

Nominalism, Antirealism, and Skepticism

Yet, despite customary charges and modern tendencies to the contrary, the 'reductionist' program and the corresponding strategy of medieval nominalism did not necessarily result in metaphysical anti-realism, conventionalism, or skepticism. Medieval nominalists typically regarded concepts as naturally representative of a world of individuals presorted into natural kinds and not sorted into these kinds by our concepts and/or linguistic conventions. Thus, they maintained an essentialist metaphysics, and so the scientific knowability of a mind-independent reality, yet without any ontological commitment to (whether subsistent or inherent) universal essences distinct from their individuals. Whether they could consistently do so is a further issue, which bears direct relevance to contemporary considerations concerning ontological commitment and metaphysical essentialism. Plato's problem of the possibility of universal knowledge still remains a problem for nominalists: Once they have rejected the moderate realists' distinct individualized forms, which in the moderate realist conception are precisely the items in reality that serve as the foundation for the abstraction of our universal concepts, the nominalists still have to provide a plausible story about how universal concepts can be abstracted from observed singulars (and hence how they can apply even to previously unobserved singulars), unless they want to give up on the possibility of universal knowledge in the classical sense altogether (Klima, 2004b, 2005).

See also: Concepts; Empiricism; Mentalese; Natural Kind Terms; Objects, Properties, and Functions; Semantic Value; Syncategoremata.

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Nominalization

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Nominalization proper means 'turning something into a noun' (Comrie and Thompson, 1985), and refers both to the corresponding processes or operations and to their results. Nominalization covers a

broad range of transpositional phenomena, where transposition, in turn, refers to word-class-changing operations (Haspelmath, 2002). Often applied without clear criteria and definitions, the term has been grossly misused. A clear definition of nominalizations and any serious attempts to approach them cross-linguistically should take into account at the least the following parameters:

- What expression types are turned into a noun?
- What are the meanings of the resulting expressions?
- What does turning into a noun really mean, i.e., in what sense is the resulting expression a noun?
- How regular is this process, e.g., is it derivational or inflectional?
- Do the resulting expressions show mixed properties (partly nominal, partly stemming from the base expression type)?
- What are the functions of the resulting expressions?

The next section will show how most of these parameters work for one particular kind of nominalizations that has received most attention within various linguistic theories and has been intensively studied cross-linguistically – action nominals. This is followed by a sketch of some other nominalization phenomena. The final section will give a brief survey of the functions in which nominalizations are typically used and point out possible connections between these uses and the morphosyntactic properties of the corresponding nominalizations. Throughout the chapter the main emphasis will be on the phenomena themselves, rather than on the various attempts to present a formal analysis of them.

Action Nominals and Action Nominal Constructions

Action nominals (*nomina actionis*, AN), such as *running*, *arrival*, *reading*, and *conquest* are in some reasonably productive way derived from verbs, either derivationally or inflectionally. Broadly speaking, they refer to situations and not only to actions, as the name might imply (Comrie and Thompson, 1985; Koptjevskaja-Tamm, 1993, 2003, 2005). Action nominals head action nominal constructions (ANCs) that may also contain expressions referring to the participants in the situation designated by its head, most often serve as arguments (complements) to predicates and refer to events, facts, and propositions, to use the semantic taxonomy launched by Vendler (1967). For instance, predicates *to assert* and *to be unlikely* combine with ANCs referring to propositions (*The collapse of the country's economy is unlikely*), the verbs *to know*, *to regret*, and *to lead* take ANCs referring to facts (as in *The enemy's destruction of the city led to a complete collapse of the country's economy*), while the verbs *to hear* and *to go on* take ANCs referring to events (*The singing of the Marseillaise went on for hours*).

ANs are either 'full-fledged' nouns or at least occur in typical nominal positions and show inflectional properties, such as case inflection, and/or

combinability with adpositions typical of nouns. There is, on the whole, relatively little consensus in terminology used for what is called 'ANs' and 'ANCs' here. Thus, 'verbal nouns,' 'gerunds,' 'nominalizations,' 'masdars,' 'infinitives' often, though not necessarily, refer to ANs (Koptjevskaja-Tamm, 1993: 22–43). Grimshaw (1990) used the term 'complex event nouns,' opposed to 'simple event nouns' (or act nouns), such as *announcement*. Action nominals, as defined here, are robustly attested cross-linguistically, though not everywhere. Thus, they are as a rule absent from Australian and most North American Indian languages.

In their semantics and discourse behavior, action nominals combine verbal and nominal properties and occupy an intermediate position between typical nouns and typical verbs. Thus, both *John's singing* and *John sings* can describe one and the same event involving the same participant, and the same goes for *the enemy's destruction of the city* and *the enemy destroyed the city*. However, ANCs, as opposed to normal finite clauses, merely name situations and occur in functions typical of NPs, for instance, as arguments to predicates. On the other hand, they differ from typical nouns that refer to things, persons, places, and other more or less concrete objects. Also, action nominals take arguments more or less like the corresponding (finite) verbs do. Nouns normally do not take arguments, even though this might be doubtful for relational nouns, such as kinship terms or words for body parts.

Morphosyntactically, ANs often show a mixture of verbal and nominal properties and provide, therefore, good examples of mixed categories (Lefebvre and Muysken, 1987; Spencer, forthcoming). Thus, in the example *John's repairing the house so quickly [came as a big surprise]*, the AN *repairing* combines with its 'object' *the house so quickly* and with the adverb in a typically verbal way, as in the corresponding finite clause *John repaired the house so quickly*. Moreover, the AN in the same construction can be negated and/or combine with auxiliaries, again in the way typical of verbs, e.g., *John's having not repaired the house*. Its 'subject,' however, appears with the 's'-marker, typical of adnominal dependents (possessors). The same action nominal may also build constructions that look very much like 'normal' NPs with underived nouns (cf. *John's quick repairing of the house* and *John's accurate map of the city*).

The question that has attracted most research is whether and how action nominals can combine with expressions referring to the participants in the situations designated by them, primarily with S (as *John* in *John's running*), and with A and P (as *the enemy* and *the city* in *the enemy's destruction of the city*). There

is a long tradition in distinguishing between derivational nominalizations (like *conquest*, *refusal*, and *arrival*) and inflectional nominalizations, like English gerunds (Chomsky, 1980). According to this tradition, derivational nominalizations are said to be lexically restricted; they may have unpredictable semantic and syntactic properties as compared to the verbs they are derived from, as well as idiosyncrasies in formation; they also combine with their dependents in exactly the same way as prototypical nonderived nouns. Inflectional nominalizations are described as being formed from any verb in a regular way, their meaning is completely predictable, and they retain a good portion of verbal syntactic properties. This distinction is, however, of little use for a cross-linguistic comparison, because it is precisely action nominals that in many languages pose serious problems for a clear-cut distinction between derivational and inflectional forms, in that the various criteria suggested for distinguishing inflection and derivation clash when applied to them (Comrie and Thompson, 1985; Koptjevskaja-Tamm, 1993: 263–266; Haspelmath, 1996). A part of the difficulties with distinguishing between derivation and inflection can stem from diachronic processes; for instance, English gerunds started as derivational, but have gradually become inflectional forms (Miller, 2002: 315–350).

Cross-linguistically ANC types may be classified in accordance with their sentence-likeness and/or NP-likeness, i.e., with the degree to which the relations between an AN and its arguments are encoded in the same way as verb-arguments relations in finite clauses or as head-dependent relations in NPs (primarily, the possessee-possessor relations, see **Possession, Adnominal**), respectively. The typology of ANCs assumed here is based on marking of the arguments themselves (by means of case-marking and adpositions) as a primary parameter, in a few cases supplemented by head-marking as an additional parameter (for details cf. Comrie and Thompson, 1985; Koptjevskaja-Tamm, 1993, 2003, 2005). One and the same language often has several ANC types, not necessarily possible for one and the same AN.

Thus, in English *John's running* and *the enemy's destroying the city* illustrate the Possessive-Accusative type: S and A are treated as possessors, while P retains sentential marking (in this case, the absence of any overt marker). *The destruction of the house by the enemy* belongs to the Ergative-Possessive type, where S and P are treated as possessors, while A is treated differently. In this particular example, A looks like the agent in passive sentences; this is a cross-linguistically usual, but not a necessary option. A may be treated as

other peripheral NPs. Finally, in *the enemy's destruction of the city*, all major arguments are treated as possessors, this is the Double-Possessive type. While English has two distinct possessor forms and possessor positions that can differentiate between the A and the P, most languages with this ANC type use one and the same form for both, as shown by ex. (1) from the Austronesian language *Tukang Besi* (*Tukang Besi* South). This type is cross-linguistically relatively rare, compared to the other ANC types.

- (1) te basa-'a nu La Petrus nu buku
 CORE read-AN POSS PROEM Peter POSS book
 'Peter's reading of the book.' (Mark Donohue p.c.)

In a number of languages ANCs are built according to the Sentential type: S, A, and P receive the same dependent-marking as in the finite clause. In ex. (2) from Tamil, the A and the P appear in the unmarked form both in the finite clause (2a) and in the ANC (2b), while possessors normally take the genitive case.

- (2a) coomu tampikki papam
 Somu younger.brother.DAT money
 kuṭu-tt-aaru
 give-PAST-3SG.HUMAN
 'Somu gave younger brother the money.'
- (2b) [coomu tampikki papam
 Somu younger.brother.DAT money
 kuṭu-tt-atu] aaccariyamaa iruntatu
 give-PAST-AN surprising be.PAST.3SG.N
 'It was surprising that Somu gave younger brother the money.' (lit. 'Somu's giving the money to the younger brother was surprising.') (Asher, 1982: 110)

In a number of languages, action nominals can never combine with both A and P within one and the same construction. Sometimes there are strategies for expressing both A and P at the same time without, however, making both of them syntactically dependent on the AN. Thus, the English ANC *John's repairing the house* may be rendered by constructions like *John's house-repairing* (where the P and the action nominal build a compound), *the repairing of the house that John did*, or *the repairing that John repaired the house*. The latter option is illustrated by (3) from Yoruba. The cover term for this somewhat heterogeneous class is the Valency-Lowering type; the common denominator is the reduced valency of an AN compared to that of the verb. This is, of course, well in line with the behavior of more typical nouns that hardly ever take two arguments.

- (3) rírá tí Olú ra aso
 buy.AN REL Olu buy dress
 'Olu's buying of the dress' (Ayo Bambgbose p.c.)

These major patterns can be ordered as a scale from sentence-like constructions to those that have a

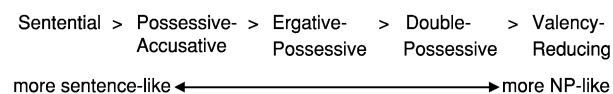


Figure 1 Scale of sentence-like and NP-like dependent-marking in the major ANC patterns.

NP-syntax, with intermediate patterns combining elements of both sentences and NPs (Figure 1).

Cross-linguistic variation in ANC structure is, thus, severely restricted in at least two respects. First, arguments differ systematically in their proneness to retain sentential marking. Second, the three kinds of overt means for encoding head-dependent relations – dependent-marking, head-marking (agreement), and word order – form a hierarchy that predicts which combinations of nominal and sentential properties are possible (cf. Figure 2). For instance, of the two arguments in transitive ANCs, the one most likely to lose its sentential dependent-marking is the A; in addition, the A never retains its head-marking. To a certain degree, though not completely, this corresponds to the assumption found in various theories that finiteness of a clause and the properties of its subject are crucially related; since ANCs are not finite, their ‘subjects’ may be or even should be different from those in finite clauses.

The data in Koptjevskaja-Tamm (1993) show that there is also a correlation between the different ANC types, on the one hand, and the presence vs. absence of other typical verbal vs. nominal features in their head, such as the ability to express tense/aspect distinctions (cf. ex. (2) from Tamil), voice and negation, and the ability to combine with adverbs/adjectives. More systematic research is, however, needed here. Also, even though ANs generally pose problems for the derivation/inflection-distinction, the ‘extreme’ ANC types do show a high degree of consistency among the different criteria. Thus, action nominals with a sentence-like syntax normally involve generally applicable and regular markers and show semantic transparency, while action nominals with a nominal syntax often manifest various idiosyncrasies typical of derivation (cf. also Haspelmath, 1996: 57–58).

Other Kinds of Nominalization and Nominalization-Related Phenomena

Expressions That Can Be Turned into Nouns and the Meanings of the Resulting Expressions

Some languages have verbal nouns which refer to the way, or manner, of performing the action denoted by the base verb – mode, or manner nominals (*nomina modi*), distinct from action nominals, e.g., in Amharic *akkiyahed* ‘the way of going’ vs. *mohed* ‘to go, going,’

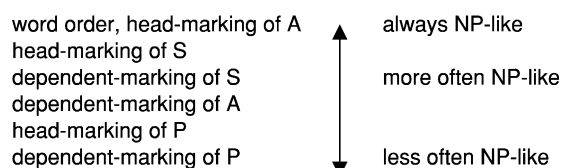


Figure 2 Hierarchy of sentential vs. NP-like syntactic means in ANCs.

or in Turkish *yürü-yüş* ‘the way of walking.’ Verbs may also be turned into nouns that name one of their arguments, or various circumstances concomitant to the situation designated by them. The former class includes agentive nouns (*nomina agentis*), or subject nominalizations, e.g., *singer*, *employer*, object nouns, e.g., *employee*, and result nominalizations, e.g., *agreement* (as in *The agreement they signed was submitted in four copies*). The latter includes instrument nominalizations, e.g., *sharpener*, locative nominalizations and reason nominalizations, e.g., derivations with the suffixes *-vvik* resp. *-ssut* in West Greenlandic (Inuktitut, Greenlandic), such as *puisinniarvik* ‘place for hunting seal’ and *kamassut* ‘reason for anger’ (Fortescue, 1984: 319).

Adjectives may also be turned into nouns, e.g., state/property nominalizations such as *stupidity* and *redness*. Occasionally words from other word classes can be turned into nouns. Languages may have much more fine-grained semantic distinctions in nominalizations than what is presented above. It is also often the case that one and the same nominalization marker can produce different meanings, e.g., the English suffix *-er* used for deriving both agent and instrument nouns.

In all the examples considered so far, a word of one particular class (verbs, adjectives) has been turned into a noun – these are instances of lexical nominalization. In clausal nominalizations, on the other hand, it is the whole finite clause that gets nominal inflectional features, while its head cannot be considered a noun (Comrie and Thompson, 1985: 392), as in (4) from Imbabura Quechua (Quichua, Highland, Imbabura).

- (4) Pedro ya -n [ñuka Agatu-pi kawsa-ni]-ta
 Pedro think-3 I Agato-in live-1-ACC
 ‘Pedro thinks that I live in Agato.’ (Cole, 1982: 43)

More specifically, the verb in such nominalized clauses normally retains all its verbal characteristics (such as person and number inflection) and does not occur with nominal derivational affixes, although the whole nominalized clause may be more or less similar to an NP. Clauses may be nominalized in different ways, for instance by taking an article or by attaching nominal inflectional suffixes to finite verbs, such as

the accusative case in (4). In the latter case, the verbs inflect in the same way as nonderived nominals, but there may still be arguments against considering them lexical nominalizations. Clausal nominalizations are quite widespread across North American Indian languages, which, as a rule, lack action nominals, and across Tibeto-Burman languages (Matisoff, 1972).

In a few cases, however, the distinction between lexical and clausal nominalizations is difficult to draw. Or rather, nominalization markers may be ‘omnivorous’ in attaching to expressions of structurally different kinds – words, word combinations, clauses. One reason for this may lie in diachronic processes; thus, it has been suggested for several languages (e.g., for Newari in Genetti, 1991 and for Navajo in Mithun, 2002) that nominalizers, case morphology, and adpositions have been extended from lexical items to clauses.

What Does Turning into a Noun Really Mean?

One of the criteria for ANs given earlier in this article is that they should at least occur in typical nominal positions and show inflectional properties, such as case inflection, and/or combinability with adpositions, typical of nouns. However, ANs often show only a subset of nominal inflectional and combinatorial properties; thus, they normally lack number distinctions.

Individual inflected forms of action nominals, often used in particular functions, may gradually detach themselves from the original paradigm and become nonfinite verb forms on their own. Thus, infinitives in many languages originate as purposive action nominals, i.e., action nominals with the dative or allative marker (Haspelmath, 1989), e.g., the Slavic infinitive ending *-ti* is the dative case of the earlier verbal noun. Adpositional or case forms of verbal nouns are a frequent grammaticalization source for converbs, i.e., nonfinite verbal forms used in adverbial subordination (Haspelmath, 1995). Such processes can sometimes result in a set of forms that all look like inflected forms of one and the same verbal noun. Synchronically, however, this analysis is hardly appropriate, and the term ‘nominalization’ is not applicable to such phenomena. Thus, typically, the whole paradigm is significantly reduced compared to the normal nominal paradigm; in addition, the inflected forms may have very specialized meanings not always easily deducible from the ‘normal’ case meanings. Examples (5) and (6) from Finnish illustrate the inflected (adessive, abessive, illative, and elative) forms of what is labeled ‘third infinitive’ in the Fennicist tradition. While the forms in (5) should rather be classified as

converbs, the forms in (6) correspond to the typical infinitival uses.

- (5) Finnish (Ylikoski, 2003: 204, 212)
 Pekka tek-i rikokse-n...
 Pekka make-PAST.3SG crime-GEN
 ‘Pekka committed a crime...’
 (5a) juo-malla olut-ta.
 drink-CONV (=‘INF3.ADE’) beer-PART
 ‘by drinking beer.’
 (5b) juo-matta olut-ta.
 drink-CONV (=‘INF3.ABE’) beer-PART
 ‘without drinking beer’
 (6a) Pekka rupes-i juo-maan olut-ta.
 Pekka begin-PAST.3SG drink-‘INF3.ILL’ beer-PART
 ‘Pekka began drinking beer.’
 (6b) Pekka lakkas-i juo-masta olut-ta.
 Pekka case-PAST.3SG drink-‘INF3.ELA’ beer-PART
 ‘Pekka began drinking beer.’

Typical infinitives may in turn be further ‘nominalized,’ e.g., by attaching a definite article, and start being used as action nominals, often acquiring more and more nominal properties. Ex. (7) shows that infinitives combined with definite articles in German and Italian may take P (object) in the possessive form and be modified by adjectives. This completes thus ‘a full cycle of noun-to-infinitive-to-noun’ (Disterheft, 1980; Gaeta, 1997).

- (7a) Italian
 Sento il mormorare somesso del mare
 hear.PRES.1SG the whisper-INF soft of.the sea
 ‘I hear the soft whisper of the sea’
 (7b) German
 Das schnelle Zerstören der Stadt
 the.N rapid destroy-INF the.GEN.FSG city
 war notwendig.
 was.3SG necessary
 ‘The rapid destroying of the city was necessary.’

There has been surprisingly little discussion in the literature of the criteria that can be used for deciding when ‘something has been turned into a noun’ and for distinguishing nominalizations from related phenomena (for some attempts cf. Noonan, 1985; Koptjevskaja-Tamm, 1993: 33–45; Haspelmath, 1995; Ylikoski, 2003). This is also, probably, the domain where different local traditions particularly diverge from each other and where consistent research in terminology is particularly urgent. To quote one example, Nordlinger (2002) argued that ‘nominalized verbs’ in the Australianist linguistic tradition are not nominalized in the usual sense of the word, i.e., have not been turned into nouns. Even though they may attach some (but not all) of the case markers (e.g., the allative case marker in ex. (8)), they cannot occur in syntactic positions typical of nouns, such as arguments. Rather they function as modifiers

– either as heads of relative clauses modifying a head noun, or as adverbial modifiers.

- (8) Warlpiri (Simpson, 1988: 205, ex. 2)
- | | | |
|----------------|----------------------|-------------------|
| Ngarrka-ngku | marlu | pantu-rnu |
| <i>man-ERG</i> | <i>kangaroo</i> | <i>spear-PAST</i> |
| [marna | nga-rninja-kurra]. | |
| <i>grass</i> | <i>eat-NMLSR-ALL</i> | |
- ‘The man speared the kangaroo while it was eating grass.’

Functions of Nominalizations Nominalizations can be used in many ways, but two groups of functions are particularly salient cross-linguistically – as non-main (dependent) predicates in a sentence and as a part of analytical or periphrastic verb forms.

There is a considerable cross-linguistic variation in how much and where nominalizations are involved in dependent predication. Some languages have a more or less strict division of verb forms into those that can be main predicates and those that cannot. In many of those action nominals are among the predominant forms used in complementation, e.g., in Cuzco Quechua (Quechua, Cuzco), Tamil, Daghestanian languages. However, even in such languages, the exact range of functions attributed to action nominals and to action nominal constructions is to a high degree language specific and depends, primarily, on what other verb forms there are in the language. In other languages, action nominal constructions compete both with other types of nonfinite complements and with finite complementation. On the whole, determining where action nominal constructions are used (as a less frequent alternative to another major complementation type, as a regular and even the only complementation type) is far from evident, and the cross-linguistic variation here is enormous. Thus, in English, *to stop* is one of the verbs that obligatorily take gerunds as complements, e.g. *to stop reading*/**to stop to read* (in the intended meaning), while its close synonym *cease* takes only infinitives (*to cease to read*). In Russian, the verb *perestat* ‘to stop’ cannot take action nominals as complements, the only option for the latter being infinitives, e.g., **perestat*’ *čteniel* *perestat*’ *čitat*.’ Curiously, its close synonym *prekratit*,’ as well as most of the other phasal verbs, allow combinations both with action nominals and with infinitives, e.g., *prekratit*’ *čteniel/prekratit*’ *čitat*.’ Still, in contrast to English, no predicates in Russian obligatorily take action nominals as complements.

Action nominals in various case forms and/or combining with various adpositions are also frequently used in adverbial functions, e.g., *after/before John’s arrival*..., and as adnominal attributes, e.g., *a knife for cutting apples*.

In many languages, subject and object nominalizations constitute the main relativization strategy, i.e., they function often as adnominal clausal modifiers. In ex. (9) from the Tibeto-Burman language Kham (Parbate, Western), the nominalizer *-o* derives a subject nominalization, which is used as a noun in ex. (9a) and as a subject relative clause in ex. (9b). Ex. (10) shows how the same marker may produce object nominalizations, which again can function both as nouns and as adnominal modifiers.

- (9a) ba-o-rə
 go-NMLZ-PL
 ‘those who went’
- (9b) ba-o mi:-rə
 go-NMLZ *person-PL*
 ‘the people who went’
- (10a) o-ra-e-o-rə
 3S-3P-give-NMLZ-PL
 ‘those to whom he gave it’
- (10b) [no-e mədə o-ra-e-o] sehr-rə
 he-ERG *wine* *3S-3P-give-NMLZ* *elder-PL*
 ‘the elders to whom he gave wine’
 (Watters, 2002: 201–206)

There is a clear correlation between the pervasiveness of action nominals in complementation and the extent to which they show sentential/verbal properties. Thus, in most of the languages with the sentential ANC type, ANs are among the predominant forms used in complementation; these are also inflectional according to most criteria and often retain, at least partly, such verbal categories as tense/aspect, voice, etc. The same tendencies seem to be operative for other nominalizations as well; thus, in languages where argument nominalizations constitute the main relativization strategy, they tend to behave like inflectional forms and retain a good portion of sentential/verbal properties. However, no systematic research has yet been conducted on argument nominalizations.

Nominalizations are also frequently used in analytical (periphrastic) verb forms, with an impressive diversity of resulting grammatical meanings. Thus, progressives often grammaticalize from locational constructions with verbal nouns, ‘X is located in V-ing.’ The English continuous forms (*Peter is going*) exemplify this development. In Iraqw, the future is expressed by the auxiliary *aw* ‘to go’ with the verbal noun of the main verb as the object preceding it (the complement of the verbal noun forms a genitive construction with the verbal noun), as in ex. (11):

- (11) makay i ma’á
 animals *SUBJ.3* *water.CONSTR*
 wahúngw ay-á’
 drinking.CONSTR *go:3-PL*
 ‘The animals will drink water.’ (Mous, 1983: 267)

Finally, (erstwhile) nominalizations may also develop main-clause (or independent-clause) functions. Thus, in a number of languages nominalizations as independent clauses are used for various discourse-pragmatic functions, primarily in backgrounded portions of discourse, e.g., setting the scene, or providing parenthetical, subsidiary information. Variations on the theme are attested in languages as diverse as Japanese (Iwasaki, 2000), Navajo (Mithun, 2002), and Kham (Watters, 2002). Mithun suggested that these functions arise due to extension from marking syntactic relations among sentences to marking pragmatic relationships among sentences in discourse.

This is not the only scenario by which nominalizations can acquire main-clause functions. Gildea (1998) suggested that the verb forms of main clauses in many Cariban languages descend from earlier copular sentences based on nominalizations, from which the copula has gradually disappeared, and showed which nominalizations become which tenses and aspects. Thus, e.g., agent nominalizers become immediate future, habitual, and 'universal' tense-aspects, object nominalizers become past, perfect, and perfective, and action nominalizers become 'universal,' immediate future, and imperfective tense-aspects.

See also: Mixed Categories; Nouns; Possession, Adnominal; Verbs; Word Classes/Parts of Speech: Overview.

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NonAustronesian Languages of Melanesia See: Papuan Languages.

Nonhuman Primate Communication

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Introduction

All primates live in social groups. Some, like orangutans, live a largely solitary life, but come together for mating, aggressive competition, and offspring care. Others, such as chimpanzees, live in large communities, but on a day-to-day basis exist in small ephemeral parties. Independent of group size and composition, monkeys and apes engage in a wide variety of social and nonsocial activities including the discovery of food, the detection of predators, intergroup encounters, group movement, play, grooming, aggressive attacks, coalitions, submissive retreats, and reconciliatory actions designed to redress imbalances in a relationship. In principle, one can readily imagine the adaptive significance of a signaling system capable of informing others of these various activities. Of particular use would be a vocal system designed to convey such information in the absence of any other contextual information. Such a system would enable Monkey A to inform Monkey B of the location, movement, and type of predator, and monkey B would be able to decode this information and more, including the fact that monkey A is a member of the same species, same group, is high ranking, and male. This hypothesis about adaptive design is only partly accurate. Non-human primates do produce vocalizations in a variety of contexts, and listeners do extract considerable information from the signal. But there are significant constraints on the kind of information conveyed

and the kind of information extracted. These constraints are both internal (peripheral and central processing mechanisms) and external (habitat, climate, distance to receivers, competing acoustic signals) to the animals themselves.

Students of animal behavior have long argued over the proper definition of communication (Hauser, 1996; Bradbury and Vehrencamp, 1998; Owings and Morton, 1998). Early theories, centered primarily in classical ethology, focused on the veridical transmission of information from sender to receiver. One variant of this view borrowed from engineering, and in particular Shannon-Weaver information theory. Communication was said to occur if a receiver's uncertainty about an event was reduced by the information transmitted in the sender's signal. Critics of this information perspective emerged with the sociobiology revolution. Dawkins and Krebs (1978) argued that a veridical signaling system was invadable by a mutant who generated the same signal but with a different, and deceptive motivation. Thus, for example, if an aggressive signal was designed to convey information about the probability of escalating aggression, then a mutant who always signaled the highest level of aggressive intent, but was bluffing, would always win because receivers would readily back down. Thus, so Dawkins and Krebs originally argued, the adaptive function of communication is for signalers to manipulate the behavior of receivers. This view was quickly criticized for being signaler-centric. Dawkins and Krebs responded by modifying their original model to include both manipulative signalers and skeptical receivers. Thus, communication evolves as an arms race in which selection favors signals designed to manipulate the behavior of receivers for fitness gains, and counterselection favors receivers that distinguish between truths and lies. Riding along with this selfish-gene perspective was