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**Forms Visualizing Communication
Notes Regarding the Parallels of Argumentation
Between Rhetoric and Geometry as Basic Communication Tools**

-Abstract-

It is well known that rhetoric and geometry were since Roman antiquity parts of the *artes liberales*, a canon of seven subjects the student was taught in. In this article we take the approach to look at the similarities of the elements of geometry and rhetoric. We show structural parallels that serve as a basic feature for visualized communication. We will argue that not only terminological, but also structural similarities between graphic, mathematical, and rhetorical communication exist and exemplify our claim by discussion examples from these fields. My primary interest is in the intersection of mathematics and rhetoric. Topology in rhetoric is the teaching of the places (*topoi*) of an argument the rhetor uses for his/her speech. Topology is an extended area of geometry between space and its fine structure using sets of family and group sets of collected abstract object.

To summarize the claims: Orality can exist in several forms and can be implemented into technical presentations. Orality – depending on human social factors– is structured in certain patterns and connoted in a code. Rhetoric as a structural feature of orality and literacy structures communication according to principles we also find in mathematical, computational, and esthetical fields.

Research Approaches

As a metasystem for the comparison of scientific fields semiotics can be used facing meanings. Already in 1877 Rieger stated: “The set-up of recent theories both in the sciences and the humanities tend to exhibit new epistemological characteristics one of which is their increasingly ‘semiotic’ tendency. [...] It is argued that any system modeling this process has to have both, formally and empirically adequate means to cope with problems of (phonetic) variety, (syntactic) ambiguity, and (semantic) vagueness.”¹ For Rieger “semiotic has a double relation to the sciences: it is both a science among the sciences and an instrument of the sciences. The significance of semiotic as a science lies in the fact that it is a step in the unification of science, since it supplies the foundations for any special science of signs, such as linguistics, logic, mathematics, rhetoric, and (to some extent at least) aesthetics [...]”² According to Reyes, although historians often have positioned rhetoric as a supplemental discipline, Reyes showed that “rhetoric is the ‘material’ out of which a new and powerful mathematical system emerges. [...] The infinitesimal found its ‘substance’ in the rhetorical arguments surrounding it, which ultimately precipitated an epistemic shift in scientific and mathematical practice.”³ Arielle Saiber in *Giordano Bruno and the Geometry of Language*

¹Rieger, Burghard. Bedeutungskonstitution. Einige Bemerkungen zur semiotischen Problematik eines linguistischen Problems. In Gunzenhäuser, R. (ed.). Semiotik. Zeitschrift für Literaturwissenschaft und Linguistik 27/28. 1977. Pp. 55-68. LDV University Trier.
<[Http://www.ldvpage/rieger/pub/aufsaeetze/bk77/bk77.html](http://www.ldvpage/rieger/pub/aufsaeetze/bk77/bk77.html)>

²Rieger, Burghard. Bedeutungskonstitution. Einige Bemerkungen zur semiotischen Problematik eines linguistischen Problems. In Gunzenhäuser, R. (ed.). Semiotik. Zeitschrift für Literaturwissenschaft und Linguistik 27/28. 1977. Pp. 55-68. LDV University Trier.
<[Http://www.ldvpage/rieger/pub/aufsaeetze/bk77/bk77.html](http://www.ldvpage/rieger/pub/aufsaeetze/bk77/bk77.html)>

³Reyes, G. Mitchell. The Rhetoric in Mathematics: Newton, Leibniz, the Calculus, and the Rhetorical Force of the Infinitesimal. Quarterly Journal of Speech. Vol. 90 (2). P.163-188

showed rhetorical and geometrical parallels in the work of Bruno. Chapter 4 pairs the angle with the axial form of chiasmus illuminating the importance of the visual in both the geometric study of angles and its corresponding rhetorical implications. In chapter 5 Saiber equates the circle with circumlocution arguing that “Bruno fills the Cena with a kind of ‘curved’ figurative language including hyperbolic exaltations, elliptical speech and confounding geometrical figures, and circumlocution. Hyperbolic praise has its geometric equivalence in the hyperbola and in a similarly etymologically neat concurrence, ellipsis relates to the ellipse, as both suggest a kind of paradoxical empty fullness (129).”⁴

I Rhetoricity as Feature of Orality and Literacy

Rhetoricity is the quality of rhetorical elements in any action. Rhetoricity is ubiquitous and comprises also communication. Geissner in *On Rhetoricity and Literarity* reviewed historical, functional, formal, generic, and aesthetic aspects to determine any distinction between the rhetorical and the literal and concludes that no distinction exists and that rhetoricity is ubiquitous and present in every communication process.⁵ While rhetoric is a condition of language and serves as a communicative condition, this condition is also reflected in the theory of communication. Brockriede in *Dimensions of the Concept of Rhetoric* wrote: “During recent years a state of cold war has existed in the field of speech. Humanists who seek to understand rhetoric primarily through the use of historical scholarship and behavioral scientists who seek to develop a communication theory primarily through empirical description and experimental research have tended to see one another as threatening enemies.”⁶ Traditionally, rhetoric serves as a condition for human communication. Bryant and Heath wrote in *Human Communication Theory and Research* regarding persuasion: “In interpersonal communication, people influence each other's judgments and behaviors; they are affected by each other's actions and statements. Corporations influence employees' opinions and behaviors, shape images each external public has of them, and create customer preferences for their products or services.”⁷ Rhetoricity is also a condition for the communication in an abstract sense. Perry in *Theory and Research in Mass Communication* wrote that “perhaps the most important lesson from decades of research is that persuasion is a complex process, more often than not defying attempts at generalization. Certainly, the persuasion stimulus does not simply determine the audience response.”⁸ Craig in *Communication Theory as a Field* stated that: “all communication theories are mutually relevant when addressed to a practical life world in which “communication” is already a richly meaningful term. Each tradition of communication theory derives from and appeals rhetorically to certain commonplace beliefs about communication while challenging other

May 2004. ERIC. January 3, 2008.

<[Http://www.eric.ed.gov/ERICWebPortal/recordDetail?accno=EJ681684](http://www.eric.ed.gov/ERICWebPortal/recordDetail?accno=EJ681684)>

⁴ Hansen, Matthew C. "Review of Arielle Saiber, Giordano Bruno and the Geometry of Language." *Early Modern Literary Studies* 12.2 (September, 2006) 9.1-4. January 3, 2008.

<[Http://purl.oclc.org/emls/12-2/revbruno.htm](http://purl.oclc.org/emls/12-2/revbruno.htm)>.

⁵ Geissner, Hellmut. *On Rhetoricity and Literarity*. In: *Communication Education*. Jul 1983. Vol. 32, 3. P 275-284. October 20, 2007

⁶ Brockriede, Wayne E. "Dimensions of the Concept of Rhetoric." In: *Quarterly Journal of Speech*, 54 (1968), Pp. 1-12.

⁷ Bryant, Jennings; Heath, Robert L. *Human Communication Theory and Research: Concepts, Contexts, and Challenges*. Lawrence Erlbaum Associates: Mahwah, NJ. 2000. P. 171.

⁸ Perry, David K. *Theory and Research in Mass Communication: Contexts and Consequences*. Lawrence Erlbaum Associates. Mahwah, NJ. 1996. P. 96.

beliefs.”⁹ According to Foulger and other researchers one outline of the functions of communication follows what might be thought of as a rhetorical approach and is as follows:

Information
Education
Persuasion
Entertainment¹⁰

Oral communication is a first step in the development of cultural communication *per se* and human communication. For Goody the oral society is linked to interpersonal communication: “The development of human society over the long term is affected by the speed and accuracy with which ideas are transferred from one individual or group to another. In the Old Stone Age, or Paleolithic period, such a process was slow since communication in the sense of physical movement was slow. And with oral communication, virtually all transfer had to be face-to-face [...].”¹¹ Susanne Günthner used in *Language and Culture - an Analysis of a Chinese-German Conversation* the term *communicative forms*: “Different communicative cultures might have similar communicative genres or activities (such as argumentations), however, these communicative forms might differ in their structural organization or their communicative function.”¹² Writing was a key of Greek education in the city-states. Oral communication was also related to social purposes. The most common form of government in the Greek city-states was oligarchy, ‘ruling by a few.’ The reforms of Solon in Athens left an oligarchy of nobles in charge of the state granting also power to an elected democratic assembly. In the 6th century democracy, ‘ruling by the demos’ (‘people’), allowed free male citizens to rule the city-states. Public speech was the most important feature of a man who started a career in any public field. The assembly, the law courts, the agora, and the theatre served as places for public speech.

II The Topology of Commonplaces and Figures

A figure of speech is a non-ordinary use of language employed to create an emphasis, amplify a meaning, draw a comparison, and finally to make a saying more persuasive. The figure may be achieved by employing several actions of change. The four categories of change (quadripartita ratio) are:

addition subtraction transposition substitution

Addition, subtraction, transposition, and substitution comprise the four categories of change. These are fundamental rhetorical strategies for the manipulation and variation of discourse across a vast array of linguistic levels: word forms, sentences, paragraphs, and entire texts or speeches.¹³ Craig in *Communication Theory As a Field* wrote: “Each tradition of

⁹ Craig, Robert T. *Communication Theory as a Field*. In: *Communication Theory*, Vol. 9, 1999. P. 119.

¹⁰ Foulger, D. and other participants. (September 27, 2007). *Functions Of Communication*. MediaSpaceWiki. December 23, 2007.

<[Http://evolutionarymedia.com/wiki.htm?FunctionsOfCommunication](http://evolutionarymedia.com/wiki.htm?FunctionsOfCommunication)>

¹¹ Goody, Jack. “Orality and the Advent of Writing”. In: *New Dictionary of History of Ideas*, October, 2005. Find Articles. [1.7.2007].

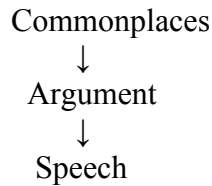
<[Http://findarticles.com/p/articles/mi_km4452/is_200510/ai_n16262560](http://findarticles.com/p/articles/mi_km4452/is_200510/ai_n16262560)>

¹² Günthner, Susanne. *Language and Culture. An Analysis of a Chinese-German Conversation*. EESE. University Erfurt. [2007].

<[Http://www.uni-erfurt.de/eestudies/eese/general_frame.html](http://www.uni-erfurt.de/eestudies/eese/general_frame.html)>

¹³ Burton, Gideon O. *Changes. Silva Rhetoricae*. Brigham Young University. December 23, 2007.

communication theory derives from and appeals rhetorically to certain commonplace beliefs about communication while challenging other beliefs. The complementarities and tensions among traditions generate a theoretical metadiscourse that intersects with and potentially informs the ongoing practical metadiscourse in society. In a tentative scheme of the field, rhetorical, semiotic, phenomenological, cybernetic, sociopsychological, sociocultural, and critical traditions of communication theory are distinguished by characteristic ways of defining communication and problems of communication, metadiscursive vocabularies, and metadiscursive commonplaces that they appeal to and challenge.”¹⁴ The commonplace is a condition for the plausibility of a theory. The commonplace is the source for arguments in rhetoric. In communication the commonplace is source for plausibility serving as a meta-concept of communication.



Communication in Rhetoric

The Imperium Romanum was a system of power held between Rome and the connected countries as colonies. They had communicative exchange due to an administrative apparatus with Romans sent to the colonies. Also the interior social structure showed different kinds of classifications of the persons living in the Imperium Romanum from the imperator and the senators to the slaves. The Latin noun *communicatio* means communication and it is the origin of terminology of communication of most European languages. The verb *communico* has a broad field of meanings such as ‘to share out’, ‘give a share in’, ‘to communicate’, ‘to take counsel’, ‘confer with a person’, ‘to join, unite’, ‘to take a share in’, and ‘to participate’. Roman art and literature were influenced by Greek culture. But some technical auxiliary tools for communication were more developed by the Romans in terms of better adjustment to the physical conditions for message exchange. A state communication system was covering the whole *Imperium Romanum* (Roman Empire) with roads for the transfer of communication issues built all over the imperium and messengers. The Silk Route was a system of pathways that began in China, crossed central Asia and ended in Rome. Caesar uses in *De Bello Gallico* (liber VI) the term *consilia communicare* (‘to communicate official decisions’) to describe a way to communicate with barbarian tribes:

*Ambiorigem sibi societate et foedere adiungunt. Quibus rebus cognitis Caesar, cum undique bellum parari videret, Nervios, Aduatucos ac Menapios adiunctis Cisirhenanis omnibus Germanis esse in armis, Senones ad imperatum non venire et cum Carnutibus finitimisque civitatibus consilia communicare, a Treveris Germanos crebris legationibus sollicitari, maturius sibi de bello cogitandum putavit.*¹⁵

In Caesar’s *De Bello Gallico* (book 7, chapter 63, section 4) we find also an example for the verb *communicare* in a public affair: “Petunt a Vercingetorige Aedui ut ad se veniat

<[Http://rhetoric.byu.edu/Four%20Changes/Four%20Changes.htm](http://rhetoric.byu.edu/Four%20Changes/Four%20Changes.htm)>

¹⁴ Craig, Robert T. Communication Theory as a Field. In: Communication Theory. Volume 9. Issue 2 (1999). P. 119.

¹⁵ Caesar, Gaius Julius. De Bello Gallico. Montclair University. October 20, 2007
<[Http://grid.montclair.edu/latintexts/caesar/gallic/gallic6.html](http://grid.montclair.edu/latintexts/caesar/gallic/gallic6.html)>

rationesque belli gerendi comunicet.” The *Imperium Romanum* used for its command network a combination of human messengers and papyrus. The Roman Empire combined transmission mechanisms with an alphabetic language for political purposes. In terms of education and learned skills the term *communicatio* was in the Roman Empire related to the *encyclos* of learning. The architect Vitruvius in *De Architectura* (*praefatio*, 1, 12) used the term *communicatio* in the statement that all disciplines (*omnes disciplinas*) have a conjunction of things and communication (*coniunctionem rerum et communicationem*) in the *encyclos*:

*At fortasse mirum videbitur inperitis, hominis posse naturam tantum numerum doctrinarum perdiscere et memoria continere. cum autem animadverterint omnes disciplinas inter se coniunctionem rerum et communicationem habere, fieri posse facilliter credent.*¹⁶

In Rome the concept of communication was dedicated to the community (*communitas*) of citizens in terms of public speech. Oratory was a special kind of public speaking for a special purpose in a special way at a special time to an audience by an *oratio*. The word *oratio* is derived from mouth ‘*os*’. Oratory was practiced by people long before the ancient rhetoricians developed its theory and a vocabulary and terminology for it. But the ancient rhetoricians actually developed rhetorical guidelines. These Roman rhetoricians used a set of principles for communication taken from Greece in the Latin language and later codified it in Latin rhetorical writings. Rhetoric was cultivated as an important art and science in Rome coming from Greece spreading over Europe across the *Imperium Romanum*.

III Rhetoricity and Communicability

When now using the word ‘rhetoricity’ as a feature of communication, it comprises the fields of rhetoricity itself, persuasion and the style. On the other hand rhetoricity is a feature of the channels orality, literacy, visuality, and general mediality. These are of course general features that most information with an intention towards the audience has in common. But communication as rhetorical communication is bound to a specific feature of rhetoric: The deliberative consultation and turn of the sender of the information towards the audience with an intended aim of the message that also with this feature needs to be made more persuasive. This act comprises the power function of communication and its influence not only in terms of the distribution of the information, but also in terms of the meaning of the information. Meaning in a broader sense here stands for the connotations of the information conveyed in any form.

If we look now at communication as a rhetorical process, we can ask: What are the specific features of rhetoricity in such a process? These features also are features of the network itself. The participating entities share a common persuasive aim. This of course is the case in an established communication network. Rhetoricity itself has no positive or negative aims; it is in its classical understanding and definition just the ability to persuade someone regarding his/her own standpoint and operates in specific forms and stylistic ways – one of them is communication. The four categories of change (*quadripartita ratio*) are addition, subtraction, transposition, and substitution. Addition, subtraction, transposition, and substitution comprise the four categories of change. These are fundamental rhetorical strategies for the manipulation and variation of discourse across a vast array of linguistic levels: word forms, sentences, paragraphs, entire texts or speeches, etc. These have been used as categories to identify

¹⁶ Pollio, Marcus Vitruvius. *De Architectura*. Liber I. University Chicago. October 20, 2007
<[Http://penelope.uchicago.edu/Thayer/L/Roman/Texts/Vitruvius/1*.html](http://penelope.uchicago.edu/Thayer/L/Roman/Texts/Vitruvius/1*.html)>

changes in word forms considered to be vices; as generative strategies for invention; as stylistic possibilities for both tropes and schemes; as pedagogical methods for developing rhetorical flexibility (see *copia* and rhetorical exercises); and as methods of imitation by which one could transform a model into something different and original. These become another means of mapping the forest of rhetoric—a way of finding motifs, habits of mind, or simply similar approaches operating on multiple levels across the breadth of rhetoric.¹⁷ Shared communication is within rhetorical tools a sign of practiced democracy. It can be traced back to the oldest democracy in the world –Greece– and the idea of shared power among politicians, the ones who care for the *polis*. But shared power finds its limits in the way and weight the power is shared. In general it is institutionalized and depersonalized. The formal aspects of rhetoricity we can trace back to the style forms of speech that represent linguistic patterns on the level of grammar, phonetic, semiotic, and semantic. They are a change of the general and standardized linguistic zero-level with no changes. Basic performances for these processes of change we already mentioned:

Addition	Addition
Change	Substitution
Transformation	Transposition
Subtraction	Subtraction

Categories of Change for Communication and Rhetoric

Schmitt, Skinner, and Kessler in *The Cambridge History of Renaissance Philosophy* wrote: “Moreover, translation as *transformatio orationis* required an oratorical ... but Pico wished to exclude his rhetorical arts from philosophy [...]”¹⁸ Rhetoricity can be expressed in schemata (figures). Historically, the discipline of rhetoric has developed and codified a number of schemata on syntactic, semiotic, and phonetic level of oral and written texts, but also comprises visual and medial forms. The Greek etymon of 'ellipsis' (Latinized as *detractio*) was a part of the stock analytical vocabulary of rhetoric and was glossed as the omission of words.¹⁹ Heinrich F. Plett, Peter L. Oesterreich, and Thomas O. Sloane mentioned that a discussion of the general category of *detractio* prepares for the lengthy treatments.²⁰

Including e.g. visuality, rhetoricity can also implement media. Rhetoricity is concerned with the relation between ‘words’ and ‘things’ and considers the ubiquitousness of rhetoric as the most valuable feature of rhetoric. If leaving the traditional concept of rhetoric and doing an excursus, we can look at typical linguistic features of communication. We said above that communication is the most successful, when applied with certain unified or standardized features that a common group of communicators share. Communication tends to be more complicated, when the linguistic features or meanings are not shared in common. Even when for example in two languages the linguistic features are the same, the meanings can be

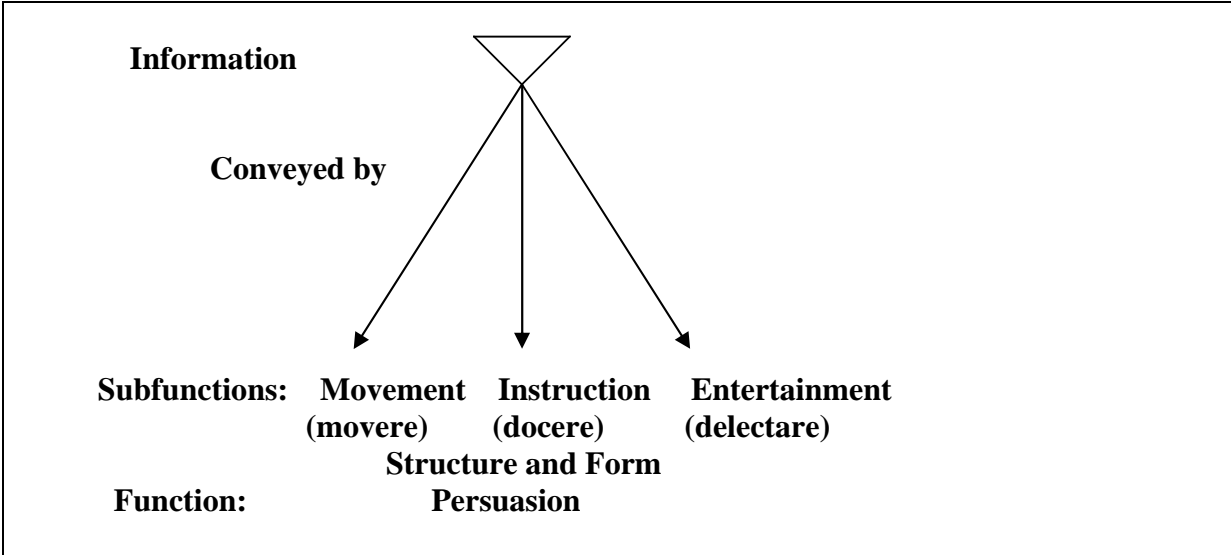
¹⁷ Burton, Gideon O.. *Silva Rhetoricae*. Brigham Young University. October 20, 2007.
<[Http://rhetoric.byu.edu/Four%20Changes/Four%20Changes.htm](http://rhetoric.byu.edu/Four%20Changes/Four%20Changes.htm)>

¹⁸ Charles B. Schmitt, Quentin Skinner, Eckhard Kessler. *The Cambridge History of Renaissance Philosophy*. Google Books. October 20, 2007.
<[Http://books.google.com/books?isbn=0521397480](http://books.google.com/books?isbn=0521397480)>

¹⁹ Brandon, E.P. *Ellipsis: History and Prospects*. Published first in: *Informal Logic*. Vol. VIII, 2. Spring 1987. Pp. 93. The University of the West Indies. October 20, 2007.
<[Http://www.cavehill.uwi.edu/bnccde/epb/ellhp.html](http://www.cavehill.uwi.edu/bnccde/epb/ellhp.html)>

²⁰ Heinrich F. Plett, Peter L. Oesterreich, Thomas O. Sloane. *Rhetorica Movet: Studies in Historical and Modern Rhetoric*. Google Books. October 20, 2007.
<[Http://books.google.com/books?isbn=9004113398](http://books.google.com/books?isbn=9004113398)>

different. The different meanings and mind concepts associated with them are for example connoted in the different uses of the word ‘communication’ in the history of Europe. The quality of rhetoricity in shared information is the quality of an interest that is claimed not only to be an interest of the entity that holds the information, but also an interest that the other entities in the communication network shall share. The persuasive act is to make the other entities consider the necessity to share this information. Channels serve as the way to convey this information.



1. Functions of Rhetoricity

The three functions movement, instruction, and entertainment derived from ancient Roman rhetorical theory (movere-docere-delectare). One specific feature of rhetoricity in communication networks is that rhetoricity is connected and mediated with the communicative network. No network – no rhetoricity – no power. We must also draw a line between rhetoricity and propaganda of ideologies. Since rhetoricity is bound to the ethical correct person that speaks or writes, it is an individual capacity of a person. Thus, it requires specific channels of personal communication. Network channels often are used to assist to convey personal rhetoricity into a broader audience. Often also organized communication channels try to participate in the rhetoricity of a person aiming to connect their aims with the aims of a rhetorician. For example Public Relations and advertisements use persons as figures that present their ideas or let them speak for them. To conclude: The question or communicability or incommunicability of information can be answered asking if here rhetoricity as a criterion of a feature of communication is available. But regarding the specific features we present here as a theory, rhetoricity is just one of them. Not all of communications and communication networks possess the quality of rhetoricity.

IV Rhetoricity and Communicability from a Functional Perspective

Rhetoric and communication share some basic elements we already illustrated in graphs. An ellipse is a set of all points P in a plane with the following property: for each such point P, the sum of its distances from the two arbitrary given points F1 and F2 in that plane is constant. Mathematically speaking the following relation must be valid: $|F1P| + |PF2| = 2a > |F1F2|$,

where $2a$ is a constant greater than the distance of the foci $F1$ and $F2$.²¹ The ellipse is a form of subtraction both in topology and rhetoric. Instead of the circle only the elliptic form is given and instead of a full sentence a part of the sentence is missing.

In topology a hyperbola ($f(x)=1/x$) is a set of all points P in a plane with the following property: for each such point P , the absolute value of the difference of its distances from the two arbitrary given points $F1$ and $F2$ in that plane (points $F1$ and $F2$ are again called foci) is constant. Mathematically speaking, the following relation must be valid: $||F1P| - |PF2|| = 2a < |F1F2|$, where $2a$ is a constant smaller than the distance of foci. Hyperbola consists of two branches. If a point P is located on one of the branches, relation $|F1P| - |PF2| = 2a$ is valid. If, on the other hand, point P is located on the other branch, relation $|F2P| - |PF1| = 2a$ is valid.²² The hyperbola is a form of exaggeration both in rhetoric and topology. It is associated with a loss of information, when $x > 1$. In topology a parabola ($f(x) = y = x^2$) is a set of all points P in a plane with the following property: for each such point P , its distance from an arbitrary given line p (called directrix), lying in that plane, must be the same as its distance from an arbitrary given point F (called focus) in that plane. Point P does not lie on the line p . Mathematically speaking, the following relation must be valid: $|FP| = |Pp|$.²³ The parabola produces narrative traffic by empowerment. We can also describe the rhetorical figures as interference phenomenon in language. Operations are done that change the surface structure of a normal linguistic pattern and the changes can be classified as rhetorical figures. Figures make the text or speech more unique, but receivers enabled to understand the code will react on it. As interference figures result from changes, additions, subtractions, and exchanges from the level 0 of a language to the rhetorical structure. The interference is also a linguistic phenomenon. For example the word communication has in different languages other words or loanwords that interfere with other words and mind concepts. Rhetoricity has the power to structure linguistic and visual phenomena. Besides unique rhetorical features a rhetorical message is an expression of power in form of persuasion. The information from x sent to the receiver y contains this information with the implemented persuasive pattern.

V Communicability or ‘When Do We Communicate?’

We can describe this state the equitation of the function $(f)x=y$ with the absolute value 0 for both x and y . The function $(f)x=y + 1$ with the absolute value 0 for both x and y would indicate that additional information exists. Given the situation that x is a constant of 0 and y is a variable for all positive numbers, we have a communicative situation with a sender with no information and a receiver with information. That is not possible. Given the case that the x is the set of all natural numbers and y is constantly 0, we have the situation that the information is not transferred to the receiver.

Two aspects of communicability exist. The state of communicability is characterized as a potential possibility to perform a communication process between participating communicators in a network. Communicability can also describe the ability of separated parts of a network to practice or participate in a communication process. We separate between the following states of communication processes.

²¹ Tuleja, Slavomir; Hanc, Jozef. Definitions. Lost Lecture. October 20, 2007
<[Http://www.lostlecture.host.sk/definitions.htm](http://www.lostlecture.host.sk/definitions.htm)>

²² Tuleja, Slavomir; Hanc, Jozef. Definitions. Lost Lecture. October 20, 2007
<[Http://www.lostlecture.host.sk/definitions.htm](http://www.lostlecture.host.sk/definitions.htm)>

²³ Tuleja, Slavomir; Hanc, Jozef. Definitions. Lost Lecture. October 20, 2007
<[Http://www.lostlecture.host.sk/definitions.htm](http://www.lostlecture.host.sk/definitions.htm)>

Incommunicability / State of “Communication Breakdown”
 Communicability / State of “Communication Breakthrough”
 Communicability / State of “Communication Breakout”

States of Communication

Addition	Communicability
Change	Communicability
Transformation	Communicability
Subtraction	Communicability

Processes in States of Communication

2. Basic States of Communication: Communicability/Incommunicability

Transformations - Systematical Interferences as Argumentation

Rhetoric and geometrical functions both operate by transformation. In particular, the term transformation usually applies to functions whose inputs and outputs are elements of the same set or more general structure. Thus, we speak of linear transformations from a vector space into itself and of symmetry transformations of a geometric object or a pattern. Formulary functions like $f(x)=y$ with its related graphs can illustrate an argumentation with arguments. The mathematical concept of a function expresses dependence between two quantities. One is the independent variable as the argument of the function. The other is produced as the dependent variable as the value of the function. A function associates a single output with every input element drawn from a fixed set, such as the real numbers.

Subtraction

Subtraction is the lack of elementary parts.

Addition

Addition is the mathematical operation of combining or adding two numbers to obtain an equal simple amount or total.

Change or Exchange

Change or Exchange means the replacement of one element by another element.

Transformation

Transformation is the change of an element

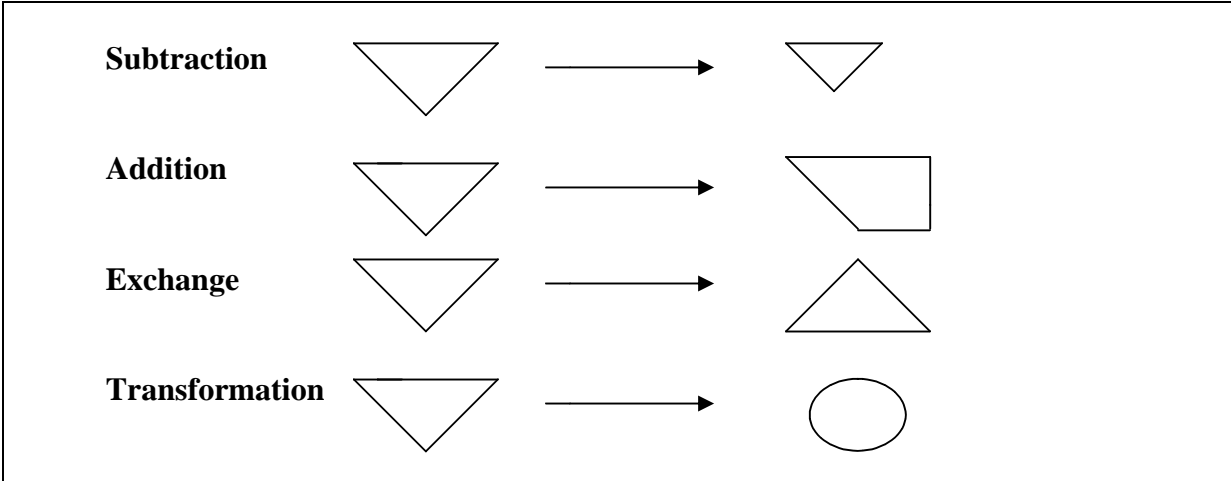
Basic Performance Categories in Communication

Binarity as Function of Communicability

Binarity is a basic asset of communication in models. Functions with a graph in form of a horizontal line with $y=f(x)$ as a constant binary set. Here the standard function $(f)x=y$ is the function of communicability. If there is no information from the sender, also the receiver has no information available. If the sender has an information a, also the receiver has

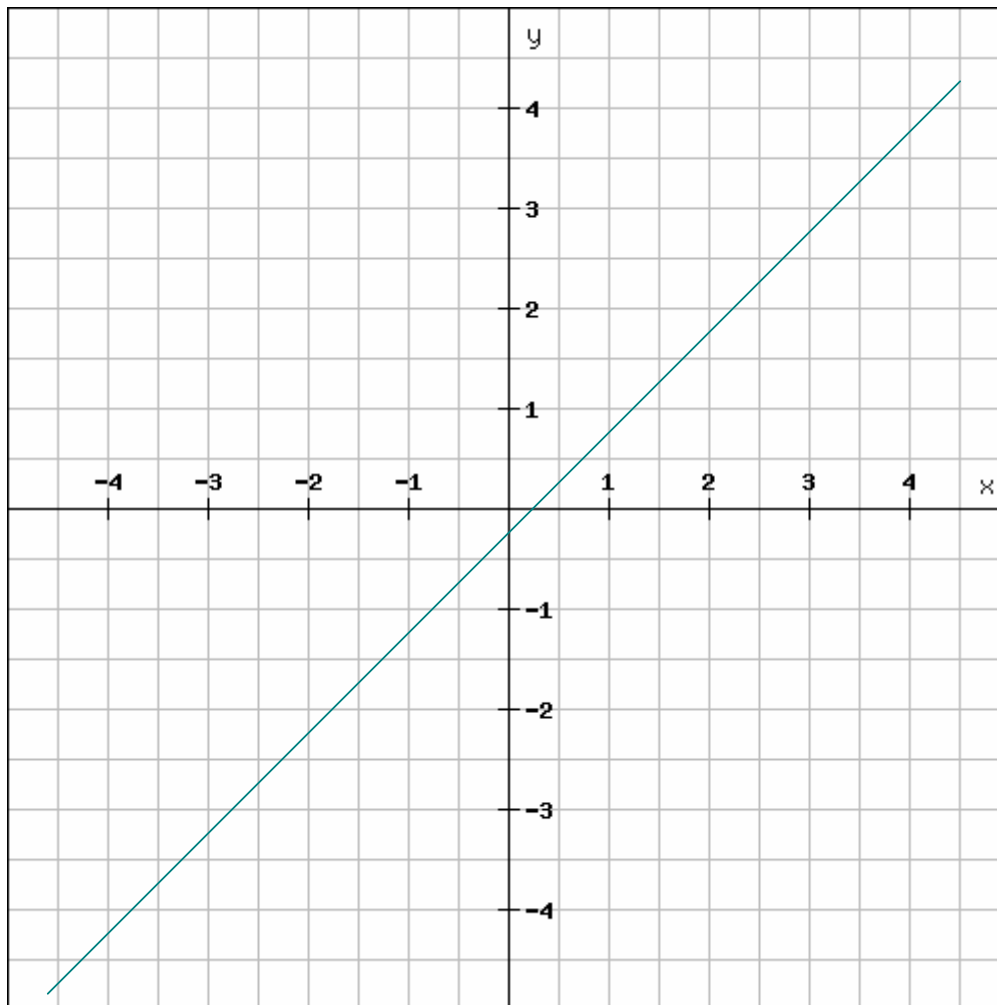
the information a. The function $(f)x=y$ expresses complete basic communicability between x and y. Functions and aims of a communication process are:

- Information Transfer
- Rhetoricity
- Network Stabilization
- Reference



3. Types of Change Enforcing Incommunicability

The function $(f)x=y - n$ expresses complete basic communicability between x and y affected by a lack of an amount of information (n) missing in y. In other world: The information is incomplete. In the case above the amount n is 2. In case that the information of x has the absolute amount 4, y receives only the amount 2. Among types of additional information we can distinguish between additional information that is added to the basic information without interference and additional information that interferes with the basic information and this way affects communicability. The addition of information can interfere with the information that is the information intended to be transmitted from sender to receiver. The function $(f)x=y + n$ expresses complete basic communicability between x and y affected by an additional amount of information (n). In the case above the absolute amount n is 2 added to the absolute amount for y.



4. Function $f(x)=y$. Complete Basic Communicability

Here the additional information (n) doesn't interfere with the basic information amount. But given the function $f(x) = y = x^n$ and $n=2$ (parabola), the information n would interfere. As a phenomenon of interference such an additional information reduced the quality of communicability. It changes the quantity or quality of the transmitted information. The additional information is here not a supplement for the information, and stands in no relation to the information to be transmitted.

VI The Historical Perspective

Kierstead wrote regarding the foundations of the Greek polis that it was "a complex hierarchical society built around the notion of citizenship. It was made up of hundreds or even thousands of independent peasant households, which neither paid impersonal dues to a centralized government, nor depended on the state for the means of life.... The equation of the polis with the whole citizen body, even if governmental functions were often reserved to a smaller group, marks it off from other ancient states. All citizens had a share in the polis, which in its most developed form was based economically on the institution of chattel slavery. If the citizens became subjects, their community ceased to be a polis."²⁴ Writing was a key of

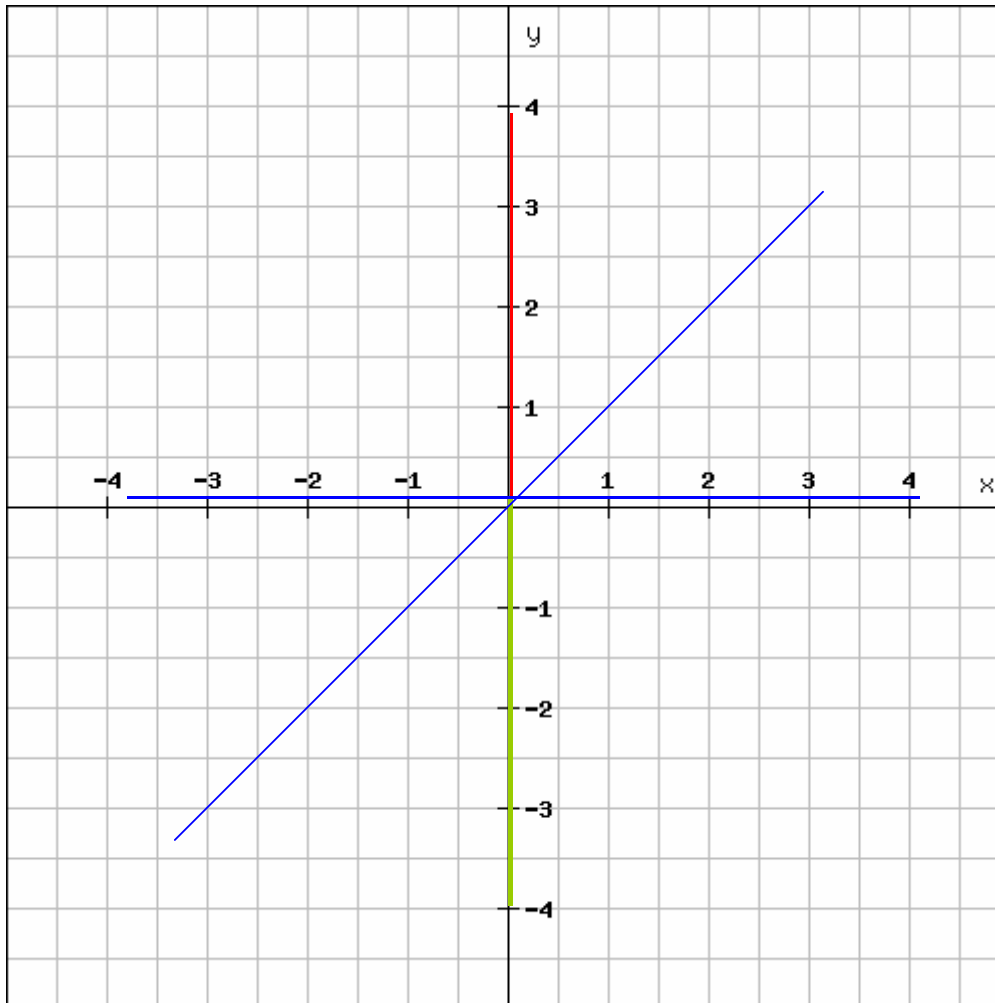
²⁴ Kierstead, Ray. Foundations of the Greek Polis: Political Culture 700-500. Reed College. [1.7.2007]. <[Http://academic.reed.edu/humanities/110tech/polisfoundations.html](http://academic.reed.edu/humanities/110tech/polisfoundations.html)>

Greek education in the city-states. Oral communication was also related to social purposes. The most common form of government in the Greek city-states was oligarchy, 'ruling by a few.' The reforms of Solon in Athens left an oligarchy of nobles in charge of the state granting also power to an elected democratic assembly. The term *communicatio* appears in several Latin writings. Apuleius describes in *De Dogmate Platonis Liber Secundus* the communication of public works (*communicatio opum publicarum*) as a field of justice:

*Duabus autem aequalibus de causis utilitatem hominum iustitia regit, quarum est prima numerorum observantia et divisionum aequalitas et eorum quae pacta sunt symbole, ad haec ponderum mensurarumque custodia et communicatio opum publicarum; secunda finalis est et veniens ex aequitate partitio, ut singulis in agros dominatus congruens deferatur ac servetur, (bonus) opimis optatior, minor non bonis; ad hoc bonus quisque natura et industria in honoribus et officiis praeferatur, pessimi cives luce careant dignitatis. Sed ille iustus in defetendo honore ac servando modus est ei qui est suffragator bonorum et malorum subiugator, ut semper in civitate emineant, quae sunt omnibus profutura, iaceant et subiecta sint cum suis auctoribus vitia.*²⁵

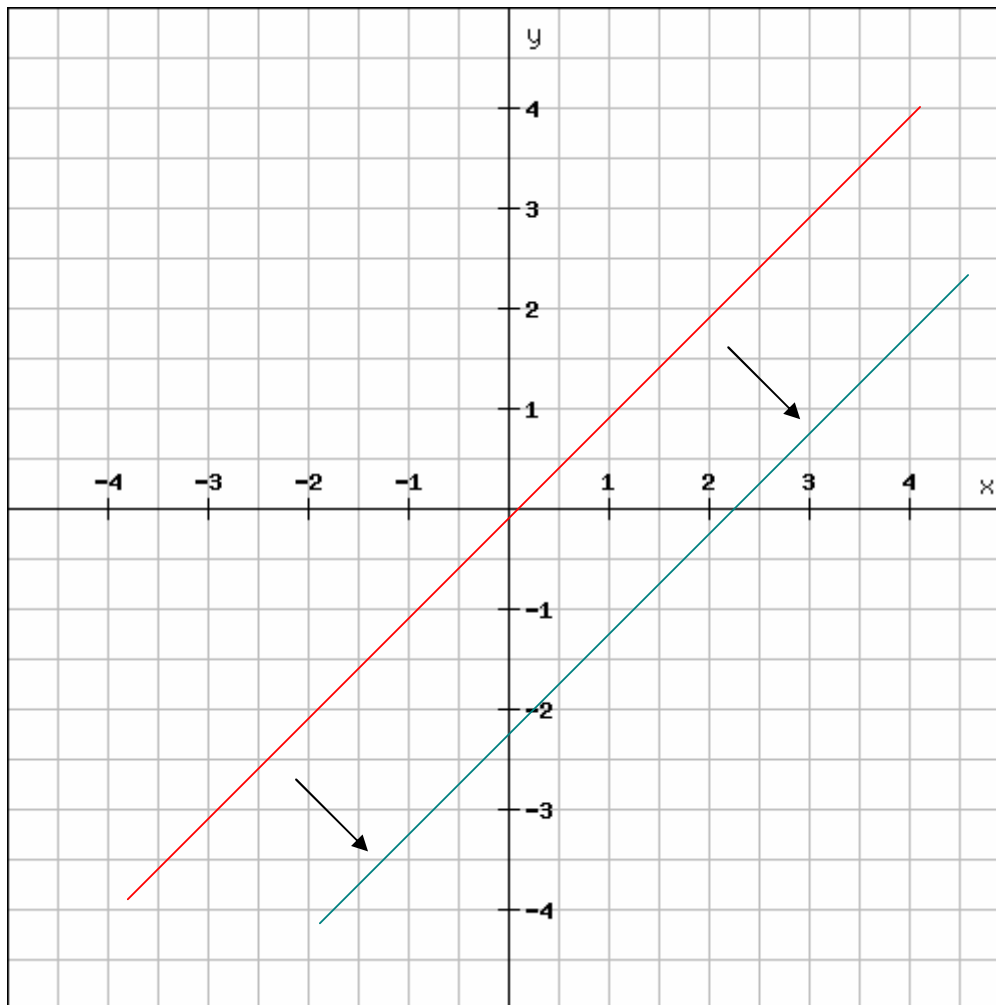
In the 6th century democracy, 'ruling by the demos' ('people'), allowed free male citizens to rule the city-states. Public speech was the most important feature of a man who started a career in any public field. The Greek *polis* had an indirect system for conditions of communication. We can describe them within the system of rhetoric. We will see how communication is implemented into the system of rhetoric. Rhetoric was the most important tool for public communication and politics. When we compare to Rome, here neither a written code of laws existed nor was the law centralized, but depended on the community of the polis. Orality was of highest demand. Greek philosophers systematically explored the tools and means of the production of meanings in their language in the field of rhetoric.

²⁵ Apuleius. *De Dogmate Platonis Liber Secundus*. The Latin Library. [2.2.2007]. <[Http://www.thelatinlibrary.com/apuleius/apuleius.dog2.shtml](http://www.thelatinlibrary.com/apuleius/apuleius.dog2.shtml)>



5. Function (f) $x=y$ for x and $y = 0$ Indicates a Case of Incommunicability.

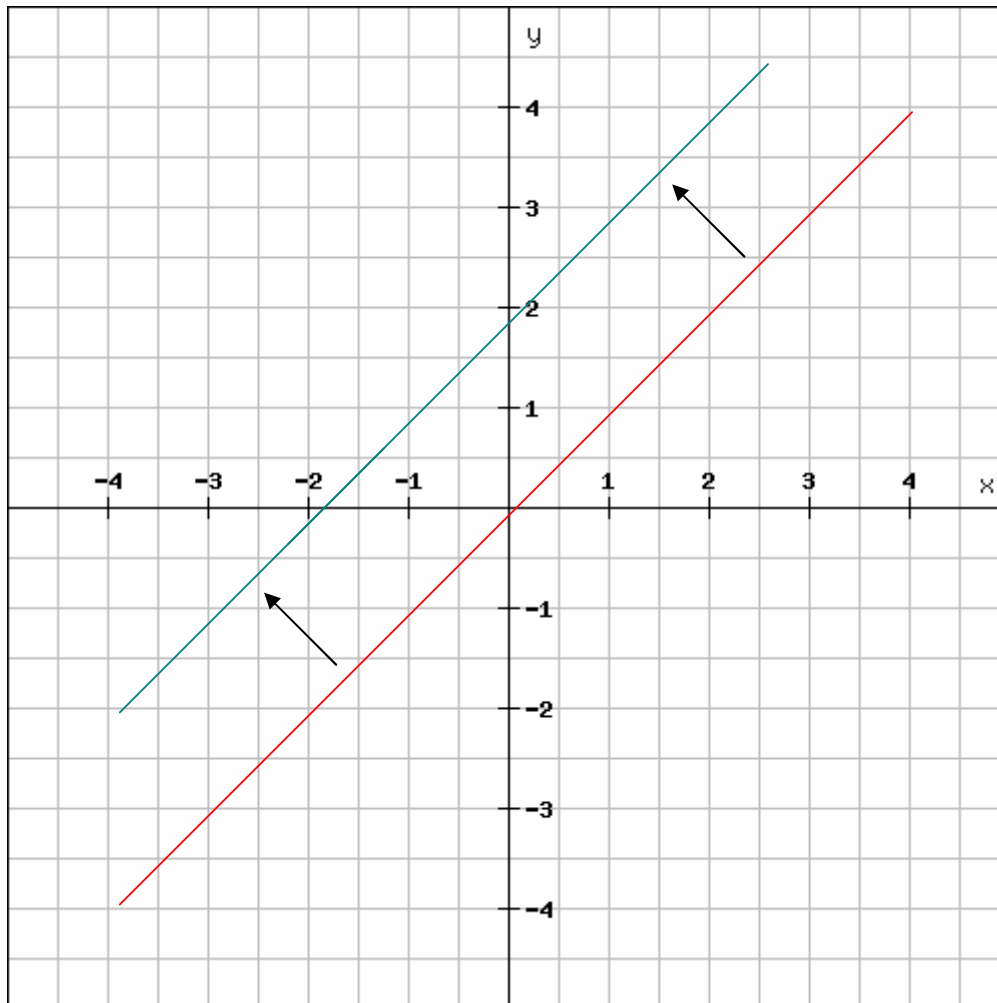
In the Greek myth the daughters of Mnemosyne called the muses, which are Clio, Melpomene, Thalia, Euterpe, Terpsichore, Eratho, Caliope, Urania, and Polihymnia, each of them representing one art. Western cultures, influenced by classical Greek and Roman traditions, developed using oratory in politics, religion, and legal affairs. In the *New Testament* the verb *semaino* is used with the definition ‘to give a sign, to signify, indicate to make known’ (John 3, Acts 2, Revelation 1). For the verb ‘to communicate’ the terms *koinoô* and *koinopoieô* next to derivatives existed, to announce is *angellô*, the noun for ‘to communicate with someone’ is *homilia* and the related verb *homileô*. The Greek noun *homilia* as ‘conversation’ has its equivalent in the Latin *sermo*. *Homileô* is a derivative from *homilos* (‘to be in company with’). *Homileô* has also the meanings ‘to associate with’, ‘to stay with’, and ‘to converse with’, ‘talk about with one’. Communication in the sense of what is announced is in ancient Greek *angelia*. The word *homily* is derived from the Greek word *homilia*, which means to have a communion with a person or in a spiritual connection with god(s). In this sense *homilia* is used in several places in the *Bible* (I Cor., xv, 33. Luke, xxiv, 14, Acts, xxiv, 26). *Homilia* in the post-*New Testament* period became a technical term for the ‘sermon’ spoken at church gatherings for religious discussion, interaction, and conversation.



6. Function $f(x)=y - n$. Subtraction

Society as united communication of the highest friendship and values is *koinônia*. The term *koinônia* was also used for longing for communion with the divine in Hellenistic religious thought and Christianity. Rhetoric is the anglicized term used for the Greek word for public speaking. This Greek term refers primarily to oral verbalization. It is derived from the Greek term *rhema* for a word or saying. The formal study of rhetoric began in Greece in the 5th century B.C.E. with the professions of the logographers and sophists. There were no lawyers in Athens, but people accused could hire a citizen, the logograph, to write a speech for them. The so-called logographers wrote speeches for citizens that had to defend themselves in court for a fee. The need for skilled speakers fostered the growth of rhetorically skilled persons. The basic elements of communication by rhetoric were the rhetor, the speech, and the audience. The audience consisted in Greece of citizens in a polis. The step from orality to literacy can be found in different cultures.²⁶ Rhetorical skills were necessary in the law courts in Greek, Hellenistic, and Roman times. Rhetoric included training for accusations and in order to defend, since no lawyers could represent the accused persons in ancient Athens. Gellius in his *Attic Nights* (VI, 15) cites Cato using the term *communicatio* for a communication with others:

²⁶ Cf. Poster, Carol. "Being and Becoming: Rhetorical Ontology in Early Greek Thought." In: *Philosophy and Rhetoric*. 29.1 (1996). Pp. 1-14.



7. Function (f) $x=y + n$. Addition.

Quae deinde Cato iuxta dicit, ea" inquit "confessionem faciunt, non defensionem, neque propulsationem translationemve criminis habent, sed cum pluribus aliis communicationem, quod scilicet nihil ad purgandum est.²⁷

The first teachers of rhetoric known as sophists were skilled in rhetoric. The sophistic movement flourished in the new democratic society. Sophists expanded their expertise from teaching argumentation to making rhetoric the basis for education in all fields. In a common definition rhetoric is the art or study of effective and persuasive use of languages. Also a treatise or book discussing this art is called rhetoric. For the practical skills of using language effectively and persuasively this expression is also used. A style of speaking or writing especially regarding a particular subject is also a feature of rhetoric.

²⁷ Gellius, Aulus. Liber Noctium Atticarum. University Chicago. [2.2.2007].
 <[Http://penelope.uchicago.edu/Thayer/L/Roman/Texts/Gellius/6*.html](http://penelope.uchicago.edu/Thayer/L/Roman/Texts/Gellius/6*.html)>

VII Examples of Parallel Argumentations in Geometry and Rhetoric

Aristotle took over the mathematical words that have now become ‘hyperbola’, ‘ellipse’, ‘parabola’ into rhetoric. Now we look at special relations with systematical interferences between the sender x and the receiver y in geometrical functions named as mentioned above. Values of x and y are not equal as we have it in the standard case of $f(x)=y$ with both x and y sharing the same amount of information. Function $f(x) = y = x^2$ shows the power of the information at x and y . The power amount of x is multiplied by itself when reaching y . (See also chapter on rhetoricity). We already mentioned that this function affects communicability and results in a loss of information for the receiver, even while the absolute amount of information increases. A similar situation we have in the function $y = f(x) = \cos(x)$. Here the information is limited for y . Function $y=f(x)=\cos(x)$ expressed unequal amounts of information between x and y . Given the case that x has the amount 1.5, the amount of y is 0. Given the case that x is 0, y is 1. So in this function both addition and subtraction of information is expressed.

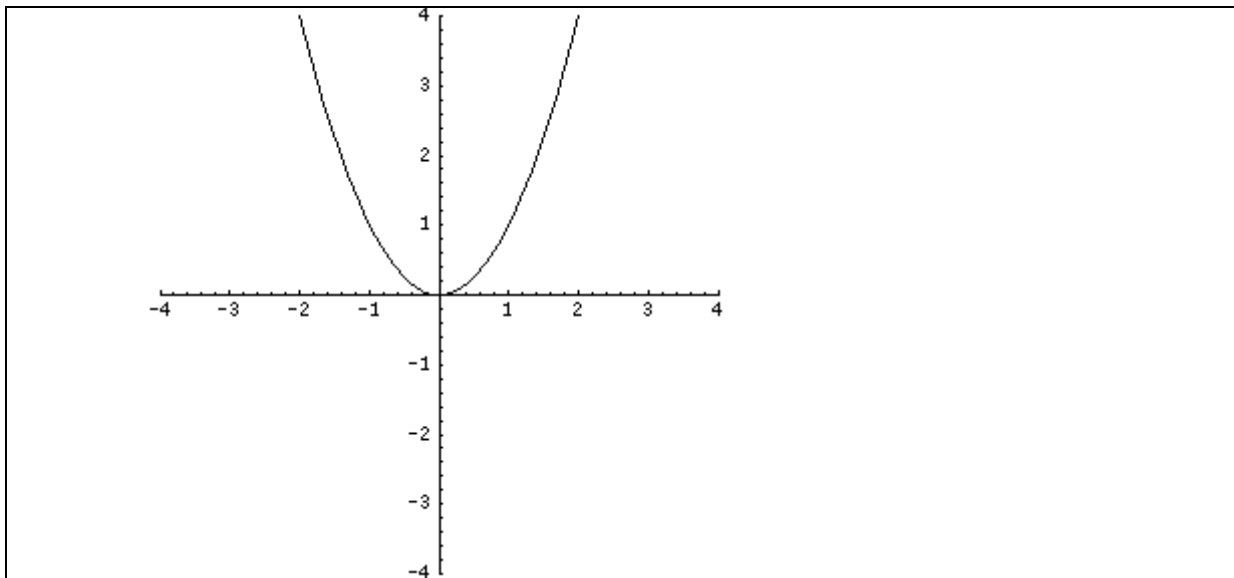
Conic Sections

The conic sections are the nondegenerate curves generated by the intersections of a plane with one or two nappes of a cone. The ellipse and hyperbola are known as central conics. A conic can be a circle, an ellipse, a parabola, or a hyperbola.²⁸ There are three non-degenerate conics: the ellipse, the parabola, and the hyperbola. The parabola results when the plane is parallel to a generating line of the cone. Conics are the curves generally given by a second degree equation:

$$(1) \quad Ax^2 + 2Bxy + Cy^2 + 2Dx + 2Ey + F = 0.$$

The discriminant $\Delta = B^2 - AC$ of the equation serves to differentiate between various curves: for ellipse, parabola, and hyperbola Δ is respectively less, equal, and greater than 0. In a special system of coordinates, (1) could be transformed into the canonical

$$(2) \quad y^2 = 2px + qx^2, \text{ which represents an ellipse, a parabola, or a hyperbola depending on whether } q \text{ is less than, equal to, or greater than } 0.²⁹$$



²⁸ Weisstein, Eric W. "Conic Section." MathWorld. A Wolfram Web Resource. January 3, 2008.

<[Http://mathworld.wolfram.com/ConicSection.html](http://mathworld.wolfram.com/ConicSection.html)>

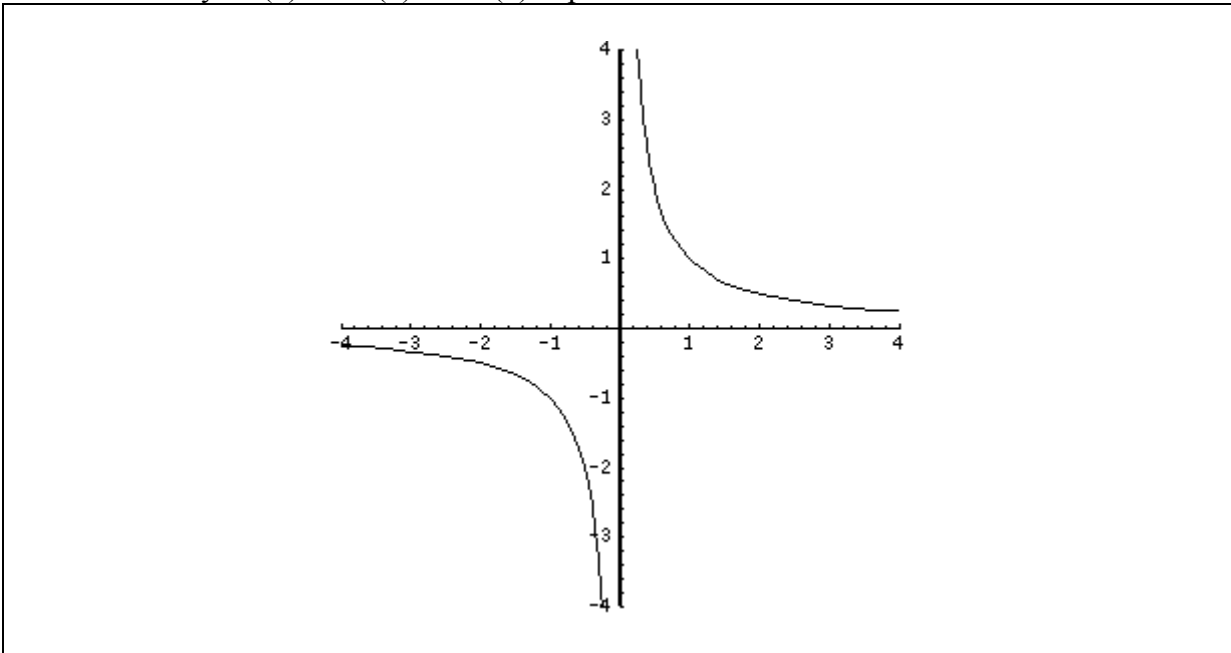
²⁹Alex Bogomolny. Cut The Knot! An Interactive Column Using Java Applets. The Parabola. March 2004. The Mathematical Organization of America. January 3, 2008.

<[Http://www.maa.org/editorial/knot/Parabola.html](http://www.maa.org/editorial/knot/Parabola.html)>

8. Parabola. Function $f(x) = y = x^2$

The hyperbola function $f(x) = 1/x$ indicates a specific case to subtraction of information in a communicative situation. Only when x is 1, the information for y is also 1. In all other cases the amount is unequal. Subtraction happens in case $x > 1$ and addition of information when $x < 1$. (See also chapter on rhetoricity). A hyperbola $y = 1/x$ indicates that only a part of the information is transferred. The higher the amount of x , the lower the amount of y and vice versa. Given such a network, it is necessary to figure out the elements of its communication.

Also function $y = f(x) = \cos(x) + \sin(x)$ expresses addition and subtraction of information.



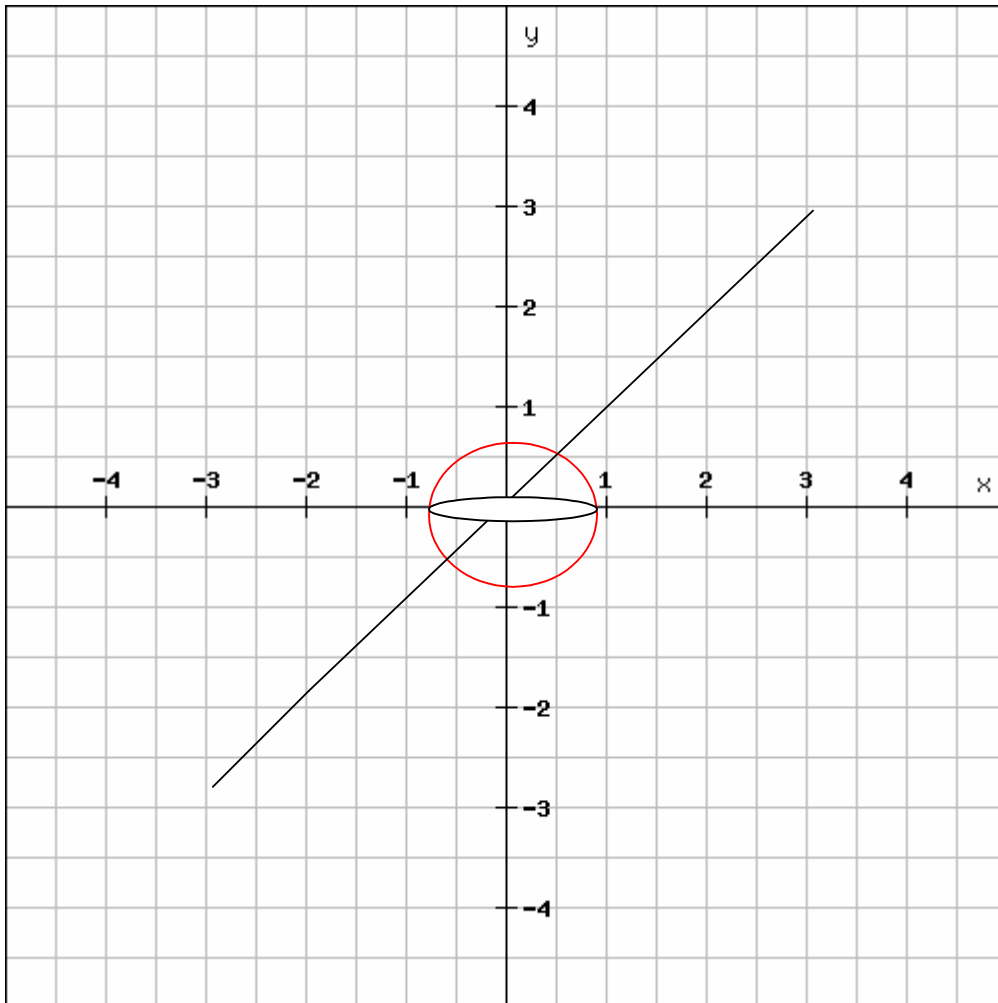
9. Hyperbola Function. $f(x) = 1/x$

For a circle the formulas $R^2 = x^2 + y^2$ and $1 = x^2 + y^2$ are given. The function $1 = x^2 + y^2$ shall express the complete area of communicability between x and y . X and y stand here for the information of the sender and the receiver. The information is –under normal conditions- identical. The area of communicability between two communicating entities x and y we can describe by this formula $1 = x^2 + y^2$. These is only one solution for : $1 = 0.5 + 0.5$ with

$$y \text{ x } y = 0.5. \quad y = 0.7071067811865476$$

$$x \text{ x } x = 0.5. \quad y = 0.7071067811865476$$

The ellipse is the deformation of the circle. Not the full area of the circle is given. A hyperbola with the function $x^2 - y^2 = 1$ indicated a special inverse function with a high amount of information of y and a low amount of x or a low amount of information of x and a high amount of information of y . Here the information can never be =0. In topology the conic sections are a circle, an ellipse, a parabola, and a hyperbola. Speech including an ellipse, a parabola, or a hyperbola goes beyond the facts.



10. Circle and Ellipse.
Circle Function $1=x^2+y^2$ Indicating an Area of Communicability
