Ladies first? Phonology, frequency, and the naming conspiracy*

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Abstract

In pairs of names, male names often precede female names (e.g. Romeo and Juliet*). We investigate this bias and argue that preferences for name ordering are constrained by a combination of gender, phonology, and frequency. First, various phonological constraints condition the optimal ordering of binomial pairs, and findings from our corpus investigations show that male names contain those features which lend them to be preferred in first position, while female names contain features which lend them to be preferred in second position. Thus, phonology predicts that male names are more likely to precede female names than follow them. Results from our name-ordering experiments provide further evidence that this "gendered phonology" plays a role in determining ordering preferences but also that an independent gender bias exists: when phonology is controlled (i.e. when two names are "phonologically equal"), subjects prefer male names first. Finally, frequency leads to another tendency to place male names first. Further investigation shows that frequent names are ordered before less frequent names and that male names are overall more "frequent" than female names. Together, all of these factors conspire toward an overwhelming tendency to place male names before female names.*

1. Introduction

Not only are *Romeo and Juliet* and *Anthony and Cleopatra* the names of famous Shakespearean plays, but they also have a second feature in common — they exemplify the trend for male names to be ordered before female names in name pairs. This trend isn't limited to famous Shakespearean couples but can also be found with other famous pairs, such as those in the cartoons (*Mickey and Minnie*), comics (*Dagwood and Blondie*), movies (*Rhett and Scarlett*), television shows (*Ozzie and Harriett*),

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and even those across history (*Adam and Eve*). General investigation of well-known name pairs shows a clear male-first ordering bias. Further examples are given below:

(1)	Fred and Wilma	Fred and Ginger
	Barney and Betty	Will and Grace
	Sonny and Cher	Franklin and Eleanor
	John and Yoko	Donald and Daisy
	Donny and Marie	Samson and Delilah

This generalization also appears to hold for pairs of male and female names more generally. Wright and Hay (2002) surveyed the web for pairs of male and female names and found that name pairs beginning with male names provided more hits than the same name pair ordered with the female name first. For example, a search on the pair "Sarah and Michael" returned 3350 hits, while a search on "Michael and Sarah" returned 5490 hits; similarly, a search on the pair "Kaitlyn and Matthew" returned 31 hits, while a search on "Matthew and Kaitlyn" returned 49 hits. Across eighteen different Internet searches on name pairs, male names preceded female names roughly 60% of the time.

These findings raise some obvious questions: why do male names tend to be placed first? Is a gender bias involved? And if so, is this bias solely responsible for the order in which names tend to appear, or are other factors involved as well? In this article we address these questions by looking at a variety of factors that contribute to the ordering of male and female names in name pairs — phonology, gender, and name frequency. We argue that all of these factors conspire together to create an overwhelming tendency to place male names first.

In Section 2, we begin by outlining relevant literature on phonological wellformedness in English in order to determine which phonological factors are optimal in conjoined word pairs in general (i.e. for determining the ordering of elements in "binomial pairs"). We demonstrate that some words display "first position" phonology and would be well formed in the first position of a binomial pair, whereas, others display "second position" phonology and would be well formed in the second position of a binomial pair. In Section 3, we analyze the phonological features of common male and female names and present findings from a large-scale corpus investigation, which demonstrates that popular male names tend to be characterized by phonological features which lend to a first-position ordering preference, while popular female names tend to be characterized by features which lend to a second-position ordering preference. In Sections 4 and 5, we then present two experiments that specifically investigate the roles that gender and various phonological features play in determining ordering preferences. In Section 6, we look more closely at these results, relating them back to the findings from our corpus study. Section 7 investigates one additional factor in the name-ordering conspiracy — the role that frequency plays in the ordering of proper names. Finally, Section 8 provides a summary and discussion of our findings.

2. Phonological constraints on ordering in English

Binomial pairs involve set phrases such as "bread and butter" or "tables and chairs," where one ordering of the elements is preferred to the opposite ordering. Several authors have argued that the ordering of the elements in such pairs is at least partially conditioned by phonological principles. For example, as shown in (2), Cooper and Ross (1975: 71) provide a list of phonological constraints that they believe may influence ordering preferences:

(2) Compared to place 1 elements, place 2 elements contain, other factors being equal:
  a. more syllables;
  b. longer resonant nuclei;
  c. more initial consonants;
  d. a more obstruent initial segment, if both place 1 and place 2 elements start with only one consonant;
  e. a vowel containing a lower second formant frequency;
  f. fewer final consonants;
  g. a less obstruent final segment, if both place 1 and place 2 elements end in a single consonant.

However, Cooper and Ross's constraints are somewhat questionable. They are each illustrated with a limited number of examples and are not supported statistically, making any assessment of their import difficult. Cooper and Ross also do not provide any independent phonological justification for their constraints. Four of the suggested constraints (a, b, e, and g) have subsequently received experimental verification (e.g. Bolinger 1962; Pinker and Birdsong 1979; Oakeshott-Taylor 1984), but many of them remain speculative. Thus, the question still remains: to what extent does phonology determine the orderings in binomial pairs?

In this section, we first outline the types of phonological principles that seem likely to influence the ordering of binomials. If there are phonological constraints on binomial pairs, then they likely relate to an optimization of the overall phonological wellformedness of the resultant phrase. The optimal segments for phrase-initial position differ from those that are optimal in phrase-final position. In other words, given a choice between "A and B" and "B and A," without a semantic or pragmatic reason to prefer one ordering over the other, a speaker is most likely to opt for the phrasing that is phonologically superior.

Of course this hypothesis raises the question of what counts as "phonologically superior?" We aim to answer this question below by discussing several phonetic/phonological processes known to operate in English. These processes relate to rhythmic structure, syllabification principles, edge effects such as domain-initial strengthening and phrase-final lengthening, and vowel quality.

2.1. *Rhythm*

English displays a strong preference for alternating beats (Selkirk 1984). These beats are organized into a trochaic foot structure, and feet are generally aligned to the left (e.g. Hayes 1995). Clearly, this can affect preferences for the orderings of words in phrases; indeed, in a word-ordering task, McDonald et al. (1993) demonstrate that subjects have a preference for words to be ordered in such a way that "enhances rhythmic alternation between stressed and unstressed syllables" (McDonald et al. 1993: 215). Thus, the optimal phrasing for a binomial expression should be one that preserves an alternating, preferably trochaic, stress structure. For example *salt and pepper* displays perfect trochaic structure. However, *pepper and salt* does not; it contains a medial sequence of two weak syllables. One-syllable words, then, should show a tendency to be ordered before multisyllabic words. In a discussion of the syllable structure of binomial phrases, Malkiel (1959) argues, "Modern English displays a very marked partiality to short plus long [elements]" (Malkiel 1959: 149). Moreover, Cooper and Ross (1975) claim that words with more syllables tend to go in the second position of a binomial pair — likely a reflection of the drive to maintain trochaic structure. In addition, Bolinger (1962) and Pinker and Birdsong (1979) demonstrate experimentally that monosyllables are preferred in initial position. In Pinker and Birdsong's investigation, they found that this preference was reliably stronger than the other vocalic factors they considered.

2.2. *Syllabification principles*

Presumably an optimally formed binomial phrase, as its own prosodic unit, will display some of the same properties that words do and, accordingly, be subject to preferred syllabification principles. The two principles likely to have greatest impact are those that are formulated in optimality theory as ONSET (syllables have onsets) and NO-CODA (syllables do not have codas) (Prince and Smolensky 1993). For example, *hook and eye* minimizes violations of these syllabification principles (assuming resyllabification can occur), whereas *eye and hook* violates both. In general, we might expect consonant-initial words to occur in first position; here they would provide the initial syllable with a natural onset. However, we might expect vowel-initial words to occur in second position. In first position, a vowel-initial word will constitute a clear violation of ONSET, whereas in second position it has the opportunity to pick up an onset from the preceding "and," for example, by gemination of the nasal.

In addition, we might speculate that vowel-final words would be preferred in second position, rather than first position. If a word ends in a vowel, then its presence in second position provides no violation and conforms with NO-CODA. If it is in first position, however, it creates a vowel-vowel hiatus with the following "and" — violating ONSET. This generalization is supported by Cooper and Ross's claim that second position words in binomial pairs tend to have "fewer final consonants."

2.3. *"Strong" and "weak" positions*

There is a robust and growing literature indicating that phrase-initial elements receive greater articulatory effort than elements that are phrase medial or phrase final. At the word-level, it has been shown that in monosyllabic CVC words the initial consonant tends to be longer and have greater articulatory magnitude than the final consonant (Lehiste 1960, 1961, 1964; Byrd 1994; Keating et al. 1999). Fougeron (1999) provides a comprehensive overview of the literature on word boundaries, summarizing as follows:

> In initial position, the glottal opening gesture for consonants is longer and greater [...]. Labial muscular activity in initial consonants and vowels is greater. The velum is higher in initial oral and nasal consonants. The tongue is higher and linguopalatal pressure greater in consonants. (Fougeron 1999: 26)

An effect of initial strengthening has also been established at the phrase level — with initial consonants showing effects of strengthening when they are phrase initial rather than phrase medial (Pierrehumbert and Talkin 1992; Jun 1993; Keating et al. 2004). Elements which are phrase final (and, in particular, prepausal) should be prone to a process of phrase-final lengthening (Wightman et al. 1992), in which the rhyme of the final syllable of the phrase is lengthened, roughly in proportion with the strength of the following boundary.

Most of the literature on edge effects relates to how the articulation of individual segments is affected by their word or phrase position. However, such generalizations are likely to also relate to the identity of segments which tend to appear in different positions. Indeed, there is some evidence that position-specific strengthening effects have led to asymmetries in phonological distribution. Segments in initial position are more often preserved, whereas those in weaker positions tend to be reduced or deleted (Martinet 1995, as cited in Keating et al. 1999). This tendency results in an asymmetrical distribution of phonemes, such that word-initial consonants are more likely to be obstruents, whereas consonants in weaker positions tend to be sonorants (Hock 1991; Vennemann 1993). Similarly, consonant clusters that require multiple constrictions and a high degree of articulatory effort might be expected to be more frequent in initial position than in final position.

We conducted a brief analysis of the phonological properties of initial and final elements of English monomorphemes to determine if the frequency of phonemes is indeed influenced by trends for initial strengthening and final weakening. This investigation was carried out by using a corpus of 11,383 monomorphemes extracted from the CELEX lexical database (see Baayen et al. 1995 for a description of CELEX, and Hay et al. 2004 for description of the corpus of monomorphemes).

Results from this brief investigation, shown in Table 1, line up well with the predictions from the literature outlined above, demonstrating that initial position tends to be a "stronger" position than final position. Consonant clusters and obstruents are more likely to be found in initial position than in final position. Moreover, voiced obstruents are more likely to occur in initial position than in final position, and words are more likely to end in vowels than begin with vowels.

Table 1. *Percentage of classes of segments in initial and final position in monomorphemes*[1]

	Initial position %	Final position %	Pearson's Chi-square
Consonant clusters	19	12	178.04, $p < .0001$
Vowels	15	17	25.05, $p < .0001$
Single consonants: obstruents	71	52	633.52, $p < .0001$
Single obstruents: stops	63	62	n.s.
Single obstruents: voiced	32	27	15.82, $p < .0001$

2.4. *Vowel quality*

Cooper and Ross (1975) claim that more closed or front vowels tend to be ordered before more open or back vowels. Pinker and Birdsong (1979) provide experimental evidence for this claim using a nonsense word task and also show evidence that this type of ordering convention may exist crosslinguistically. Their contention is that it is neither height nor frontness alone that conditions the observed orderings, but rather their interaction:

> Since most vowels in English and other languages at least partially confound height and frontness however, it would seem that neither of the vowel quality formations can be replaced by the other; perhaps then the "best" vowel pattern in a freeze would alternate a high front vowel with a low, back one. (Pinker and Birdsong 1979: 506)

Oakeshott-Taylor (1984) also tested the influence of vowels on ordering preferences, focusing specifically on CVC syllables. He also found a preference for syllables with front vowels to be ordered before syllables with back vowels, as well as a preference for syllables with short vowels to be ordered before syllables with long vowels. Like Wightman et al. (1992), he argues that the preferences regarding vowel length can be accounted for by "prepausal lengthening": ordering long vowels after short vowels facilitates the natural process of phrase-final lengthening by placing lengthier segments in phrase-final position.

2.5. *Phonological properties of binomial pairs*

Drawing together the literature with the above generalizations relating to English words, we can begin to make some fairly robust predictions about the "optimal" phonology of binomial pairs. First, the initial segment of a binomial pair is a strong position — particularly if it is also phrase initial. Thus, we expect a higher incidence of obstruents in this position than elsewhere, including a greater incidence of voiced obstruents. In terms of manner of articulation of an initial obstruent, we might predict plosives to be more probable in initial position than elsewhere. We might also expect consonant clusters to be more probable in initial position, as they require a relatively high degree of articulatory effort. Finally, with regard to vowel quality, initial words should also contain high front vowels.

The final segment of a binomial pair should be more likely to be sonorant and more likely to be devoiced. If it is phrase final, it should also be prone to a process of phrase-final lengthening. If there is any effect of the manner of articulation of a final obstruent, we predict nonplosives to be overrepresented. Finally, we expect second position words to contain low back vowels.

Work on binomial expressions tends to be well aligned with the predictions relating to final elements. For example, Cooper and Ross (1975) argue that words in second position tend to have more syllables than words in initial position (e.g. *salt and pepper*). This is a factor that Malkiel (1959), Bolinger (1962), and Pinker and Birdsong (1979) also address. In addition, Cooper and Ross claim that words in second position tend to have fewer final consonants (e.g. *betwixt and between*). They also claim that the final consonant tends to be less obstruent (e.g. *spic and span*), a factor that Bolinger (1962) notes as well. In addition, Cooper and Ross claim that words with longer vowels tend to go in the second position of a binomial expression, while words with shorter vowels are preferred in first position (e.g. *hands and feet*). Pinker and Birdsong (1979) provide some evidence that native English speakers display such a preference, and Oakeshott-Taylor (1984) also found such a tendency, by testing the ordering preferences of CVC syllables in English, as well as in other languages. No work that we are aware of addresses the voicing of final obstruents in binomial pairs.

However, the work on binomial expressions does not coincide well with predictions related to initial segments. For example, Cooper and Ross (1975) maintain that words in second position tend to begin with a more obstruent consonant. This claim is backed up experimentally by Pinker and Birdsong (1979), who manipulate initial obstruents in ten nonsense binomial pairs. These results cast our predictions regarding initial obstruency into some confusion. We return to this issue experimentally below.

In addition, Cooper and Ross also claim that words in second position are more likely to have a greater number of initial consonants. However, as this position is clearly phrase-medial, the literature outlined above would suggest that the optimal phrasing would instead place words beginning with consonant clusters first, rather than second. Moreover, Cooper and Ross's constraints are only based on a small corpus, are not treated statistically, and are not justified phonologically, so it is difficult to know how much weight to place upon them. Indeed, in their discussion of initial consonant clusters, they point out that the constraint is based on just a small number of examples and that the ordering of at least some of the examples may be semantically determined and not necessarily phonologically determined. The uncertainty of Cooper and Ross's claim stands in contrast to the relative robustness of the recent literature of domain-initial strengthening and the clear differences between initial and final segments found in our CELEX investigation. In the absence of experimental evidence relating to consonant clusters, we therefore choose to take the more phonologically plausible claims as our working hypothesis, while acknowledging that the overall situation relating to initial segments appears less clear-cut than that relating to final segments.

Clearly some of these tendencies are stronger than others — some have very robust evidence, and some need to be tested empirically. Overall, we feel the above discussion has provided a sufficiently clear idea of the desirable phonological properties of binomial pairs. Thus, we now turn to an analysis of male and female names. In the beginning of this article, we questioned why male names precede female names in name pairs. We now investigate systematically the degree to which the phonology of male and female names lines up with the optimal ordering preferences for binomial phrases.

3. The phonology of male and female names

In many languages, male and female names are distinguishable by their pronunciation, for example, by gender-specific morphology that differentiates male names from female names. However, in English, the gender of a first name is largely arbitrary; that is, there is nothing about the pronunciation of *John* that distinguishes it as being a distinctly male name or the pronunciation of *Jen* that distinguishes it as being a distinctly female name. Nonetheless, it has been shown that male and female names have particular phonological properties in English. Slater and Feinman (1985) and Cutler et al. (1990) show that male and female names in English are characterized by different phonological patterns. Moreover, Cassidy et al. (1999) demonstrate that many of these patterns are sufficiently distinct that they can be learned by a connectionist network, indicating that the phonology of names is a reliable cue to predicting gender. Finally, Wright and Hay (2002) not only show that male and female names are distinguished by different phonological properties but crucially that these properties indicate a "conspiracy" in terms of the ordering of proper names in name pairs. This preliminary data supported the idea that male names are characterized by "first position phonology" (i.e. phonological properties that lend them to be preferred in first position), while female names are characterized by "second position phonology." According to this conspiracy, male names are ordered before female names in name pairs in part because they contain phonological properties that lend them to be preferred in first position.

Wright and Hay (2002) analyzed 1998's most popular names in English according to Cooper and Ross's taxonomy of binomial features using the 200 most popular male names and 200 most popular female names in American English. In the current study, the corpus investigation was expanded to include 1,000 names total — the 500 most popular male names and 500 most popular female names of 1998. These were taken from the *Baby Zone* website (http://www.babyzone.com), which includes a listing of the most common names taken from social security card applications.[2] For all 1,000 names, we examined their phonological attributes with regard to the various constraints identified in Section 2 that help to determine the optimal articulatory effect of phrase structure. The results of this investigation provide further evidence for the conspiracy alluded to in Wright and Hay (2002). Phonology plays an important role in determining name-ordering preferences: overall, male names are characterized by first position phonology, while female names are characterized by second position phonology.

3.1. *Rhythm*

As outlined above, it has been argued that first position elements tend to have fewer syllables than second position elements (Malkiel 1959; Bolinger 1962; Cooper and Ross 1975; Pinker and Birdsong 1979). Again, this ordering is desirable as it tends to preserve a trochaic stress pattern (e.g. *salt and pepper* instead of *pepper and salt*) and minimally maintain the rhythmic alternation between stressed and unstressed syllables.

Our investigation of popular names reveals that female names are on average longer than male names: female names average 2.4 syllables, while male names average 2.1 syllables. Moreover, separating monosyllabic names from multisyllabic names in our corpus, we found that female names are significantly more likely to be multisyllabic. Only 4.4% of female names are monosyllabic, while 18% of male names are monosyllabic (Pearson's Chi-square $= 46.493$, $p < .0001$). These findings coincide with the results from our previous investigation (Wright and Hay 2002), as well as with various findings presented in the literature (Slater and Feinman 1985; Cutler et al. 1990; Cassidy et al. 1999). Thus, if ordering principles are based upon syllable structure, these findings predict that male names would be more likely to be ordered before female names as they tend to have fewer syllables. Table 2 provides a comparison of male names versus female names according to number of syllables.

Table 2. *Rhythm: a comparison of the number of syllables in male and female names*

	1 Syllable	2 Syllables	3 Syllables	4 Syllables	5 Syllables
Male	90	299	98	13	0
Female	22	268	181	28	1

Table 3. *Syllabification principles: a comparison of the types of tokens in the onsets and codas in male and female names*

	Onsets		Codas	
	V-initial	C-initial	V-final	C-final
Male	82	418	143	357
Female	102	398	329	171

3.2. *Syllabification principles*

3.2.1. *Onsets.* Initial consonants provide the element in first position with a natural onset. Vowel-initial names would lack an onset if ordered in first position: #A*nna and Mike*; however, they could receive an onset from the conjunction *and* if ordered in second position: *Mike an*D A*nna* (or minimally *Mike* N A*nna*, since *and* is often reduced to a syllabic nasal). Thus, for syllabification purposes (i.e. the ONSET constraint), one might expect consonant-initial names to sound better in first position and vowel-initial names to sound better in second position. Overall, 16.4% of male names begin with a vowel, whereas 20.4% of female names begin with a vowel. Thus, for this factor, there is a nonsignificant tendency for male names to be ordered before female names.

3.2.2. *Codas.* As discussed above, according to the NO-CODA constraint, second position elements should be more likely to end in vowels than first position elements. Of the popular female names, approximately 65.8% end in vowels, whereas of the popular male names, approximately 28.6% end in vowels. Clearly, female names are significantly more likely than male names to end in vowels (Pearson's Chi-square = 137.362, $p < .0001$). This finding is not unique. Dunkling (1977), Slater and Feinman (1985), and Lieberson and Bell (1992) have all noted that female names tend to be more likely than male names to end in vowels, particularly schwa. Table 3 provides a summary of these observed counts.

3.3. *Strong and weak positions*

3.3.1. *Domain initial strengthening.* The given names in our corpus were analyzed in terms of initial sonority. This analysis revealed a slight tendency for male names to begin with more obstruent initial segments than female names, but the differences were not significant.[3] As discussed earlier, male and female names differ in the percentage of vowel-initial and consonant-initial names: female names are more likely than male names to begin with a vowel (20.4% vs. 16.4%, respectively). However, there is virtually no difference in the obstruency of the initial consonant. Of the names that begin with a single consonant, 68.9% of male names begin with obstruents, while 67.7% of female names begin with obstruents.

We next turned to the percentage of initial stop consonants. Stops are the most obstruent segment and may be expected to be overrepresented in a phrase initial "strengthened" position. 56.2% of obstruent-initial male names begin with stops, whereas only 48.9% of obstruent-initial female names begin with stops. This result approaches significance, but does not reach it.

Effects of domain-initial strengthening indicate voicing may play a role as well. In particular, we predict a preference for elements beginning with voiced segments to be ordered before elements beginning with voiceless segments. Our results indicate that male names are significantly more likely to begin with voiced obstruents than female names (49% vs. 36.6%, Pearson's Chi-square = 8.45, $p < .005$). Similarly, Slater and Feinman (1985) report a nonsignificant tendency for male names to begin with voiced consonants.

Finally, the number of initial consonants was investigated. As discussed above, consonants, clusters in particular, should be preferred in initial position due to ease of articulation. Overall, 16.4% of male names begin with a vowel, 70.2% begin with a single consonant, and 13.4% begin with two or more consonants. Of the female names, 20.4% begin with a vowel, 71.8% begin with a single consonant, and 7.8% begin with two or more consonants. A Chi-square test comparing the number of names with two or more consonants versus the number of names with fewer than two initial consonants provides a significant effect (Pearson's Chi-square = 8.273, $p < .005$); however, this result is likely due to the fact that female names are more likely to begin with vowels. If the statistical analysis is limited to only those names beginning with consonants, the results are not significant; moreover, if we compare the number of initial vowels to the number of initial consonants, the results are not significant either. Table 4 provides counts of these findings.

Table 4. *Domain initial strengthening: a comparison of the initial segments in male and female names*

	Vowel	Consonant cluster	Single consonant	Sonorant	Obstruent	Obstruent stop	Voiced obstruent
Male	82	67	351	109	242	136	119
Female	102	39	359	116	243	119	89

3.3.2. *Final weakening.* We next turn to properties associated with final weakening. First, final weakening effects predict a preference for sonorant-final names to occur in second position. Indeed, Slater and Feinman (1985) found that female names are significantly more likely to end in sonorant consonants than male names. In our corpus investigation, if we focused our comparison on the names that end in consonants, we also find a trend for female names to end in a more sonorant segment than male names: 70.8% versus 63.9%. However, this difference seems to be carried by the fact that female names are unlikely to end in consonant clusters. If we restrict the comparison just to names containing single consonants, the difference disappears — 71.5% of these names end in a sonorant for female names, versus 71.25% for male names.

It has been claimed that male names are more likely to end in stops than female names (Barry and Harper 1995), a feature we suggested earlier may be associated with first position elements. In our corpus, more male names end in stops than female names, but the differences were not significant. Of the male names ending in single obstruents, 47.8% ended in stops. Of the comparable female names, only 35.4% ended in stops.

Final devoicing/weakening predicts there to be a preference for voiceless segments to occur in phrase-final position; therefore, names that end in voiceless segments would have a second-position preference. Slater and Feinman's results, comparing voiced and voiceless consonants, show a tendency for female names to end in voiced consonants. However, this result is almost certainly due to the finding that female names often end in sonorants. In our analysis, we limited the comparison to (single) obstruent consonants and found that a higher percentage of female names ended in voiceless obstruents, 85.4%, than male names, 79.3%. Although not significant, this trend is consistent with our earlier findings.

Finally, we looked at the number of final consonants. We predict that names ending in consonants — and clusters in particular — would be poor candidates for second position, due to effects of final weakening. In our investigation, we found that female names contain fewer final consonants than male names (Fisher's exact test: $p < .0001$). Of the popular female names, 65.8% end in vowels, 33.8% end in a single consonant, and

Table 5. *Final weakening: a comparison of the final segments of male and female names*

	Vowel	Consonant cluster	Single consonant	Sonorant	Obstruents	Obstruent stop	Voiceless obstruent
M	143	37	320	228	92	44	73
F	329	2	169	121	48	17	41

less than 1% end in two or more consonants. Of the popular male names, 28.6% end in vowels, 64% end in a single consonant, and 7.4% end in two or more consonants. Table 5 summarizes this data.

3.3.3. *Phrase-final lengthening.* Cooper and Ross (1975) claim that vowel length affects the ordering of binomial pairs, arguing that elements with long vowels tend to be ordered after elements with short vowels (e.g. *hands and feet*). This preference was also noted by Pinker and Birdsong (1979) and Oakeshott-Taylor (1984).

In our investigation, we first looked at differences in vowel length with monosyllabic names. According to Oakeshott-Taylor's findings, prepausal lengthening plays a clear role in the ordering of monosyllabic elements. Thus, all vowels of monosyllabic names were coded for length, using a simple division between names with "long" vowels (long vowels or diphthongs) and names with short vowels. We found that monosyllabic female names are significantly more likely than male names to contain long vowels (Fisher's exact test: $p < .05$). Of monosyllabic female names, 90.9% have long vowels, while of monosyllabic male names, 71.7% have long vowels. Thus, if we can assume that vowel length is relevant for monosyllabic names, we see further evidence for a male first ordering preference.

While there is good reason to suspect that vowel length plays a role in determining the ordering of monosyllabic names, it is unclear as to what role it plays in predicting the ordering of multisyllabic names. Nonetheless, we did expand our investigation to look at names that contain two or more syllables. If vowel length primarily affects ordering preferences in terms of prepausal lengthening, we surmised that it should only be relevant for the final vowel in a particular name — whether or not it was in a stressed position. Thus, all of the final vowels in our corpus of names were coded according to length. This produced inconclusive results, however, largely due to the fact that there appears to be a strong interaction between vowel length and word stress. As mentioned previously, monosyllabic female names have significantly more long final vowels than male names. These same results hold for names that have a trochaic stress pattern. Of the trochaic male names, 21.7% end in long vowels, while significantly more of the trochaic female names, 35.2%, end in long vowels (Pearson's Chi-square = 12.013, $p < .0005$). However, for names with an iambic stress pattern, we found the opposite result. All of the iambic male names in our corpus ended in long vowels, while only 48.1% of the iambic female names ended in long vowels. These results are admittedly questionable, given that only eight of the male names in our corpus have an iambic stress pattern; nonetheless, this result shows a very different pattern from that found with the trochaic names. The patterns in three-syllable names show similar levels of interaction between stress and length.

In fact, altogether, more male names contain final long vowels than female names. Of all of the names in the corpus, 38.2% of male names contain a long final vowel, while 31.2% of female names contain a long final vowel (Pearson's Chi-square = 5.4, $p < .02$). This result is the first we have encountered which predicts female names to occur in first position. However, we regard it with some suspicion. Because there appears to be such a strong interaction between stress pattern and vowel length, it's not clear that a single statistic summarizing vowel length over all stress patterns is entirely meaningful. We leave it to further research to determine exactly how vowel length affects ordering preferences and the degree to which stress and vowel length interact.

3.4. *Vowel quality*

Finally, as discussed above, there is evidence that words containing stressed vowels which are high and front should be ordered before words that contain stressed vowels that are low and back. Cutler et al. (1990) noted differences between male and female names in terms of vowel type, identifying a significant overrepresentation of the stressed /i/ in female names. In our investigation, 29% of the monophthongal stressed vowels in female names are high, whereas 23% of vowels in male names are high. Thus, vowel height shows a nonsignificant tendency for female names to be placed in first position. In addition, of monophthongal stressed vowels in female names, 78% are front, as opposed to 66% in male names (Pearson's Chi-square = 12.892, $p < .001$). Here, we have a clear counterexample to the emerging generalization that male names tend to be characterized by first position phonology. As pointed out by Cutler et al. (1990), however, vowel quality and vowel length are not independent and may often make conflicting predictions. For example, /i/ is a long vowel, and long vowels tend to follow short vowels.

Table 6. *Phonology of optimal binomial phrases, and predictions stemming from the phonology of male and female names (an asterisk indicates a significant effect)*

Phonological principle	Specific constraint	Position 1	Position 2	Predicts first element is
Rhythm	trochaic foot structure	monosyllabic		male*
Syllabification principles	onset	initial consonant		male
	no-coda		final vowel	male*
Strong and weak positions	domain-initial strengthening	initial obstruent		no trend
		(if obstruent) plosive		male
		(if obstruent) voiced		male*
		initial cluster		male
	final 'weakening'		final sonorant	male
			(if obstruent) non-plosive	male
			(if obstruent) voiceless	male
			no final clusters	male*
	phrase-final lengthening		long final vowel: monosyllables	male*
			long final vowel: trochees	male*
			long final vowel: all names	female*
Vowel quality		high vowel	low vowel	female
		front vowel	back vowel	female*

3.5. *Summary of corpus study*

Our analysis of a large corpus of popular American names clearly demonstrates that male and female names are distinguished by different phonological properties, specifically those properties that dictate orderings in binomial pairs. In comparison with female names, male names contain fewer syllables (i.e. are more likely to preserve a trochaic stress pattern in binomials), contain more initial and final consonants, have a more obstruent final segment, and are more likely to begin and end with a voiced obstruent and a plosive. In addition, for monosyllabic and trochaic names, they are less likely to contain a long final vowel. However, female names are more likely to contain vowels that are high and front. These findings are summarized in Table 6.

In light of phrase structure constraints associated with conjoined name pairs, we see that there is a clear phonological basis for ordering male names before female names as measured by a variety of constraints. Overwhelmingly, male names are characterized by first position phonology, while female names are characterized by second position phonology. These trends indicate that phonology alone would predict the male-first ordering bias found in binomial pairs of names.

Nonetheless, a number of questions still remain. First, how strong of a role does phonology play in determining ordering preferences? Moreover, how exactly do the various phonological constraints interact? Are some constraints stronger than others, and, if so, which ones? Does this male-first ordering solely reflect a phonological preference, or are there additional biases at work? For example, if the phonological biases are removed (i.e. if two names are "phonologically equal"), will that completely eliminate the male-first ordering preference in binomial name pairs?

In the following sections, we present two experiments that set out to answer these questions. Both Experiments 1 and 2 verify that phonological factors do play an important role in determining name-ordering preferences and that, in fact, some constraints are stronger than others. However, they demonstrate that phonology alone does not account for ordering preferences. When the phonological bias is removed, we found that an independent gender bias exists and that gender, too, accounts for preferences in the ordering of proper names.

4. Experiment 1

Experiment 1 was designed to empirically test the interaction between phonology and gender in name pairs. In particular, we examined the contribution of three factors to the ordering of proper names: gender, syllable count, and onset identity (simple consonant onsets versus complex consonant onsets). Syllable count was manipulated because we felt it was likely to exert the strongest influence of all of the phonological characteristics outlined above. Cooper and Ross (1975) suggest syllable count is the strongest of their constraints, and Pinker and Birdsong (1979) found that syllable count influenced subjects' preferences for orderings of nonsense words more strongly than other factors. Onset identity was manipulated in an attempt to clarify the status of this as a factor that influences ordering preferences. As indicated above, the claims made by Cooper and Ross (1975) regarding initial consonant clusters make opposite predictions to those arising from the literature on domain-initial strengthening.

No empirical work has investigated the potential role of consonant clusters in determining ordering, and so, this was included in the experiment with the hope that the results may shed some light on this question. Finally, gender was manipulated in order to test the degree to which a gender bias influences ordering preference and, crucially, whether or not it can be isolated independently from phonology.

4.1. *Methods*

We presented 46 Northwestern University undergraduates with 100 pairs of written names and asked them to indicate the order in which the names sounded most natural in a given sentential context. An example is given in (3):

(3) Tammy, Freddy
______ and ______ went to the yogurt factory.

The subjects were told to mark 'A' on their answer sheet if the order in which the names were presented sounded most natural (i.e. if they thought *Tammy and Freddy went to the yogurt factory* sounded most natural) and 'B' if they thought the opposite order sounded most natural (i.e. if they thought *Freddy and Tammy went to the yogurt factory* sounded most natural). The order of presentation was randomized and counterbalanced, such that half of the name pairs were presented in the order we expected the subjects to prefer and the other half were presented in the opposite order. Moreover, all of the sentential contexts began with the string *went to*, although the specific destination varied. Our pilot data indicated that including a sentential context was important in order to avoid a strong response bias (see Wright and Hay [2002] for details).

4.2. *Stimuli*

The stimuli consisted of 100 pairs of names, taken from a large corpus of American English names. Thirty pairs of names manipulated a single variable (gender, syllable count, or onset identity), while controlling for others. Thus, the gender condition matched male names with female names while controlling for syllable count and onset identity (e.g. *Bob*, *Peg*), the syllable condition paired one-syllable names with two-syllable names, while gender and onset were controlled (e.g. *Ted*, *Patrick*), and the onset condition matched names with simple onsets with names with complex onsets, while gender and syllable count were controlled (e.g. *Stella*, *Tessa*).

Twenty pairs of names tested the interaction between gender and syllable count. Ten pairs were included in what we call the "matched condition." Here we matched the two factors so they both made the same prediction for ordering preferences — one-syllable male names were paired with two-syllable female names (e.g. *Ben*, *Karen*). Ten pairs were in our "mismatched condition" (the two factors made the opposite prediction for ordering). In this condition, we paired one-syllable female names with two-syllable male names (e.g. *Peg*, *Patrick*).

Twenty pairs tested the interaction between gender and onset type. In our matched condition, we paired male names with complex onsets with female names with simple onsets (e.g. *Freddy*, *Tammy*); the mismatched condition included female names with complex onsets paired with male names with simple onsets (e.g. *Trudy*, *Corey*).

Twenty pairs tested the interaction between syllable count and onset type. In the matched condition, one-syllable names with complex onsets were paired with two-syllable names with simple onsets (e.g. *Trish*, *Candace*). In the mismatched condition, one-syllable names with simple onsets were matched with two-syllable names with complex onsets (e.g. *Kate*, *Scarlett*).

Finally, we included ten pairs in which we predicted that all three factors would agree in terms of ordering predictions. Here one-syllable male names with complex onsets were matched with two-syllable female names with simple onsets (e.g. *Fred*, *Candace*).

In addition to controlling for the factors discussed above, the initial and final segments were matched for obstruency, and no names ended in consonant clusters. Thus, we either manipulated or controlled for most of the factors identified above. The only factors we were unable to control for were initial and final voicing and vowel length. These factors proved too difficult to control in conjunction with all of the other factors we manipulated; thus, we allowed for some variation here and analyzed the effects in a post-hoc analysis.

4.3. *Results*

Both gender and phonology play roles in determining ordering preferences. First, when phonology was controlled, subjects displayed a significant preference for male names to be ordered before female names ($p < .001$).[4] Overall, 61% of subjects ordered a majority of pairs in the "gender" condition with the male name first, 26% displayed no preference, and 13% displayed a tendency for the female name first. Moreover, we noticed that this preference was stronger for male respondents than for female respondents. Due to the composition of the subject pool in which this experiment was conducted, we had more female respondents (31) than male respondents (15) in this study; nonetheless, when we break down our data by male and female respondents, some interesting differences are revealed. In the gender condition, 66% of male respondents showed a tendency for a male-first ordering preference, while only 58% female respondents showed that same tendency.

An analysis of the syllable condition demonstrates that phonology also plays a role in determining ordering preferences: one-syllable names are preferred before two-syllable names. When gender was controlled, subjects displayed a significant preference for one-syllable names in first position ($p < .01$). 61% of subjects displayed a significant preference for one-syllable names in first position ($p < .01$), 17% of subjects displayed no preference, and 22% of subjects displayed a tendency to put two-syllable names first. Again, when we break our data down by male and female respondents, some interesting differences are revealed. For female respondents, the syllable bias was the strongest constraint: 66% showed a preference to place one-syllable names before two-syllable names. For male respondents, the gender bias was the more dominant constraint; only 57% of male respondents placed one-syllable names before two-syllable names (see Wright and Hay 2002 for more discussion).

The onset condition revealed no significant results. As we suspected, there was a tendency for subjects to place cluster-initial names in first position, but it was a weak tendency and did not reach significance. This finding suggests that if the onset condition plays any role in determining ordering preferences, it plays a small role at best.

As indicated above, we were unable to completely control for vowel length, although it has been argued that this does play a role in influencing ordering preferences (Cooper and Ross 1975; Pinker and Birdsong 1979; Oakeshott-Taylor 1984). And while we were able to control for the sonority of initial and final consonants, we were unable to completely control for voicing.

Therefore, we carried out a post-hoc analysis to check whether vowel length, initial voicing, or final voicing contributed significantly to subjects' ordering preferences and also to check that the syllable bias and gender bias are not artifacts of lack of control for vowel length or voicing. Thus, each name in our stimuli was assigned values for the potential contribution of the following factors to its acceptability in first position:

(4) a. gender
b. syllable count
c. onset identity
d. vowel length
e. initial voicing
f. final voicing

All but one of these factors was binary (e.g. male = 1, female = 0; monosyllabic = 1, multisyllabic = 0, etc.), with the exception of vowel length, where we made a ternary distinction between short vowels, long vowels, and diphthongs. Six "difference" values were calculated for each pair of names in the stimuli — the differences between the names' scores for each of the variables — and this data was then implemented into a multiple regression model. Our model indicated that three factors — gender, syllable count, and vowel length — played significant roles in determining subjects' ordering preferences, returning $r^2 = .37$, $p < .001$. This test demonstrates that vowel length did make a significant contribution to subjects' behavior, but it also demonstrates that the significant results involving gender and syllable count are not artifacts of a lack of control for other factors. All three factors significantly contributed to subjects' preferred orderings.

5. Experiment 2

In our second experiment, we further examine the interaction between gender and phonology by focusing on the contribution of two additional phonological factors to name-ordering preferences — sonority of the initial and final consonants. We manipulated initial and final sonority in part to clarify their status in terms of determining name-ordering preferences. Our corpus data indicated greater differences between male and female names in terms of final sonority than initial sonority, and we wanted to see whether there were any such differences in an empirical investigation. Second, the role of initial sonority is extremely unclear. While, on phonological grounds, we expect more obstruent-initial segments phrase-initial, Cooper and Ross (1975) and Pinker and Birdsong (1979) argue that the opposite is actually true in English. Pinker and Birdsong's experimental data is somewhat limited (ten nonsense word pairs, and no control for prosodic positioning, or preceding environment). Thus, we wanted to investigate whether the directionality of their result would be replicated with a more careful study. Thirdly, by manipulating only initial and final sonority (in conjunction with gender), we found that we had more flexibility in terms of our stimuli choice; crucially, we were able to use more carefully controlled stimuli than in the first experiment by specifically choosing name pairs that matched with respect to vowel length, eliminating the need to evaluate this post hoc. However, we were unable to completely control for voicing of initial and final obstruents. This factor simply proved too difficult to control for in addition to everything else; moreover, as the post-hoc analysis of Experiment 1 showed no significant effect of voicing, we allowed for some variation in voicing. Finally, by again manipulating both phonological constraints and gender, we were able to determine the interaction among these different constraints for determining ordering preferences.

5.1. *Methods*

The methodology used for Experiment 2 is identical to that for Experiment 1. We presented 28 Northwestern University undergraduates with 100 pairs of written names and asked them to indicate the order in which the names sounded most natural in a given sentential context. Again, the order of presentation was randomized and counterbalanced, such that half of the name pairs were presented in the order we expected the subjects to prefer and the other half were presented in the opposite order.

5.2. *Stimuli*

The stimuli consisted of 100 pairs of names taken from a large corpus of American English names. Thirty pairs of names manipulated a single variable (either gender, sonority of the initial consonant, or sonority of the final consonant), while controlling for others. In the gender condition, we matched male names with female names while controlling for initial and final sonority (e.g. *Don*, *Kim*). In the initial-sonority condition, names beginning with sonorant initials were paired with names beginning with obstruent initials, while gender and other phonological factors were controlled (e.g. *Liz*, *Tess*). In the final-sonority condition, names ending with sonorant finals were paired with names ending with obstruent finals, while again gender and other phonological factors were controlled (e.g. *Dave*, *Shane*).

Twenty pairs of names tested the interaction between gender and initial sonority. Again, we use the terminology "matched" and "mismatched" for convenience to describe the different interactions, while acknowledging that the predictions here are unclear. The terms "matched" and “mismatched” are used under the assumption that our results will replicate Pinker and Birdsong’s (1979) findings. Ten of the pairs matched the two factors so they both made the same prediction — sonorant-initial male names were paired with obstruent-initial female names (e.g. *Lincoln*, *Karen*). Ten pairs were in the mismatched condition, in which obstruent-initial male names were paired with sonorant-initial female names (e.g. *Gary*, *Molly*).

Twenty pairs tested the interaction between gender and final sonority. Ten of these pairs matched the two factors — sonorant-final male names were paired with obstruent-final female names (e.g. *Neil*, *Rose*). Ten of these pairs mismatched these two factors — obstruent-final male names were paired with sonorant-final female names (e.g. *Ed*, *Ann*).

Twenty pairs tested the interaction between the sonority of the initial and the final consonants. In the matched condition, names with obstruent initials and sonorant finals were matched with names with sonorant initials and obstruent finals (e.g. *Dawn*, *Ruth*). In the mismatching condition, names with obstruent initials and obstruent finals were matched with names with sonorant initials and sonorant finals (e.g. *Neil*, *Dave*).

In the final condition, we included ten pairs that manipulated all three factors together. We paired male names with sonorant initials and obstruent finals with female names with obstruent initials and sonorant finals (e.g. *Mike*, *Jane*). Here, gender, final sonority, and initial sonority all predict the male name will appear first (that is, assuming that Pinker and Birdsong are correct).

5.3. *Results*

Replicating the results from Experiment 1, we found that when phonology is controlled, subjects display a significant preference for male names in first position ($p < .01$). Overall, 57% of subjects ordered a majority of pairs in the “gender” condition with the male name first, 29% displayed no preference, and 14% displayed a tendency for the female name first. Since there were a limited number of male subjects who participated in this second experiment (only six total males), we were unable to determine whether there were any differences in responses according to the gender of the respondent.

In addition, we found further evidence that phonology plays a significant role. When gender is controlled, subjects prefer obstruent-final names in first position ($p < .05$). 64% of subjects displayed a significant preference for obstruent-final names in first position, 14% of subjects displayed no preference, and 21% of subjects displayed a tendency to put sonorant-final names first.

Analyzed in isolation, the initial-sonority condition revealed no significant results. In fact, contrary to our initial expectations (and in line with Pinker and Birdsong's findings), we found that there was a tendency for subjects to place sonorant-initial names in first position. 43% of subjects displayed a preference for sonorant-initial names in first position, 32% of subjects displayed no preference, and 25% of subjects displayed a tendency to put obstruent-initial names first.

We analyzed the contribution of five separate factors through a multiple regression model, coding each name for the following:

(5) a. gender
 b. initial sonority
 c. final sonority
 d. initial voicing
 e. final voicing

Our results show that a stepwise linear model retains all three manipulated factors (gender, initial sonority, and final sonority) as significant predictors of the direction and strength of subjects' preferred orderings. The voicing of the initial segment had no effect, and thus was not incorporated into the model, but the voicing of the final segment was significant: final voiceless segments were preferred in second position. Thus, also included in the model was the interaction between final sonority and voicelessness, as voicing clearly only matters amongst the obstruent consonants. Overall, the model returns $r^2 = .51$, $p < .0001$. This demonstrates that three phonological factors, in conjunction with gender, played a role in determining name-ordering preferences and that contrary to our expectations, initial sonorants were more likely to be ordered before initial obstruents. Ordering the factors by the strength of the return coefficients gives the following ranking of constraints: gender > final sonority > initial sonority > final voicing.

6. Ordering of constraints

Experiment 1 demonstrates that gender and syllable count play significant roles in accounting for name-ordering preferences. Experiment 2 indicates that gender, initial sonority, and final sonority also play significant roles in accounting for name-ordering preferences, although initial sonority is admittedly a weak tendency and in the opposite direction from that predicted by effects of domain-initial strengthening. In addition, our post-hoc findings indicate significant effects of final voicing and vowel length, as well as a nonsignificant tendency in the predicted direction for initial consonant clusters.

Thus, of the factors manipulated, gender, syllable count, and final sonority show very robust effects for ordering. The effect of vowel length also emerges as a strong one in our post-hoc analysis and has previously been demonstrated experimentally to have a significant effect upon ordering (Oakeshott-Taylor 1984). Final devoicing also emerges post hoc as a significant factor in just one of our experiments but not the other — so we can perhaps regard this as tentative evidence in favor of its influence. Initial sonority has a weaker effect and consonant clusters show no significant effect.

Strikingly, we see interesting similarities between these experimental results and our corpus findings in that those constraints that had the strongest effects in the experiment were those that seemed to be most overrepresented in popular male names. As discussed above, some phonological effects played more significant roles than others in the name-ordering tasks. Similar differences were found in our corpus study. Here we found that there were significant differences between male and female names in terms of syllable count and vowel length (at least for monomorphemes and trochees, which our experimental stimuli consisted of). In the corpus, there was also a strong trend for final sonorants — a factor that Slater and Feinman (1985) reported had a significant effect in their corpus of names. In addition, we found nonsignificant trends for factors involving final voicing and consonant clusters, and we found no trend for initial consonant clusters.

Clearly, further investigation is necessary to determine exactly how all of these factors correlate. However, we predict that future work may reveal that the degree to which a factor affects a first-position preference in binomials is partially correlated with the degree to which it is overrepresented in male names.

7. Frequency

Both corpus data and experimental data suggest that preferences for name ordering are constrained by a combination of gender and phonology. Male names are characterized by first position phonology, while female names are characterized by second position phonology, and this phonological bias, together with an independent gender bias, accounts for an overwhelming tendency to place male names first. However, one potential factor that has not yet been addressed is the role of frequency.

Golenbock (2000) argues that in general binomial pairs, the more frequent word tends to be ordered first (e.g. *ball and chain*). Is this true for name pairs as well? That is, in name-ordering tasks, do people tend to put more frequent or more common names first? In this section, we discuss a post-hoc analysis that set out to determine whether or not frequency also plays a significant role in name-ordering preferences.

7.1. *Post-hoc analysis*

To address this issue, we coded the names used in Experiments 1 and 2 according to their rank in the corpus of names from social security card applications in 1998, as listed on the Baby Zone website. We operated under the assumption that the more frequent names would be ranked higher in the corpus than the less frequent names. Thus, the name Michael was coded '1,' as this was the most popular boys' name, and the name Harvey was coded '755,' as this is the position on the list of boys names where "Harvey" appears. We then took the difference between the two names in each stimulus pair and added this factor into the multiple regression analysis conducted for each experiment.

For the dataset presented in Experiment 1, we found that frequency proved to be a highly significant factor in predicting name-ordering preferences. More common names were more likely to be ordered before less common names (f-statistic = 20.44, $p < .0001$; complete model: $r^2 = .46$, $p < .0001$). For the dataset presented in Experiment 2, we found that there was a tendency for frequent names to be ordered first, but it didn't reach significance. However, as shown by its retention in a stepwise multiple regression model, frequency helped to account for modeling the data overall. Frequency, in conjunction with gender and phonological constraints, accounts for name-ordering preferences ($r^2 = .53$, $p < .0001$). Thus, in addition to gender and phonology, frequency seems to play an important role in dictating name-ordering preferences. In name pairs, frequent names tend to be ordered before less frequent names.

7.2. *Frequency of male and female names*

The frequency bias is particularly intriguing because frequency and gender do not appear to be independent. Barry and Harper (1995) compare popular names in 1960 with those in 1990 and find that choices of names were more diverse for females than males in both years. If there tended to be a wider range of names for females than males, then this would lead male names, at any given time, to be more frequent. Cutler et al. (1990) analyze the lists of the 50 most popular names in (a) the United States in 1925, 1950, 1970, and 1986, and (b) England and Wales in 1925, 1950, 1965, 1970, and 1986. They find that male names are more consistent across these different lists than female names. Such consistency would again lead male names to be more frequent.

In our corpus investigation, we found even further evidence for this claim. Over time, popular male names remain fairly stable while popular female names often change. In a large corpus of popular male and female names from 1880 to 1990 (www.babycenter.com), we found that male names remain on the top ten lists of popular names significantly longer than female names (2-tailed, unpaired $t(81) = 3.765$, $p < .001$). For example, the name *James* has remained popular for over a century, appearing on the top ten lists of most popular names for all twelve decades between 1880 and 1990. Similarly, *John* and *William* have remained popular, appearing on top ten lists eleven and ten decades, respectively, and *Robert* has appeared as a popular name on nine of the twelve lists. In fact, between the years of 1880 and 1990, an analysis of the most popular male names from each decade demonstrates that the average male name occurs 4.25 times across the twelve different lists. Only seven names appear on one single list during this time period (Ronald, Gary, Steven, Brian, Jason, Andrew, and Justin), suggesting that over time, popularity with regard to male names does not change all that much.

On the other hand, there is much less stability with popular female names, as they are less consistent across time. *Mary* is by far the most frequent female name, occurring on ten of the twelve lists between 1880 and 1990. *Margaret* is the second most common name, occurring on seven separate top ten lists, and *Elizabeth* is the third most common name, occurring on six different lists. Overall, female names remain on the top ten lists for an average of only 2.22 decades. In fact, we found that twenty-four female names appear on only one single top ten list (e.g. Minnie, Doris, Kimberly, Brittany, . . .), indicating far greater variation in terms of the popularity of female names. Unlike male names, female names that are popular one decade are not necessarily popular the next.

Overall, corpus studies of names indicate that popular male names are more stable, consistent, and frequent than popular female names. This finding, together with the finding that frequent names tend to be ordered before less frequent names, strongly reinforces the overall tendency for male names to be ordered before female names. Male names occur in first position in part because they are simply more frequent. This gendered frequency effect, in conjunction with multiple phonological constraints and an independent gender bias, creates an overwhelming tendency to order male names first.

8. Summary and discussion

In pairs of names, male names often precede female names (e.g. *Anthony and Cleopatra*, *Romeo and Juliet*). In this article, we set out to investigate this gendered bias and determine how it interacts with a variety of different constraints, including phonological constraints on binomial pairs and the frequency associated with popular names.

A number of phonological constraints condition the optimal ordering of binomial pairs. Several phonetic and phonological processes help determine whether an element sounds better in the first or second position of a binomial pair, including processes such as rhythmic structure, syllabification principles, domain-initial strengthening, final weakening, phrase-final lengthening, and vowel quality. Moreover, an analysis of the 500 most popular male and 500 most popular female names in American English reveals tendencies that align surprisingly well with these different constraints. Specifically, we found that male names tend to be characterized by first position phonology, while female names tend to be characterized by second position phonology. Thus, phonology predicts that male names are more likely to precede female names than follow them.

Results from our name-ordering experiments provide further evidence that this "gendered phonology" plays a role in ordering preferences. Subjects clearly use phonological cues when making decisions about which names sound better in the first position of a binomial pair. However, our experiments demonstrate that phonology alone is not responsible for the tendency to place male names before female names. Both of our experiments show that when phonology is controlled (i.e. when two names are "phonologically equal"), an independent gender bias still exists: subjects prefer male names before female names.

Finally, frequency seems to play an important role in ordering preferences as well. In binomial pairs, subjects show a general preference to order more frequent words before less frequent ones. Likewise, in name-ordering tasks, subjects are more likely to order frequent names before less frequent names. Since male names tend to be more stable and consistent over time, they tend to be more frequent; consequently, frequency leads to another tendency to place male names before female names.

Overall, our results reveal that preferences for name ordering in American English are constrained by a combination of gender, phonology, and frequency. Together, these factors conspire toward an overwhelming tendency to place male names before female names.

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Notes

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1. These percentages are based on type counts rather than token counts.
2. We specifically used the name list from 1998, as this was the most recent year with extensive data available; the years following 1998 did not have enough names listed for a full investigation.
3. Slater and Feinman (1985) find a higher percentage of initial sonorant consonants for female names than male names. Interestingly, this did not reach significance for given names but was larger and significant for people's preferred names ("the name you like to be called by"). This is due to differences between given and nicknames for male names rather than female names (c.f. William ~ Bill, Robert ~ Bob). Unfortunately we do not have access to information on preferred names or nicknames.
4. Except where stated otherwise, all probability values reported in these next two sections are the results of by-subjects Wilcoxon tests. For example, the result reported here shows that significantly more subjects showed a tendency to put male names first than the opposite tendency. Since each condition contained only ten items, this severely limits the power of comparable by-items tests.

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