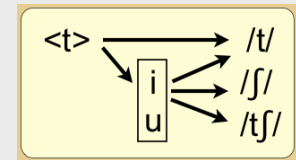
Graphemes comprised of single letters or 2- or 3-letter teams that represent a phoneme. They occur within morphemes.

Possible phonological representations of a grapheme are signaled by circumstances.

The diagram above shows three of the possible phonological representations of the <t> grapheme. Two of these are realized in the words of the <quest> matrix shown on this page.

Note that since the <o> and the <e> graphemes in <does> are not in the same morpheme, there is no <oe> digraph in this word.

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base spelled	base pronounced	Word Sums (examples listed by pronunciation of base)	
<quest>	/kwɛstʃ/	*quest + ion* → question	*quest + ion + able* → questionable
	/kwɛst/	in + quest → inquest con + quest → conquest	re + quest + ed → requested

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matrix	base spelled	base pronounced	Word Sums (examples listed by pronunciation of base)
do ing es ne	<do>	/du:/	do + ing → doing
		/dʌ/	do + es → does do + ne → done

A Series of "Teacher-Led Inquiry" lessons sparked from the question "Why is there a <g> in <sign>?

Taken from "Teaching How the Written Word Works" (Bowers, 2009)

Name_____

Activity Sheet #1

Word Building: Using a Real Spelling Word Matrix

A WORD MATRIX USUALLY ONLY SHOWS *SOME* POSSIBLE WORDS, YOU CAN USUALLY FIND MORE IF YOU TRY!

Rules for reading a word matrix:
- Read a matrix from left to right
- Make only single, complete words from a matrix
- If you are unsure that a word you build is a real word, check a dictionary
- You don't have to take an element from every column of a matrix – BUT
- You must not 'leapfrog' over a column
- WATCH THE JOINS – sometimes changes happen where you add a suffix

re		**sign**	al ing ed ment ify
as			
re	de		ate	ure

Build words with your cut out **prefixes** and **suffixes** on the **base** <*sign*>. Once you have built a word, write the **word sum** as modeled in 1 and 2.

Part A:

_____

prefix(es)- **base** - suffix(es)

1) <u>sign + al</u>   → <u>signal</u>

2) <u>as + sign + ment</u>   → <u>assignment</u>

3) _____ → _____

4) _____ → _____

5) _____ → _____

6) _____ → _____

7) _____ → _____

8) _____ → _____

9) _____ → _____

10)_____ → _____

4

┌───┐
Real Spelling Tool Box Connection
3E - The base elements <sci> and <sign>
└───┘

Lesson #2: Spelling Detectives

When does Suffixing Cause Changes at the Joins?

A) Investigation: Developing a hypothesis

Study the matrix for <move> and the word sums created from it to see if you can discover a consistent suffixing pattern.

Word Sums from <move> Matrix

(Draw a line through silent <e>s replaced during suffixing as shown in the second sum.)

re un	**move**	s ing ed er ment

move + s	→	moves
move + ing	→	moving
move + ed	→	moved
move + er	→	mover
move + ment	→	movement
re + move + ed	→	removed
re + move + er	→	remover
un + move + ed	→	unmoved

1. What is the change that sometimes occurs at the suffix join?

2. List the suffixes that cause the change: _____ _____ _____
3. List the suffixes that cause no change: _____ _____
4. How are these suffixes different from each other?

5. Our class' hypothesis to explain how you know which suffixes *may* force a change at the join:

┌───┐
Real Spelling Tool Box Connections
1K - Learning from Love (Learn about the letter <v>)
3A - Revisiting Suffixing (Learn many roles of the single, silent <e>)
└───┘

12

From the Matrix to the Word Sum

A foundational part of structured word inquiry is testing connections of structure and meaning by learning to building word sums from matrices.

All of these matrices are taken from the Real Spelling **70 Matrices** disk (www.realspelling.com). This resource allows you to copy and paste any of those matrices to build lessons in minutes. With a little practice, teachers and students soon start building their own matrices.

Rules for reading a word matrix:

- Read a matrix from left to right.
- Make only single, complete words from a matrix.
- Only build words you can use in a sentence.
- You don't have to take an element from every column of a matrix – BUT...
- You must not 'leapfrog' over a column.
- WATCH THE JOINS! Sometimes changes happen where you add a suffix.
  (See the Real Spelling "Big Suffix Checker" Or Neil Ramsden's "Interactive Suffix Checker.")

Some Challenges

Write your word sums that come from these matrices on a separate page. Investigate the matrices to build word sums that...

- Produce compound words.
- Have suffixing changes.
- Force a change in the pronunciation of the base.
- Produce complex words that have 'long vowel sounds'.

Some Questions

- Can you find a base with a grapheme that can represent more than one phoneme?
- What base uses a trigraph?
- What base uses a <t> to represent /t/ in one derivation, but /ʃ/ in another derivation (the same phoneme commonly associated with the <sh> digraph).
- What other questions challenges could you give your class from these matrices?

when how what who	**ever**	y	thing body one where

un dis	**ease**	y	er est ly ness
			es ing ed

super	**star**	s ing ed y less	
		dom let	
		dust light struck fish	
		gaze	ing

ful less	ly ness

	fright	ful	ly ness
		en	s ed
			ing	ly
		s	

un re	**do**	ing er ne able	
		es	n't
		n't	

mis dis ab un re	**use**	ful less	ly ness
		es ing ed er age able ive	
		u	al	ly

un non	**stop**	s ing ed able	
door back show		er	s
		age	es
		gap over watch	

ne	o		al	ly ity
un in ante pre peri post	**nate** *"come into being, be born"*	ion	al	ly ity
			ly	
		ist	ic	
		ure	al	ize *or* ise	es ed ing
					ate	ion
		ive	s ity	

Investigate word meanings by investigating spelling structure and history

Follow the traces of meaning marked by the "footprints" of spelling structure of the family of words built on the base <vestige>.

Word Matrix

in	vestige	i	al	ly
		ate	ed ing ive s	
			ion	s
			or	s y
		es		
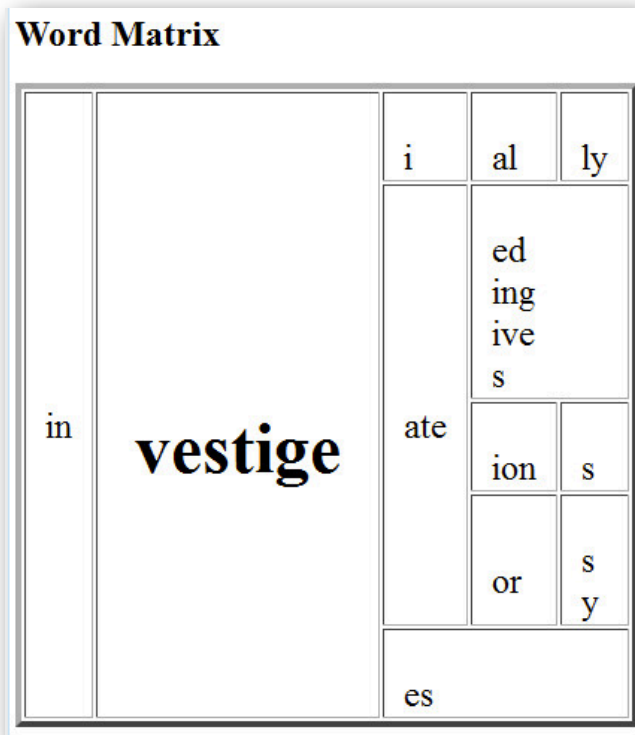
From the Oxford English Dictionary:
<vestige>:
ORIGIN early 16th cent.: from Latin *investigat- 'traced out,'* from the verb *investigare*, from *in- 'into'* + *vestigare 'track, trace out.'*

<investigate>:
ORIGIN early 16th cent.: from Latin investigat- 'traced out,' from the verb investigare, from in- 'into' + vestigare 'track, trace out.'

Learn about words from and with students

This matrix was constructed by a 12-year-old student named Thelonious and his tutor in San Francisco. It was produced as the result of an investigation of the word <investigate> with the help of a new tool called the Word Microscope. This image was from their post on Real Spellers. It was by reading that post that I first learned of the spelling-meaning link between <investigate> and <vestige>.

With the help of the matrix and word sums, elementary students can discover connections of meaning between words that few adults have made. This is just one piece of evidence that it is time to bring these reliable linguistic tools into English speaking classrooms everywhere.

Go here for the word sums Thelonious and his tutor created, and the discussion that grew on www.realspellers.org from this investigation. Download the Word Microscope here. (For now it only available on PC's).

Follow in the footsteps of Thelonious.
Construct word sums from this matrix.

The grapheme-phoneme diagram below clarifies the shift in pronunciations associated with the <g> grapheme in these words.
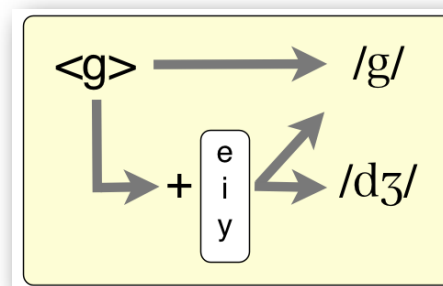
Links & Resources

Wordworks: www.wordworkskingston.com
Free resources, images, video clips and descriptions of this instruction in action around the world.

- YouTube videos of structured word inquiry in practice.
- **WordWorks Newsletter**: Email us at wordworkskingston@gmail.com to receive our free Newsletter with updates, Word Detective Episodes and frequent extra resources.
- **Teaching How the Written Word Works** (Bowers, 2009). This book builds on the 20 session intervention study I conducted (Bowers & Kirby, 2010) in Grade 4 and 5 classes. The lessons with the <sign> and <move> matrices are the first lessons in that book. Email Pete to order a copy.

Real Spelling www.realspelling.com
This is not a spelling program or teaching approach. It a reference that explains how English spelling works. Find many free resources and also excellent resources for sale.

LEX (Linguist-Educator-Exchange)

This excellent blog by Gina Cooke for educators who trying to make sense of the linguistic structure of words.

On-line Structured Word Inquiry Tools:

The Word Searcher:
A key free tool for collecting words according to surface patterns so that word scientists can investigate the substructure of words. This is an invaluable tool for your spelling investigations.

Mini Matrix Maker
A basic tool for typing word sums and turning them into matrices. See a "how to video" at this link.

The Word Microscope:
This software allows the user to construct matrices from word sums, search for likely members of morphological families and much more. It guides learners in their quest to make sense of English spelling.

Real Spellers: www.realspellers.org
This website by Matt Berman (Grade 4 teacher at Nueva School in Hillsborough, California) is an excellent site for resources and spelling discussions from teachers around the world.

Teacher Blogs with Videos, Investigations etc:

- Dan Allen's Grade 5 Blog
- Ann Whiting's Grade 7 Blog
- Jen Munnerlyn's LIteracybytes Blog

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