

# Metathesis

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## Introduction

Metathesis is a term used in linguistics to describe a language pattern where a sequence of two sounds occurs in one order in one context and in the opposite order in a related context. For example, a word might have two sounds in one order in its singular form but the opposite order in its plural form; or the relative ordering of two sounds within a word form might change over the history of a language; or a speaker might swap two sounds when speaking quickly. The literature on metathesis dates back at least a century and covers topics concerning its origin, typology, [Conditioning Factors](#), and theoretical status, among others. This bibliography provides a broad overview of the research carried out on the topic. It should be noted, however, that the literature on metathesis is not as expansive as, for example, that of processes such as assimilation or deletion. One reason for this is because metathesis does not occur as pervasively across languages and, as a result, it has been given less attention than other more common processes. This has resulted in the status of metathesis as a regular process being questioned, as discussed in the articles listed under [Regularity of Metathesis](#). While links between metathesis and speech errors have sometimes been assumed ([Metathesis and Speech Errors](#)), most work on metathesis focuses on more regular phonological or morphological patterns ([Morphological Metathesis](#)), and among these, on metathesis involving a consonant and vowel or two consonants (though see [Uncommon Metathesis Patterns](#)). There are several informative works on cross-linguistic patterns of metathesis (see [Typological Studies](#)) as well as in-depth studies of metathesis in particular languages (see [Language Case Studies](#)). The literature is generally divided as to whether metathesis is analyzed as a synchronic process (see [Theoretical Phonology Approaches](#)), or as sound change (see [Historical Approaches](#)). In addition to theoretical and descriptive studies, metathesis has been examined to a lesser extent from psycholinguistic and computational perspectives (see [Psycholinguistic Approaches](#), [Computational Approaches](#)) and also in terms of first and second language learning (see [Language Acquisition](#)). Most articles contain information on the factors conditioning metathesis (see [Phonetic and Phonological](#), [Sociolinguistic](#), and [Statistical](#)) which has provided insight into its nature, and has revealed that most of the factors conditioning metathesis are the same as those involved in more common processes (see [Conditioning Factors](#)). The authors wish to thank Kylie Fitzgerald for her assistance with this project.

## Typological Studies

There are few works that provide extensive cross-linguistic studies of metathesis. [Ultan 1978](#) is a classic reference which describes the array of metathesis types observed in language. [Buckley 2011](#) is more recent and a good starting point for those wanting to learn about the process. The most comprehensive collection of cases can be found on the metathesis website [Metathesis in Language](#). [Mielke and Hume 2000](#) uses the database to study the cross-linguistic distribution of metathesis within words. Additional works to be considered are [Blevins and Garrett 1998](#) and [Blevins and Garrett 2004](#) (cited under [Historical Approaches](#)) and the study [Hume 2004](#) on consonant-consonant metathesis, all of which are extensive studies of metathesis patterns and their [Conditioning Factors](#).

Blevins, Juliette, and Andrew Garrett. 1998. The origins of consonant-vowel metathesis. *Language* 74.3 (September): 508–556. DOI: [10.2307/417792](https://doi.org/10.2307/417792)

An in-depth study into how synchronic patterns of consonant-vowel (CV) metathesis develop historically. Two types are proposed to emerge through distinct historical pathways: perceptual and compensatory metathesis. A third type is classified as pseudo-metathesis. The article provides a good overview of CV metathesis and the types of factors that can influence sequences of sounds involved in the process.

Buckley, Eugene. 2011. Metathesis. In *The Blackwell companion to phonology. Vol. 3, Phonological processes*. Edited by Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume, and Keren Rice, 1380–1407. Blackwell Companions to Linguistics Series. Malden, MA: Wiley-Blackwell.

An informative overview of metathesis with descriptions provided of typical examples of consonant-consonant, consonant-vowel, and vowel-vowel metathesis. The chapter offers a broad perspective and includes recent empirical, theoretical, and experimental research on metathesis. It also includes discussion of synchronic and diachronic cases, and related processes.

Hume, Elizabeth. 2004. **The indeterminacy/attestation model of metathesis.** *Language* 80.2:203–237. DOI: [10.1353/lan.2004.0083](https://doi.org/10.1353/lan.2004.0083)

The goal of this study is to develop a model that predicts the conditions under which the order of two sounds may be reversed. Based on thirty-four cases of consonant-consonant metathesis, two general conditions are proposed. First, there is indeterminacy in the acoustic signal due to the listener's experience with the two sounds and the quality of the sounds' acoustic cues in context. Second, the phonotactic or syllable structure that is created by reversing the input order must be attested in the language.

### ***Metathesis in Language.***

This Ohio State University website contains a database of over one hundred cases of metathesis developed by Elizabeth Hume and students. Cases are organized by language and according to whether they involve two consonants or a consonant and vowel. Each entry provides a description of the specific example of metathesis with data, information on [Conditioning Factors](#), and references.

Mielke, Jeff, and Elizabeth Hume. 2000. Consequences of word recognition for metathesis. In *Surface syllable structure and segment sequencing*. Edited by Elizabeth Hume, Norval Smith, and Jeroen van de Weijer, 135–158. Leiden, The Netherlands: Holland Institute of Generative Linguistics.

The paper contributes to understanding why metathesis is less common than processes such as assimilation. Part of the reason, it is argued, is because metathesis can disrupt word recognition more so than processes like assimilation. This predicts metathesis to be less likely at word beginnings, important contexts for word recognition. Evidence supporting the hypothesis comes from patterns of metathesis in fifty-four languages.

Ulan, Russell. 1978. A typological view of metathesis. In *Universals of human language. Vol. 2, Phonology*. Edited by Joseph H. Greenberg, Charles Albert Ferguson, and Edith A. Moravcsik, 367–402. Stanford, CA: Stanford Univ. Press.

This is the first cross-linguistic study of metathesis and provides an informative overview of the range of sounds involved in metathesis. The paper categorizes cases of metathesis according to the factors that condition its occurrence. The author furthers the proposition that metathesis is a regular process that occurs widely across languages.

## Historical Approaches

The explanation for why certain sequences of sounds occur in different orders is controversial. At the most general level, the approach that a given linguist takes to analyze metathesis reflects different theoretical assumptions. Yet, there can also be disagreement among those working within a similar approach. Common to all studies in this section is the assumption that metathesis emerges as a result of one or more historical processes. [Blevins and Garrett 1998](#) (cited under [Typological Studies](#)), [Blevins and Garrett 2004](#), and [Anderson 2004](#) argue that metathesis can be understood historically; for example, as the outcome of a series of phonetically natural sound changes, or as a phonetically natural sound change itself. Under the assumption that metathesis can be explained as a result of historical change, synchronic explanations are unnecessary. [Anderson 2004](#) also proposes that synchronic productivity in [Morphological Metathesis](#) patterns is simply due to humans' flexible ability to learn arbitrary linguistic patterns. This perspective contrasts with one in which metathesis is the direct product of generative devices in a speaker's synchronic grammar. Articles assuming the latter appear in [Theoretical Phonology Approaches](#). The other papers in this section each present a historical analysis of a metathesis pattern in a specific language, including Polish in [Czaplicki 2009](#), Old English in [Hogg 1977](#), Bulgarian in [Koorbanoff 1992](#), Mandaic in [Malone 1971](#), and Armenian in [Picard 1989](#).

**Anderson, Stephen R. 2004. Morphological universals and diachrony. In *Yearbook of morphology 2004*. Edited by Geert Booij and Jaap van Marle, 1–17. Dordrecht, The Netherlands: Springer Netherlands.**

Metathesis provides a case study to argue against including formal morphological devices as part of the human language faculty. Instead, it is argued that historical pathways can be used to explain different types of metatheses, as well as why metathesis is less common than affixation as a morphological marker.

**Blevins, Juliette, and Andrew Garrett. 2004. The evolution of metathesis. In *Phonetically based phonology*. Edited by Bruce Hayes, Robert Kirchner, and Donca Steriade, 117–156. Cambridge, UK: Cambridge Univ. Press. DOI: [10.1017/CBO9780511486401.005](https://doi.org/10.1017/CBO9780511486401.005)**

This paper proposes several historical pathways that can result in consonant-consonant metathesis, and argues that diachronic explanations for metathesis take precedence

over synchronic ones. It presents a typology of consonant-consonant metathesis (perceptual, compensatory, coarticulatory, auditory), and concludes that most regular historical metatheses result from coarticulation that leads to ambiguous perception.

**Czaplicki, Bartłomiej. 2009. Non-teleological approaches to metathesis: Evidence from dialects of Polish. *Poznań Studies in Contemporary Linguistics* 45.3 (1 January). DOI: [10.2478/v10010-009-0020-8](https://doi.org/10.2478/v10010-009-0020-8)**

An account of vowel-consonant (VC) metathesis in Polish motivated largely by phonetic factors. The paper proposes that this metathesis arose diachronically in a nonoptimizing manner.

**Hogg, Richard M. 1977. Old English r-metathesis and generative phonology. *Journal of Linguistics* 13.2:165–175. DOI: [10.1017/S0022226700005375](https://doi.org/10.1017/S0022226700005375)**

The author argues that a generative phonological account is unnecessary to explain regular r-metathesis in Old English. The patterns can instead be understood from the perspective of sound change and in a way that is consistent with a Neogrammarian approach.

**Koorbanoff, Dorna Louise. 1992. Bulgarian metathesis reconsidered: Diachrony and synchrony. PhD diss., Brown Univ.**

This thesis includes both synchronic and diachronic analyses with the aim of creating a unified account of liquid metathesis in Bulgarian. The diachronic analysis shows that a majority of exceptions to the proposed phonological account entered the language after a crucial period in which syllabic liquids underwent phonemic reinterpretation. The synchronic account analyzes these exceptions.

**Malone, Joseph L. 1971. Systematic metathesis in Mandaic. *Language* 47.2 (June): 394–415. DOI: [10.2307/412088](https://doi.org/10.2307/412088)**

A diachronic account of two metatheses in Mandaic, a Semitic language, and implications for other languages. One metathesis involves /t/ of the reflexive prefix before a sibilant, while the other involves a root-final /h/ and the preceding consonant.

**Picard, Marc. 1989. A reanalysis of Armenian prothesis and metathesis. *Folia Linguistica Historica* 10.1–2:61–69. DOI: [10.1515/flih.1989.10.1–2.61](https://doi.org/10.1515/flih.1989.10.1-2.61)**

The paper provides an analysis of Armenian prothesis and metathesis, and explores historical changes that resulted in vowel-r metathesis in Armenian.

## Regularity of Metathesis

The extent to which metathesis occurs as a regular pattern in language has been a matter of debate in the literature. Regularity here refers to systematic application within a language (e.g., Gascon in [Duménil 1987](#), and Yuman in [Langdon 1976](#)). Works such as [Stonham 1990](#) and [Webb 1974](#) (cited under [Transformational Rules](#)) argue that there are no cases of regular synchronic metathesis, while the other contributors in this section attempt to

provide evidence that it is systematic. [Hock 1985](#) and [Hume 2001](#) both propose conditions under which metathesis may be regular. One challenge to recognizing metathesis as a regular process in a generative grammar is that allowing a string-reversal process in the grammar potentially opens the door to allowing a large variety of unattested phonological processes (see also [Anderson 2004](#), cited under [Historical Approaches](#)). [Canfield 2016](#) reviews evidence for systematic, productive metathesis, and argues that all attested metathesis processes can be analyzed within previously proposed formal limits on phonological processes. Given the many attested cases of metathesis reported in the literature, it is now generally accepted that metathesis can be a regular process.

**Canfield, Tracy A. 2016. Metathesis is real, and it is a regular relation. PhD diss., Georgetown Univ.**

This dissertation provides an extensive overview of many cases of metathesis. It is argued that metathesis can be a regular phenomenon and that the theoretical mechanisms that can be used to account for it are also regular in the sense of formal language theory. Useful discussion of previous approaches to diachronic and synchronic metathesis is included.

**Duménil, Annie. 1987. A rule-account of metathesis in Gascon. *Linguisticae Investigationes* 11.1 (1 January): 81–113. DOI: [10.1075/li.11.1.04dum](#)**

Metathesis of a cluster of stop and liquid in Gascon is shown to be predictable and rule-governed. The paper provides a large dataset along with insightful analyses. Syllable weight is argued to condition metathesis: a liquid shifts to the preceding syllable if that syllable is heavier than the original syllable.

**Hock, Hans Henrich. 1985. Regular metathesis. *Linguistics* 23.4:529–546. DOI: [10.1515/ling.1985.23.4.529](#)**

Although previous works had discussed examples of regular metathesis, Hock tackles the question of ‘when’ metathesis may be regular. This paper posits that there must be a specific structural purpose served in order for metathesis to become regular.

**Hume, Elizabeth. 2001. Metathesis: Formal and functional considerations. In *Surface syllable structure and segment sequencing*. Edited by Elizabeth Hume, Norval Smith, and Jeroen van de Weijer, 1–25. Leiden, The Netherlands: Holland Institute of Generative Linguistics.**

The paper provides evidence that regular synchronic metathesis is attested cross-linguistically and is conditioned by natural language constraints. There is also detailed discussion of different formal accounts and of the linguistic and nonlinguistic factors that condition metathesis.

**Langdon, Margaret. 1976. Metathesis in Yuman languages. *Language* 52.4 (December): 866–883. DOI: [10.2307/413299](#)**

Provides evidence from Yuman supporting the notion that metathesis can be systematic. Yuman data is tested against universals proposed by [Ultan 1978](#) (cited under

[Typological Studies](#)). The author suggests that greater integration of phonological and syntactic perspectives may facilitate work on this and other aspects of language.

**Stonham, John Thomas. 1990. Current issues in morphological theory. PhD diss., Stanford Univ.**

The author argues that, despite observed patterns, metathesis is not used as a grammatical device to signal morphosyntactic properties in natural language, nor is it conditioned by any other morphological alternations.

## Theoretical Phonology Approaches

The theoretical treatment of metathesis has been controversial. Part of this revolves around whether or not it exists as a regular process. Some works have claimed that it does not ([Webb 1974](#) cited under [Transformational Rules](#)) while others argue against this position ([Hume 2001](#) cited under [Regularity of Metathesis](#)). These views can be reflected in a theory's capacity to represent metathesis. In rule-based phonology and [Optimality Theory](#), metathesis is analyzed using the same theoretical machinery as other processes, while in nonlinear phonology, there is no straightforward means of describing metathesis as a single process. Metathesis has also been used as evidence for advancing particular theoretical claims (e.g., [Bat-El 1988](#) and [McCarthy 1989](#), both cited under [Nonlinear Phonology](#)).

### Transformational Rules

Transformational rules were introduced most explicitly in [Chomsky and Halle 1968](#). In that volume, it was proposed that metathesis can be described using the rule format presented in the theory. [Kiparsky 1967](#) provides an example in support of the rule-based account of metathesis, while [Webb 1974](#) argues against metathesis being described as rules.

**Chomsky, Noam, and Morris Halle. 1968. *The sound pattern of English*. New York: Harper & Row.**

Metathesis is discussed as an example of a process which changes multiple segments, alongside contraction and elision. All three processes are used in a description of nominal number marking in Kasem (Gur).

**Kiparsky, Paul. 1967. Sonorant clusters in Greek. *Language* 43.3 (September): 619–635. DOI: [10.2307/411806](#)**

A diachronic study of metathesis and other processes involving sonorant consonants and /s/ in Greek. Explaining the data through the use of distinctive features and ordered rules is claimed to be better than through a historical linguistics approach that uses correspondences. The former is able to account for sound changes in Greek that had previously been considered anomalous.

**Webb, Charlotte Ann Yates. 1974. Metathesis. PhD diss, Univ. of Texas.**

A response to the claim in [Chomsky and Halle 1968](#) that metathesis has the same status as other processes and is thus a regular phonological rule. Webb reexamines proposed cases of metathesis in [Arabic](#) and [Greenlandic](#) and concludes that there is no evidence for a synchronic rule of metathesis.

## Nonlinear Phonology

The development of nonlinear and autosegmental phonology saw metathesis being used as evidence in new theoretical debates involving the relationships among tiers. [Bat-El 1988](#), [Hume 1991](#), and [McCarthy 1989](#) address the extent to which morphemes and sounds are represented on the same or different tiers. In this approach, metathesis could not be analyzed as straightforwardly as more common processes such as assimilation and deletion. [Lipski 1991](#) and [Malone 1985](#), however, argue that some cases of metathesis could still be analyzed more parsimoniously than with [Transformational Rules](#). The greater structural complexity in representing metathesis could be seen as a reflection of the process's lower rate of occurrence cross-linguistically.

**Bat-El, Outi. 1988. [Remarks on tier conflation](#). *Linguistic Inquiry* 19.3:477–485.**

Metathesis (/t/ + [sibilant]) in Modern Hebrew provides evidence against the concept of tier conflation. This relates to a debate in the 1980s and 1990s where autosegmental tiers are used as a formal device to distinguish morphemes: each morpheme is represented on a different tier. The interaction of metathesis and voicing assimilation across morpheme boundaries suggests that tiers are not a sufficient mechanism for distinguishing morphemes.

**Hume, Elizabeth. 1991. [Metathesis in Maltese: Implications for the strong morphemic plane hypothesis](#). In *Proceedings of the 21st Annual Meeting of the North East Linguistic Society*. Edited by Tim Sherer, 157–172. Amherst, MA: GLSA, Univ. of Massachusetts.**

The paper provides an example of metathesis being represented as a series of rules of vowel epenthesis and deletion, rather than as a single operation. Metathesis in the Maltese plural imperfective is also used as evidence to support the view that consonant and vowel features cannot be completely separated on different tiers throughout a derivation. An enriched model of feature organization is used.

**Lipski, John M. 1991. [Metathesis as a template-matching: A case study from Spanish](#). *Folia Linguistica Historica* 12.1–2:127–145.**

The paper analyzed a collection of obstruent + /r/ metatheses in varieties of Spanish. A morpho-prosodic templatic approach proposed in the 1980s is used to formally represent metathesis and other morpho-phonological patterns.

**Malone, Joseph L. 1985. [Classical Mandaic radical metathesis, radical assimilation and the devil's advocate](#). *General Linguistics* 25.2:92–121.**



Representing the interaction of /h/ assimilation and metathesis in Classical Mandaic serves as a test of the explanatory value of auto-segmental phonology. This analysis is then compared with earlier approaches.

**McCarthy, John J. 1989. *Linear order in phonological representation*. *Linguistic Inquiry* 20.1:71–99.**

The paper deals with a range of sound patterns including metathesis which appear to affect the ordering of sounds. It is argued that the segregation of vowels and consonants onto different representational planes is integral to providing a formal account of the patterns. A central insight of the paper is that segregation occurs when ordering is otherwise predictable.

## Optimality Theory

With the advent of optimality theory (OT), metathesis was represented using the same theoretical tools (constraint ranking) as other phonological processes. This had consequences for the place of metathesis in phonological analyses. For example, a goal of [Hume 2001](#) (cited in [Regularity of Metathesis](#)) is to show that a key reason for why metathesis was not previously considered to be a regular synchronic process in [Nonlinear Phonology](#) is because that theory did not include the requisite formalism to describe it as a single process. This changed with OT, in which metathesis can be described just as straightforwardly as any other process (see also [Canfield 2016](#) in [Regularity of Metathesis](#) on metathesis in formal language theory in general and OT specifically). In particular, a violable constraint which penalizes ordering changes can be ranked above or below other standard faithfulness constraints in order to construct a simple phonological grammar that prefers metathesized output forms in some environments. [Coetzee 1999](#) is a good starting point for those with limited grounding in optimality theory, as no background in OT is assumed. Using constraints to describe processes also opened the door to examining the motivation for a particular constraint. Consequently, a greater emphasis was placed on the factors conditioning metathesis. For example, metathesis in [Butskhrikidze and van de Weijer 2003](#) and [Holt 2004](#) is driven by syllable-structure constraints that are ranked higher than the constraint on input order; while in [Hume and Seo 2004](#), the higher-ranked constraints that cause metathesis are related to perceptual factors. [Gerlach 2010](#) uses more complex constraints on sound order in an account of metathesis in child language. On the other hand, [Jetchev 1997](#) does not refer to ordering constraints at all, but describes surface metathesis patterns as derived from complex underlying forms.

**Butskhrikidze, M., and Jeroen van de Weijer. 2003. *On the formal description of metathesis: A case study of v-metathesis in modern Georgian*. *Lingua* 113.8:765–778. DOI: [10.1016/s0024-3841\(02\)00129-8](https://doi.org/10.1016/s0024-3841(02)00129-8)**

An optimality theoretic account of consonant-consonant (CC) metathesis in Georgian. Segmental and syllable structure constraints provide motivation for the metathesis of /v/, part of a thematic suffix, and the final sonorant consonant of the verb root.

Coetzee, Andries W. 1999. Metathesis in Tiberian Hebrew: A perspective from optimality theory. *Theoretical Linguistics* 25.2–3:99–132. DOI: [10.1515/thli.1999.25.2-3.99](https://doi.org/10.1515/thli.1999.25.2-3.99)

Based on evidence from Tiberian Hebrew, the paper concludes that phonotactic constraints prohibiting certain contiguous segments should be included in the group of constraints that may lead to metathesis being selected as the output form.

Gerlach, Sharon Ruth. 2010. **The acquisition of consonant feature sequences: Harmony, metathesis and deletion patterns in phonological development.** PhD diss., Univ. of Minnesota.

The dissertation presents a longitudinal study of the acquisition of [English](#) by one child, focusing on processes affecting consonants. Consonant-consonant metathesis occurring across a vowel is one of the sound patterns examined. The analyses are cast within the framework of optimality theory.

Holt, D. Eric. 2004. Optimization of syllable contact in Old Spanish via the sporadic sound change metathesis. *Probus* 16.1 (19 January). DOI: [10.1515/prbs.2004.003](https://doi.org/10.1515/prbs.2004.003)

An optimality theoretic account of CC metathesis in Spanish, which is shown to be motivated by syllable structure constraints. Interesting discussion of the Real Academia Española de la Lengua (1713–1714), proposed to have been an external force influencing which forms persisted in the language.

Hume, Elizabeth, and Misun Seo. 2004. Metathesis in Faroese and Lithuanian: From speech perception to optimality theory. *Nordic Journal of Linguistics* 27.1:35–60. DOI: [10.1017/S0332586504001143](https://doi.org/10.1017/S0332586504001143)

Similar fricative-stop metatheses in Faroese and Lithuanian are shown to be conditioned by prosodic and segmental factors. It is proposed that metathesis enhances the perceptibility of the consonants involved. An optimality theoretic account is presented which includes a potential case of derivational opacity.

Jetchev, Georgi Ivanov. 1997. **Ghost vowels and syllabification: Evidence from Bulgarian and French.** PhD diss., Scuola Normale Superiore di Pisa.

A study of liquid/schwa metathesis in Bulgarian with extensive discussion of the contexts and [Conditioning Factors](#); included as part of an analysis of vowel alternations in Bulgarian and French. A syllable-based account is proposed within an optimality theoretic framework.

## Morphological Metathesis

Metathesis is commonly classified as a phonological process, but in some cases, the transposition of sounds serves a morphological function in the language such that different word functions are distinguished through segment order. [Thompson and Thompson 1969](#), [Janda 1984](#) and [Stonham 1990](#) (cited in [Regularity of Metathesis](#)) are especially useful sources for

finding data and discussion of metatheses of this nature. [Idrissi, et al. 2008](#) and [Prunet, et al. 2000](#) use morphological metathesis patterns to argue for the morphological status of consonantal roots, and [Arregi and Nevins 2012](#), [Harris and Halle 2005](#), and [Kilani-Schoch and Dressler 1986](#) illustrate how morphological metathesis can be analyzed in derivational theories of morphology.

**Arregi, Karlos, and Andrew Nevins. 2012. Linearity-based morphotactics. In *Morphotactics: Basque Auxiliaries and the Structure of Spellout*. By Karlos Arregi and Andrew Nevins, 237–340. Studies in Natural Language and Linguistic Theory 86. Dordrecht, The Netherlands: Springer.**

Chapter 5 (Linearity-based morphotactics) analyzes metathesis in several languages within the formal theory of distributed morphology. Basque is given special attention.

**Harris, James, and Morris Halle. 2005. Unexpected plural inflections in Spanish: Reduplication and metathesis. *Linguistic Inquiry* 36.2:195–222. DOI: [10.1162/0024389053710710](https://doi.org/10.1162/0024389053710710)**

Spanish plural inflections are analyzed within a distributed morphology framework. The paper argues that metathesis can be expressed formally as a special case of partial reduplication in this framework.

**Idrissi, Ali, Jean-François Prunet, and Renée Béland. 2008. On the mental representation of Arabic roots. *Linguistic Inquiry* 39.2: 221–259. DOI: [10.1162/ling.2008.39.2.221](https://doi.org/10.1162/ling.2008.39.2.221)**

The psycholinguistic study examines metathesis of consonants in [Arabic](#) and French in the speech of a dyslexic Arabic-French bilingual, building on an earlier study by the same authors ([Prunet, et al. 2000](#), cited in this section). Metathesis of nonadjacent consonants in Arabic is argued to provide evidence for the morphemic status of the consonantal root.

**Janda, Richard D. 1984. Why morphological metathesis rules are rare: On the possibility of historical explanation in linguistics. *Proceedings of the Tenth Annual Meeting of the Berkeley Linguistics Society* (October 17): 87–103. DOI: [10.3765/bls.v10i0.1972](https://doi.org/10.3765/bls.v10i0.1972)**

It is argued that morphological metathesis is uncommon because diachronically, the possible sources that could lead to metathesis are themselves uncommon.

**Kilani-Schoch, Marianne, and Wolfgang Dressler. 1986. Métathèse et conversion morphologiques en Arabe Tunisien. *Zeitschrift Für Phonetik, Sprachwissenschaft Und Kommunikationsforschung* 39.1: 61–75. DOI: [10.1524/stuf.1986.39.14.61](https://doi.org/10.1524/stuf.1986.39.14.61)**

Written in French, the paper focuses on alternations between the CVCC and CCVC forms of words in Tunisian Arabic. The differences are argued to be due to morphological metathesis, where CVCC characterizes verbs and CCVC denotes the nominal counterpart. A detailed discussion is provided of the nature of the morphological metathesis rule and its interaction with other rules.

Prunet, Jean-François, Renée Béland, and Ali Idrissi. 2000. The mental representation of Semitic words. *Linguistic Inquiry* 31.4 (October): 609–648. DOI: [10.1162/002438900554497](https://doi.org/10.1162/002438900554497)

Metathesis errors in the aphasic speech of an Arabic speaker are argued to provide evidence for the status of consonantal roots as independent morphological units that native Arabic speakers access.

Thompson, Laurence C., and M. Terry Thompson. 1969. Metathesis as a grammatical device. *International Journal of American Linguistics* 35.3: 213–219. DOI: [10.1086/465056](https://doi.org/10.1086/465056)

At the time this paper was written, various studies had cited examples of morphophonemic metathesis, though few had suggested that it served as a grammatical process. Using examples from Rotuman ([Austronesian](#)) and Clallam (Straits Salish), the authors argue for the consideration of metathesis as a grammatical device that signals semantic contrast.

## Psycholinguistic Approaches

An increasing amount of research examines metathesis experimentally. In the psycholinguistic literature, metathesis is more often called ‘transposition’ (especially when discussing written forms) or ‘exchange’ (see also [Metathesis and Speech Errors](#)). [Guerrera and Forster 2008](#); [Lupker, et al. 2008](#); and [Perea and Carreiras 2008](#) investigate how letter transposition influences priming effects, with the goal of learning more about word recognition systems in general. [Lupker, et al. 2008](#) and [Perea and Carreiras 2008](#) find that written word recognition is relatively more robust to letter transpositions than other spelling perturbations, but this may be partially due to the kinds of letter strings that tend to be formed by transposition. In the auditory modality, [Makashay 2001](#) (cited in [Statistical](#)) points toward a variety of other factors that influence recognition of transposed forms in speech, and [Mielke and Hume 2000](#) (cited in [Typological Studies](#)) argues that languages tend to avoid initial metathesis, which might be relatively disruptive to word recognition. [Prunet, et al. 2000](#) and [Idrissi, et al. 2008](#) (both cited in [Morphological Metathesis](#)) examine metathesis patterns in speakers with aphasia and dyslexia in order to inform linguistic theorizing.

Guerrera, Christine, and Kenneth Forster. 2008. Masked form priming with extreme transposition. *Language and Cognitive Processes* 23.1:117–142. DOI: [10.1080/01690960701579722](https://doi.org/10.1080/01690960701579722)

This paper demonstrates the flexibility of word recognition systems in terms of letter position. Strong priming effects are observed when up to six letters of an eight-letter word are transposed. Three models of letter coding are reviewed in light of the results.

Lupker, Stephen J., Manuel Perea, and Colin J. Davis. 2008. Transposed-letter effects: Consonants, vowels and letter frequency. *Language and Cognitive Processes* 23.1 (1 January): 93–116. DOI: [10.1080/01690960701579714](https://doi.org/10.1080/01690960701579714)

This paper corroborates Spanish findings (with [English](#)), showing that transposed-letter non-word primes are more effective than replacement-letter non-word primes, but that this advantage only exists for the transposition of consonants, not vowels. A further experiment shows this may be at least partly attributable to vowels being more frequent.

**Perea, Manuel, and Manuel Carreiras. 2008. Do orthotactics and phonology constrain the transposed-letter effect? *Language and Cognitive Processes* 23.1 (1 January): 69–92. DOI: [10.1080/01690960701578146](https://doi.org/10.1080/01690960701578146)**

A study of whether transposed-letter effects in masked priming experiments are affected by the result of being an illegal or legal cluster. The finding that an illegal bigram had a greater priming effect is important for those conducting lexical activation studies.

## Computational Approaches

Studies approaching metathesis from a computational perspective are rare. The only examples found of this type, [Canfield 2016](#) (cited in [Regularity of Metathesis](#)) and [Chandlee, et al. 2012](#), both discuss how metathesis can be formalized in terms of finite state transducers.

**Chandlee, Jane, Angeliki Athanasopoulou, and Jeffrey Heinz. 2012. Evidence for classifying metathesis patterns as subsequential. In *Proceedings of the 29th West Coast Conference on Formal Linguistics*. Edited by Jaehoon Choi, E. Alan Hogue, Jeffrey Punske, Deniz Tat, Jessamyn Schertz, and Alex Trueman, 303–309. Somerville, MA: Cascadia Proceedings Project.**

Three categories of metathesis (adjacent, bounded, unbounded long distance) are proposed and formalized as finite state transducers. The relative computational complexity of the types is argued to be reflected typologically in patterns of metathesis.

## Language Acquisition

In recent years, a growing amount of research has been devoted to the status of metathesis in first and second language learning. Children may have a limited ability to produce complex consonant sequences while their speech apparatus is still developing, and both L1 and L2 learners may lack experience in producing such complex sequences. Metathesis is one way that learners simplify complex syllable structures. [Keren-Portnoy, et al. 2009](#) and [Łukaszewicz 2007](#) illustrate metathesis in child language learning, which they argue may result from restrictions on syllable structure at an intermediate stage of language development. [Kløve and Young-Scholten 2001](#) makes a similar argument from L2 production data. The long-distance metathesis studied in [Gerlach 2010](#) (cited in [Optimality Theory](#)) is less likely to be the result of syllable simplification, but it might still be accounted for by a limited ability to plan certain consonant sequences. On the other hand, [Fukazawa and Miglio 2008](#) also points toward spelling analogies as an additional cause of metathesis in L2 production, and

it is clear that the study of metathesis during language acquisition is an area of investigation that is ripe for further exploration.

**Fukazawa, Haruka, and Viola Miglio. 2008. What metathesis reveals about L1 and L2 acquisition. In *Proceedings of the 9th Generative Approaches to Second Language Acquisition Conference (GASLA 2007)*. Edited by Slabakova Roumyana, Rothman Jason, Kempchinsky Paula, and Gavruseva Elena, 30–36. Somerville, MA: Cascadilla Proceedings Project.**

This paper addresses the question of whether metathesis in first language acquisition differs from that in second language acquisition. Data come from the speech of a monolingual Japanese child, a trilingual child, and Japanese adults learning [English](#). The authors conclude that metathesis in L1 and L2 differs crucially in that analogy to spelling patterns is an important factor in adult L2 patterns.

**Keren-Portnoy, Tamar, Marinella Majorano, and Marilyn M. Vihman. 2009. From phonetics to phonology: The emergence of first words in Italian. *Journal of Child Language* 36.2: 235–267. DOI: [10.1017/S0305000908008933](#)**

A study of the phonological development of four Italian children up to age 2. The transcribed productions included in the paper include some examples of metathesis. The authors argue that one of the factors influencing the children's speech is the acquisition and preference for particular CV templates.

**Kløve, Marit Helene, and Martha Young-Scholten. 2001. Repair of L2 syllables through metathesis. *IRAL - International Review of Applied Linguistics in Language Teaching* 39.2 (5 January): 103–133. DOI: [10.1515/iral.39.2.103](#)**

A production study on the role of metathesis as a syllable structure repair strategy in adult L2 Polish (by native speakers of [English](#) and Japanese) and L2 Norwegian (by native speakers of Cantonese).

**Łukaszewicz, Beata. 2007. Reduction in syllable onsets in the acquisition of Polish: Deletion, coalescence, metathesis and gemination. *Journal of Child Language* 34.1 (February): 53–82. DOI: [10.1017/S0305000906007707](#)**

A case study of onset reduction strategies of a child acquiring Polish. Metathesis is used to resolve word-medial consonant clusters. Gemination is also used word-medially although deletion or coalescence occurs in word-initial clusters. The analyses are formalized within an optimality theoretic framework.

## Conditioning Factors

Understanding the factors that contribute to the occurrence of metathesis has drawn considerable attention. Four types of factors are considered in this section: phonological, phonetic, [Sociolinguistic](#), and [Statistical](#). Most of the literature on metathesis makes reference to the phonological and phonetic properties of sounds involved in metathesis and their conditioning contexts. Thus while only a sampling of articles is presented in this section, many

articles throughout the bibliography are relevant. More unique are those papers dealing with sociolinguistic or statistical properties, such as those included below.

## Phonetic and Phonological

The typical phonetic and phonological properties involved in metathesis are now fairly well understood. The cross-linguistic studies [Blevins and Garrett 1998](#) (cited under [Typological Studies](#)), [Blevins and Garrett 2004](#) (cited under [Historical Approaches](#)), and [Hume 2004](#) (cited under [Typological Studies](#) with [Hume 1998](#) being an earlier study included here) are particularly informative in this regard. The other papers included in this section focus more on metathesis in a particular language, including varieties of [English](#) ([Anttila, et al. 2008](#) and [Makashay 2001](#), cited under [Statistical](#)); Faroese and Lithuanian ([Hume and Seo 2004](#), cited under [Optimality Theory](#)); L2 Polish and L2 Norwegian ([Kløve and Young-Scholten 2001](#), cited under [Language Acquisition](#)); Bulgarian ([Jetchev 1997](#), cited under [Optimality Theory](#)); and German ([Park 2006](#)). [Park 2006](#) additionally includes typological evidence to support the hypothesis that greater variability in gestural coordination is associated with metathesis.

**Anttila, Arto, Vivienne Fong, Štefan Beňuš, and Jennifer Nycz. 2008. Variation and opacity in Singapore English consonant clusters. *Phonology* 25.2:181–216. DOI: [10.1017/S0952675708001462](https://doi.org/10.1017/S0952675708001462)**

A valuable empirical contribution to the study of metathesis. Data collected from speakers of Singapore [English](#) provide a significant number of cases of CC metathesis. [Statistical](#) analyses show that the following lexical segment or boundary conditions metathesis. The process is argued to be a lexical rather than a postlexical process.

**Hume, Elizabeth. 1998. The role of perceptibility in consonant/consonant metathesis. In *Proceedings of West Coast Conference on Formal Linguistics*. Edited by Susan Blake, Eun-Sook Kim, and Kimary Shahin, 293–307. WCCFL 17. Stanford, CA: Center for the Study of Language and Information.**

This is the first detailed study of the perceptual motivation behind cross-linguistic patterns of consonant-consonant metathesis. It is superseded by [Hume 2004](#) (cited under [Typological Studies](#)), where it is shown that by taking into account both phonetic factors and cluster frequency, the resultant order of consonants in metathesis can be predicted.

**Park, Haeil. 2006. Local intrasyllabic consonant cluster metathesis: Dynamical aspects. 언어연구 [Eoneoyeongu] 23.1:97–124.**

Consonant-consonant metathesis is examined from an articulatory phonology approach. It is argued that consonant clusters with greater variability in gestural timing are more prone to metathesis.

## Sociolinguistic

At the current time, [Keshavarz 2000](#) is the only study of metathesis that takes into account sociolinguistic factors. The paucity of research on the topic is likely due in part to the observation that metathesis is less common than many other processes affecting sounds.

**Keshavarz, Mohammad H. 2000. A sociolinguistic analysis of metathesis in Persian. *The International Journal of Humanities* 7.1–2: 16–22.**

This is perhaps the only sociolinguistic study of metathesis to date. A production experiment involving native speakers of Persian shows that age, sex, and social class influence the use of the metathesized variant of a given word.

## Statistical

Research taking into account the statistical nature of language as it relates to metathesis is, at present, rare. This is likely due to the fact that probabilistic approaches to understanding sound patterns (and language more generally) were relatively uncommon until more recently. [Hume 2004](#) (cited under [Typological Studies](#)) proposes that metathesis is conditioned by language-users' experience with a particular order of sounds, including the frequency of that order in the language. [Makashay 2001](#) provides experimental evidence that the frequency of consonant clusters in [English](#) influences the degree to which clusters are perceptually metathesized by listeners.

**Makashay, Matthew J. 2001. Lexical effects in the perception of obstruent ordering. In *Surface Syllable Structure and Segment Sequencing*. Edited by Elizabeth Hume, Norval Smith, and Jeroen van de Weijer, 117–134. Leiden, The Netherlands: Holland Institute of Generative Linguistics.**

This paper tests claims about perceptibility as a motivating factor in consonant-consonant metathesis. It shows that for English, both the perceptual cues of the adjacent consonants as well as the frequency of the clusters influence the degree to which clusters are perceptually metathesized by subjects in an experiment.

## Uncommon Metathesis Patterns

Virtually all cases of metathesis discussed thus far have involved two consonants or a consonant and vowel. Vowel-vowel (VV) metathesis is rare, thus making the cases of Hawu ([Blust 2012](#)) and Kasem ([Burton 1989](#), and [Chomsky and Halle 1968](#) [cited in [Transformational Rules](#)]) especially interesting. However, [Burton 1989](#) provides a reanalysis of the Kasem data that does not treat it as VV metathesis. Also uncommon is the metathesis of tones, as discussed in [Holscher, et al. 1991](#).

**Blust, Robert. 2012. Hawu vowel metathesis. *Oceanic Linguistics* 51.1: 207–233. DOI: [10.1353/ol.2012.0009](https://doi.org/10.1353/ol.2012.0009)**

A rare case of regular vowel-vowel metathesis is proposed to occur in Hawu under the conditions that (1) the height of the first vowel is higher than that of the second, and



(2) the vowels are separated by a consonant. Although alternative explanations are explored, the evidence supports the view that the change involves direct segmental transposition.

**Burton, Strang. 1989. Kasem coalescence and metathesis: A particle analysis. *Toronto Working Papers in Linguistics* 10 (1 January).**

This paper provides an analysis of metathesis in Kasem, proposed as a case of VV metathesis in [Chomsky and Halle 1968](#) (see section [Transformational Rules](#)), but reanalyzed by many authors since. In this account, the author argues that particle theory is able to provide a better account of the pattern than an account using distinctive features.

**Holscher, Daniel P., Monica Macaulay, and Marnie Jo Petray. 1991. Tone metathesis in the Dangme imperative. *Annual Meeting of the Berkeley Linguistics Society* (25 July):120–133. DOI: [10.3765/bls.v17i2.1660](#)**

This paper proposes that a rare case of tonal metathesis occurs in the Kwa language, Dangme, spoken in Ghana. Positing metathesis is intended to account for the unexpected patterning in certain imperative forms of the potential aspect marker high tone.

## Language Case Studies

The majority of research on metathesis focuses on specific language cases and in this research, certain languages have received a disproportionate amount of attention. Particularly notable are [Austronesian](#) and [Romance Languages](#) where metathesis is widespread, as well as some [Native North American Languages](#). Several articles have also been devoted to metathesis in [Arabic](#), [English](#), and Slavic languages, among others. Metathesis in [Greenlandic](#) has been included in this section as an example of early debates about whether metathesis is phonological or morphological, and whether it is a single process or involves several distinct processes.

### Arabic

Arabic has been the focus of several papers on metathesis since the order of vowels and consonants in a word corresponds to a morphological class. Despite this observation, differences in the linear order of sounds are not typically treated as a single process of metathesis. More commonly, the sounds that make up a word are assumed to map onto a distinct morphological template which itself specifies the order of the sounds (for related discussion, see [McCarthy 1989](#) cited under [Nonlinear Phonology](#)). [Dat 2009](#); [Idrissi, et al. 2008](#) (cited in [Morphological Metathesis](#)); and [Kilani-Schoch and Dressler 1986](#) (cited in [Morphological Metathesis](#)) all use metathesis as evidence for these morphological templates.

**Dat, Florin–Mihai. 2009. Métathèse et homonymie en Hébreu Biblique. *Suvremena Lingvistika* 35.67: 1–21.**

The article, written in French, proposes that Semitic triconsonantal roots are composed of a biconsonantal root and a matrix of phonetic features. One source of evidence for biconsonantal roots is the reversibility (metathesis) of consonants in semantically related words. It is argued that the proposed account is better able to capture regularities in the lexicon than alternatives.

## Austronesian

Sound reversals are pervasive in Austronesian languages and, as a result, they have received considerable attention in the literature on metathesis. The cases are of particular interest given the various **Conditioning Factors** involved which, aside from common phonological factors, also include speech style, as discussed in [Sohn 1980](#) and [Heinz 2005](#). [Besnier 1987](#), [Biggs 1965](#), and [Schmidt 2003](#) discuss a well-known case of morphological metathesis in Rotuman (see also [Thompson and Thompson 1969](#) cited under [Morphological Metathesis](#)). However, [McCarthy 2000](#) shows that it is also conditioned by prosodic structure. [Laycock 1982](#) and [Steinhauer 1996](#) discuss morphological metathesis in Dawanese. Among other languages noted below, [Bonthuis 2001](#), [Hume 1998](#), [van der Hulst and van Engelenhoven 1995](#), and [van Engelenhoven 1996](#) discuss a case in Leti which shows that metathesis can serve to mark whether or not a word is at the end of a phrase.

**Besnier, Niko. 1987. *An autosegmental approach to metathesis in Rotuman*. *Lingua* 73.3:201–223. DOI: [10.1016/0024-3841\(87\)90008-8](#)**

The author argues that an autosegmental phonological account of sound patterns in Rotuman provides a simpler explanation than previous approaches. Word-final vowels in CV structures are truncated and then reassociated leftward with the preceding vowel.

**Biggs, Bruce. 1965. *Direct and indirect inheritance in Rotuman*. *Lingua* 14.1–2: 383–415. DOI: [10.1016/0024-3841\(65\)90053-7](#)**

A seminal paper on the Rotuman sound system in which comparative diachronic data are presented showing that CV metathesis in the language distinguishes words in complete and incomplete morphological phases. The historical origins of the patterns are discussed.

**Bonthuis, Fiorieneke. 2001. Metathesis in Leti. In *Surface syllable structure and segment sequencing*. Edited by Elizabeth Hume, Norval Smith, and Jeroen van de Weijer, 26–52. Leiden, The Netherlands: Holland Institute of Generative Linguistics.**

A study of the use of CV metathesis in Leti as a grammatical device to mark phrase edges.

**Heinz, Jeffrey. 2005. Optional partial metathesis in Kwara'ae. In *Proceedings of the Twelfth Annual Conference of the Austronesian Formal Linguistics Association (AFLA)*. Edited by Heinz and Ntelitheos, 91–102. UCLA Working Papers in Linguistics 12.**

Metathesis data from Kwara'ae show the process involving pairs of words differing in register (citation versus normal speech), as previously noted in [Sohn 1980](#), cited in this section. Metathesis is claimed to originate as a process of copy and deletion of a following vowel. Stress interacts with vowel deletion in some forms.

**Hume, Elizabeth. 1998. Metathesis in phonological theory: The case of Leti. *Lingua* 104.3: 147–186. DOI: [10.1016/s0024-3841\(97\)00031-4](#)**

A study of metathesis in the Austronesian language, Leti. Two types of CV metathesis are examined. The first is motivated by a requirement that all phrases end in a vowel, and the second, by syllable well-formedness conditions: syllables have onsets and tautosyllabic consonant clusters are avoided. Using phonological evidence, it is argued that the direction of metathesis is opposite to that proposed in [van Engelenhoven 1996](#) (cited in this section) and [van der Hulst and van Engelenhoven 1995](#) (cited in this section).

**Laycock, Donald C. 1982. Metathesis in Austronesian: Ririo and other cases. Pusat Pembinaan dan Pengembangan Bahasa, Departemen Pendidikan dan Kebudayaan/National Center for Language Development, Ministry of Education and Culture.**

Metathesis in Ririo and other Austronesian languages is compared, arguing that there is no evidence that these systems are the same. The paper provides a useful overview of types of metathesis and discussion of the systematicity of metathesis, and whether it can result from “play language.”

**McCarthy, John J. 2000. The prosody of phase in Rotuman. *Natural Language & Linguistic Theory* 18.1: 147–197. DOI: [10.1023/a:1006342918830](#)**

In addition to the morphological status of Rotuman metathesis, the author proposes that a prosodic difference between the complete and incomplete phases conditions metathesis. Optimality theoretic constraints that compare potential surface forms are proposed in order to account for the differences.

**Schmidt, Hans. 2003. Temathesis in Rotuman. In *Issues in Austronesian Historical Phonology*. Edited by John Lynch, 175–207. Canberra, Australia: Pacific Linguistics, Research School of Pacific and Asian Studies, Australian National University.**

A summary of seven accounts of the Rotuman morphophonological processes, all proposing metathesis, but differing in the stage when metathesis occurs and the other processes involved. The author builds on these accounts to propose his own theory. A useful resource for considering how metathesis interacts with other morphophonological processes. Edited by John Lynch.

**Sohn, Ho-min. 1980. Metathesis in Kwara'ae. *Lingua* 52.3–4: 305–323. DOI: [10.1016/0024-3841\(80\)90039-x](#).**

Primary data is presented showing synchronic CV metathesis in Kwara'ae as a regular phonologically conditioned process that can serve a morphological function. It can also

be conditioned by the formality of the situation (informal versus formal), a conditioning factor not commonly observed. Linear phonological rules are used to formalize the process.

**Steinhauer, Hein. 1996. Morphemic metathesis in Dawanese (Timor). *Pacific Linguistics. Series A. Occasional Papers.* 84:217–232. DOI: [10.15144/PL-A84.217](https://doi.org/10.15144/PL-A84.217)**

The article shows metathesis to occur in all major word classes in Dawanese, and is conditioned by morphology and the phonemic structure of the root. The author suggests that metathesis can be analyzed as strengthening lexical border signals, rather than weakening the phonological integrity of lexemes. The author also critiques [Laycock 1982](#), cited in this section.

**van der Hulst, Harry, and Aone van Engelenhoven. 1995. Metathesis effects in Tutukeian-Letine. In *Leiden in last*. Edited by Harry van der Hulst and Jeroen Maarten van de Weijer, 243–267. The Hague : Holland Academic Graphics.**

A government phonology analysis of metathesis in Leti. Crucial to the account is the assumption that syllable structure is strictly onset/nucleus. [Hume 1998](#) (cited in this section) provides a critical assessment of this analysis.

**van Engelenhoven, Aone. 1996. Metathesis and the quest for definiteness in the Leti of Tutukei (East-Indonesia). *Pacific Linguistics. Series A. Occasional Papers.* 84:207–215. DOI: [10.15144/PL-A84.207](https://doi.org/10.15144/PL-A84.207)**

The author, a native speaker, presents data and discussion of metathesis in Leti which occurs across word boundaries and phrase-finally. Metathesis can also serve a semantic function. The data have been analyzed in several works including [van der Hulst and van Engelenhoven 1995](#) (cited in this section) and [Hume 1998](#) (cited in this section).

## English

While metathesis is less pervasive in varieties of English than in some other languages, it is nonetheless observed both historically and synchronically. [Alexander 1985](#) and [Keyser 1975](#) provide rule-based accounts of alternations with the latter proposing typologically uncommon vowel-vowel metathesis though the alternations only occur at an abstract level of representation. [Anttila, et al. 2008](#) (cited under [Phonetic and Phonological](#)) offers insight into a contemporary variety of English which includes a productive process of metathesis.

**Alexander, James D. 1985. R-Metathesis in English: A diachronic account. *Journal of English Linguistics* 18.1: 33–40. DOI: [10.1177/007542428501800104](https://doi.org/10.1177/007542428501800104)**

Examples of r-vowel metathesis collected from various dialects of English from the Oxford English Dictionary, among other sources. Metathesis is argued to be rule governed.

Keyser, Samuel Jay. 1975. **Metathesis and Old English phonology.** *Linguistic Inquiry* 6.3:377–411.

A rule of vowel-vowel metathesis is proposed for classes of weak verbs in Old English. Metathesis operates at an abstract level so that the sounds never occur in the metathesized order on the surface. The reordering creates the context for subsequent rules of vowel deletion to apply.

## Greenlandic

The literature on metathesis in Greenlandic has been included in this section as an example of early debates about metathesis. [Cearley 1970](#) addresses whether metathesis is phonological or morphological, and [Pyle 1970](#), [Sadock 1972](#), and [Underhill 1971](#) discuss whether it is a single process or involves several distinct processes.

**Cearley, Alvin. 1970. Epenthesis, metathesis, and assimilation in West Greenlandic. In *CLS: Special edition on Eskimo Linguistics*. Chicago, IL: Chicago Linguistic Society.**

Cearley offers ordered sets of phonological processes (including metathesis) that Greenlandic words arguably go through to reach their derived form. In a footnote added some years later, Cearley claims that although fundamentally correct, the rules should have been morphologically based, rather than phonological.

**Pyle, Charles. 1970. West Greenlandic Eskimo and the representation of vowel length. *Research on Language & Social Interaction* 3.1: 115–146. DOI: [10.1080/08351817009389142](https://doi.org/10.1080/08351817009389142)**

Although metathesis is not the main theme of the paper, the author follows some earlier works in assuming that certain attested forms in Greenlandic can be accounted for by processes of metathesis, followed by assimilation.

**Sadock, Jerrold M. 1972. In defense of metathesis in Greenlandic. *Paper in Linguistics* 5.1 (March 1): 1–9. DOI: [10.1080/08351817209370282](https://doi.org/10.1080/08351817209370282)**

The author supports the approach taken in [Pyle 1970](#) (cited in this section) and disputes many of the points made in [Underhill 1971](#) (cited in this section). It is stated that Underhill's argument cannot entirely remove metathesis as an explanation though it is acknowledged that ad hoc accounts have often been proposed to explain the data.

**Underhill, Robert. 1971. Metathesis vs. gemination in Greenlandic. *Papers in Linguistics* 4.2: 299–311. DOI: [10.1080/08351817109370261](https://doi.org/10.1080/08351817109370261)**

In disputing [Pyle 1970](#) (cited in this section) analysis, the author argues that gemination provides a better account of the observed data than does metathesis and assimilation. However, the gemination process is considered to be so old that it is difficult to create a systematic account of the modern forms.

## Native North American Languages

The native languages of North America provide a rich source of data on metathesis. Most cases serve the function of distinguishing morphological classes, such as verb aspect in Saanich (Montler 1989) and Lummi (Demers 1974). Thompson and Thompson 1969 (cited under Morphological Metathesis) is one of the earliest papers to show that metathesis can play a role in signaling a semantic contrast. Stress, syllable weight and other phonological factors are also relevant, as in Alsea (Buckley 2007), Mutsun (Okrand 1979), and Sierra Miwok (Davis 2002). Flemming 1996 describes a case in Cherokee where aspiration may appear before, after, or instead of a vowel, depending on the surrounding consonants. Okrand 1979 hypothesizes about the history of metathesis in the Ohlone languages (also called Costanoan). Powell 1985 compares a variety of explanations for metathesis in Chimakum and Quileute, with the goal of evaluating proposed cross-linguistic metathesis tendencies.

**Buckley, Eugene. 2007. Vowel-sonorant metathesis in Alsea. *International Journal of American Linguistics* 73.1: 1–39. DOI: [10.1086/518333](https://doi.org/10.1086/518333)**

A careful study of VC metathesis in this Amerindian language. For some alternating pairs, metathesis serves a morphosemantic function, signaling aspectual differences between words. Phonological factors also play a role: it is proposed that syllable weight is a conditioning factor explaining why only sonorant consonants metathesize.

**Davis, Cathlin Maire. 2002. Case and pronominal suffixes in Sierra Miwok. PhD diss., Univ. of Wisconsin.**

A chapter in the dissertation is devoted to metathesis involving a subset of the possessive morphemes. The author argues that this is different from the more typical segment-based metathesis as it involves the displacement of an entire morpheme. Metathesis is phonologically conditioned (by syllable structure) though proposed to be a morphological process.

**Demers, Richard A. 1974. Alternating roots in Lummi. *International Journal of American Linguistics* 40.1: 15–21. DOI: [10.1086/465285](https://doi.org/10.1086/465285)**

The paper presents data from the Salish language, Lummi, in which aspectual differences between verbs involves the CCV in one form corresponding to CVC in another. The author does not treat this as metathesis but rather gives a linear rule-based account involving vowel deletion in order to account for the patterns.

**Flemming, Edward. 1996. Laryngeal metathesis and vowel deletion in Cherokee. *UCLA Occasional Papers in Linguistics* 16:23–44.**

Metathesis data comes from the author's fieldwork with a speaker of Cherokee. The process, analyzed within Optimality Theory, involves the metathesis of the laryngeal fricative /h/ across a vowel to an unaspirated consonant resulting in the consonant becoming aspirated.

**Montler, Timothy. 1989. Infixation, reduplication, and metathesis in the Saanich actual aspect. *International Journal of the Linguistic Association of the Southwest* 9.1: 92–107.**

This paper argues that in Saanich (a North Straits Salish dialect), reduplication, infixation, and metathesis are ways of achieving a closed (CVCC) environment for the stressed vowel in ACTUAL aspect. An important point is that the processes are phonologically related in their goal and therefore need to be studied together.

**Okrand, Marc. 1979. Metathesis in Costanoan grammar. *International Journal of American Linguistics* 45.2 (April 1): 123–130. DOI: [10.1086/465583](https://doi.org/10.1086/465583)**

Metatheses in the Costanoan language, Mutsun, serve a morphological function but are also constrained by phonology. The author provides a detailed account of the patterns based on historical records.

**Powell, Jay V. 1985. An occurrence of metathesis in Chimakuan. *Oceanic Linguistics Special Publications* 20:105–110.**

Cognate sets with metathesis in Chimakum and Quileute in which consonants arguably metathesize across a vowel. The author suggests that the patterns are consistent with the cross-linguistic tendency for metathesis to preserve segments that would have otherwise been lost (Ultaun 1978 cited in [Typological Studies](#)).

## Romance Languages

Metathesis patterns are observed diachronically and synchronically in French, Sardinian, and Spanish. The data in the majority of cases involve liquid consonants (especially /r/) metathesizing with a consonant or vowel, such as in the classic studies of varieties of French in [Grammont 1907](#) and [Grammont 1933](#). For those unable to read French, similar patterns are discussed in [Lyche 1995](#) and [Spence 1990](#). For those interested in understanding metathesis from a historical perspective, [Wiltshire and Graczyk 1989](#), [Wireback 2002](#), and [Wireback 2005](#), all in Spanish, are recommended. Other papers use metathesis to argue for a particular theoretical approach, such as optimality theory ([Bradley 2007](#), [Webb and Bradley 2009](#), and [Holt 2004](#) cited under [Optimality Theory](#)) and distributed morphology ([Harris and Halle 2005](#) cited under [Morphological Metathesis](#)). The sole paper on Sardinian, [Molinu 1999](#), is a solid study based on extensive data.

**Bradley, Travis G. 2007. Constraints on the metathesis of sonorant consonants in Judeo-Spanish. *Probus* 19.2 (11 January): 171–201. DOI: [10.1515/PROBUS.2007.006](https://doi.org/10.1515/PROBUS.2007.006)**

Consonant-consonant metathesis in Judeo-Spanish changes intervocalic liquid-stop sequences. An optimality theoretic account is proposed with one pattern being motivated by syllable contact restrictions and another by the avoidance of adjacent segments sharing place, manner, and voice features.

**Grammont, M. 1907. La métatèse à Pléchâtel (Aute-Bretagne). *Romanische Forschungen* 23.1: 517–523.**

An early and informative study of metathesis, written in French. Over forty examples of vowel/r metathesis are presented from the variety of French spoken in Pléchâtel in

northwestern France. The author argues that metathesis is regular and follows general principles in the language, themes that recur in the literature on metathesis.

**Grammont, Maurice. 1933. *Traité de Phonétique*. Paris: Librairie Delagrave.**

An insightful account, written in French, that proposes different categories of metathesis based on explanatory factors, including syllable structure, articulatory complexity, and analogy to the order of sounds in other words.

**Lyche, Chantal. 1995. Schwa metathesis in Cajun French. *Folia Linguistica* 29.3–4: 369–394. DOI: [10.1515/flin.1995.29.3–4.369](https://doi.org/10.1515/flin.1995.29.3-4.369).he**

Metathesis of /r/ + schwa in a French variety spoken in the United States; the case is similar to patterns presented in Grammont 1907 (cited in Romance Languages). The vowel metathesizes with a preceding /r/ occurring word-initially or when preceded by an obstruent. A unified treatment of the two types is given using a single epenthesis rule.

**Molinu, Lucia. 1999. Métathèse et variation en Sarde. *Cahiers de Grammaire* 24:153–181.**

An extensive study of vowel/r metathesis in the language varieties of Sardinia. The article, written in French, is rich in data and offers good discussion of potential causes of metathesis.

**Spence, Nicol. 1990. Sporadic changes in Jersey French. In *Variation and change in French: Essays presented to Rebecca Posner on the occasion of her sixtieth birthday*. Edited by J. Green and W. Ayres-Bennett, 210–225. New York: Routledge.**

CV metathesis, most involving /r/, is one of the processes discussed in this paper. The patterns are similar to those discussed in other French varieties included in this section.

**Webb, Eric Russell, and Travis G. Bradley. 2009. Rhotic metathesis asymmetries in Romance: Formalizing the effects of articulation and perception on sound change. *Selected papers from the 37th Linguistic Symposium on Romance Languages (LSRL), Pittsburgh, 15-18 March 2007*. Edited by Pascual José Masullo, Erin O'Rourke, and Chia-Hui Huang, 321–337. Amsterdam/Philadelphia: John Benjamins Publishing Company.**

Metathesis is used to test claims that rhotics are a single class of sounds that share a common feature. Rhotic metathesis in French and Spanish are analyzed within Optimality Theory.

**Wiltshire, Caroline, and Randolph Graczyk. 1989. On metathesis in diachrony. In *CLS 25: Papers from the 25th Annual Regional Meeting of the Chicago Linguistic Society*. Part One: The General Session 1. Edited by Bradley Music, 25:434–450. Chicago, IL: Chicago Linguistic Society.**



An in-depth historical study of metathesis, primarily in Spanish. A lot of ground is covered in a relatively short paper: pseudo-metathesis; actual metathesis; metathesis of adjacent consonants; long-distance metathesis; historical origins; and phonetic, phonological, and morphological factors. Well worth reading for those interested in understanding metathesis in Spanish.

**Wireback, Kenneth J. 2002. On the metathesis of labials + /J/ in Hispano-Romance. *Hispanic Review* 70.3: 311–331. DOI: [10.2307/3247205](https://doi.org/10.2307/3247205)**

Assuming a four-stage model of consonant-glide metathesis, Wireback uses a combination of evidence from intermediary sounds evidenced in Hispano-Romance languages and perceptual and phonetic evidence to propose which stages are essential and which may be bypassed. Evidence is presented for different consonants, and similarities are drawn between consonant-glide metathesis and consonant-consonant metathesis.

**Wireback, Kenneth. 2005. On the regularization of consonant + consonant metathesis in the history of Spanish. *Bulletin of Hispanic Studies* 82.2 (May): 137–158. DOI: [10.3828/bhs.82.2.1](https://doi.org/10.3828/bhs.82.2.1)**

The paper compares four instances of CC metathesis in Spanish, which became regular, with cases that did not gain regularity. It finds that less regular cases lacked one or more of the following factors: misperception due to adjacency, phonetic similarity, stretched out acoustic cues, and in some cases possible blended intermediate articulations.

## Metathesis and Speech Errors

A few articles on speech errors are included since in some cases the reordering of sounds is observed. [Fromkin 1971](#) and [MacKay 1970](#) are classic articles on speech errors, and [Nooteboom and Quené 2013](#) presents experimental elicitation data in which exchange errors are the most common kind of error. However, the similarities and differences between reorderings in metathesis patterns and speech errors has not, to date, been systematically investigated. This would be a fruitful area of research and one that could provide insight into whether some metatheses arise as a result of production errors.

**Fromkin, Victoria A. 1971. The non-anomalous nature of anomalous utterances. *Language* 47.1 (March): 27–52. DOI: [10.2307/412187](https://doi.org/10.2307/412187)**

Classic study of speech errors. Transpositions, also referred to in this paper as metathesis, are among the most common in the examined dataset.

**MacKay, D. G. 1970. Spoonerisms: The structure of errors in the serial order of speech. *Neuropsychologia* 8.3: 323–350. DOI: [10.1016/0028-3932\(70\)90078-3](https://doi.org/10.1016/0028-3932(70)90078-3)**

A mathematically rigorous study of a large number of involuntary sound reversals produced by speakers of German in order to discover the contributing factors. These include, among others, phoneme frequency, proximity of affected sounds, phonetic similarity, and syllable structure.

Nootboom, Sieb G., and Hugo Quené. 2013. Heft lemisphere: Exchanges predominate in segmental speech errors. *Journal of Memory and Language* 68.1: 26–38. DOI: [10.1016/j.jml.2012.08.004](https://doi.org/10.1016/j.jml.2012.08.004)

The paper presents evidence that the exchanges of sounds, viewed as a form of speech error, may be more prevalent than previous studies have found.