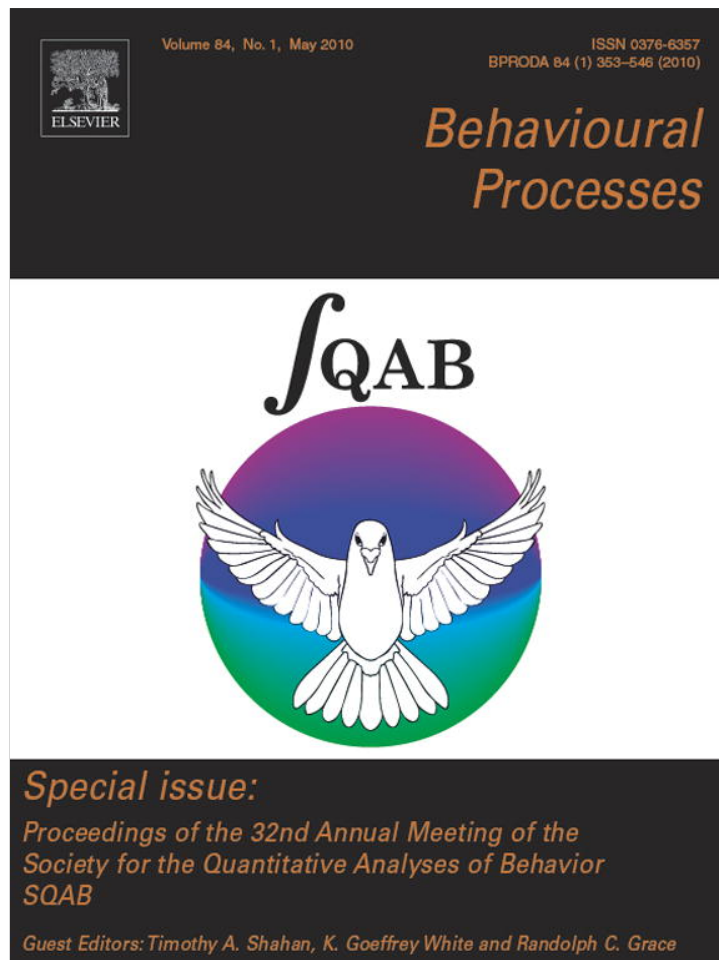


Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Contents lists available at ScienceDirect

Behavioural Processes

journal homepage: www.elsevier.com/locate/behavproc

Anatomy of deception: A behavioral contingency analysis

Francis Mechner

The Mechner Foundation, 200 Central Park South, 18E, New York, NY 10019, United States

ARTICLE INFO

Article history:

Received 1 September 2009

Received in revised form 3 February 2010

Accepted 4 February 2010

Keywords:

Deception

Misperception

Mistaken prediction

Economics

Property transfer

Ponzi schemes

Derivatives and securitization

Military operations

Intentionality

Theory of mind

ABSTRACT

Deception, a basic and pervasive biological phenomenon, takes many forms, variously referred to as mimicry, trickery, seduction, pretense, feigning, masquerading, impersonation, distraction, or false promises, and these share certain common distinguishing behavioral elements that permit them to be classified into categories. A symbolic language for the codification and analysis of behavioral contingencies shows that all instances of deception are based on a misperception, misprediction, non-perception, or non-prediction by the deceived party, and can be further categorized based on features of the contingencies that define them. Instances of particular interest are those in which a deceiving party predicts (and in that sense “intends”) the deception. In those instances, the effect of the deception is usually to the deceiving party's benefit and to the deceived party's detriment.

In economics, finance, business, military operations, public affairs, education, and everyday social interaction, deception takes numerous forms. Special forms, usually involving obfuscation, concealment, counterfeiting, and misrepresentation, occur in certain prevalent types of property transfer, including securitization, the creation of derivatives, and various types of Ponzi schemes. Such property transfers tend to be driven by opportunities for deception. They all involve blurring and clouding of the contingencies that defined the transferred properties, thus permitting their obfuscation.

© 2010 Elsevier B.V. All rights reserved.

1. Introduction

Deception is an essential and pervasive biological function that evolved as an integral part of the behavioral repertoires of most animal and some plant species (Bergstrom, 2008). In general, the deceiver secures benefits to the detriment of the deceived by operating on the latter's behavior. The multiple forms of deception are described by such terms as mimicry, trickery, seduction, pretense, feigning, concealment, masquerading, distraction, obfuscation, and diversion of attention. Instances include insect camouflage, the Venus flytrap's deception of insects as it lures them into its blossom, and predators stalking prey. Deception is also pervasive in human affairs, manifesting itself in most social interactions, even at the level of subtle facial expressions and gestures (Depaulo and Friedman, 1998).

Application of a formal language for the codification and analysis of behavioral contingencies (Mechner, 2008a,b, 2010, section “Deception and Entrapment”) shows that all forms of deception share certain features that identify them as such and that distinguish them from other categories of contingency. Contingency analysis reveals instances of deception in a wide range of human affairs including economics, business, finance, education, sociology, health, law, military operations, and public policy.

For the convenience of readers who are not familiar with the behavioral contingency language, a brief review of the particular features of the language that are used in the present analysis is provided in Appendix A.

2. Varieties of deception and their classification

In all instances of deception, the deceived organism responds to a stimulus event as if it were a different one,¹ often to its detriment. Non-detrimental instances are harmless optical illusions or a magician's tricks. In all instances of deception, the stimulus event can be occasioned by the inanimate environment (e.g., a desert mirage, the moon illusion) or by another organism. When by another organism (the deceiver), the response of the deceived is usually advantageous to the deceiver, and usually (but not always) disadvantageous to the deceived. Instances of harmless deception are parent telling child that Santa Claus will come, or arranging a surprise birthday party. Familiar instances of deception detrimental to the deceived party are frauds or cons. Application of the formal language for the analysis of behavioral contingencies reveals the myriad varieties and nuances of deception we see in human affairs and in nature generally, and their detailed features and dynamics, and suggests ways to organize them.

¹ i.e., in a way it has learned or been genetically programmed to respond to a different one.

E-mail address: fmechner@panix.com.

Of particular interest are the forms of deception seen in the common types of property transfer that comprise the domains of economics and finance. By revealing detailed structural similarities and differences, the language provides a system for categorizing these varied instances of deception, much as it provides rationales for categorizing the behavioral contingencies that define other fields (e.g., Mechner, 2009, 2010, section “Categorization of Behavioral Contingencies”).

3. Formal definition of deception

This paper focuses on the forms of deception that involve one individual **a** performing an act **A** that results in individual **b** misperceiving, failing to perceive, mispredicting, or failing to predict a consequence **C**, and/or some of **C**'s modifiers.² Such modifiers may include **C**'s valences for **a** and/or **b**, and the time delays, probabilities, and magnitudes of **C** and/or **C**'s modifiers.

Intent: If an act's agent **a** predicts the **C** or any of the **C**'s modifiers, **a** is said to “intend” these (Mechner, 2008, 2009, 2010, section “Deception and Entrapment”). In “intentional” deception, the deceptive act's agent **a** predicts that another party **b** would misperceive, not perceive, mispredict, or not predict **C** (or some of the **C**'s modifiers.) In the diagram at the right, the **a** s shown in the upper left quadrants of the **b** and the **b^x** show that **a** predicts **b**'s perception of **C** and misprediction of the negative valence. The present analysis will focus mainly on instances of intentional deception—those in which **a** both predicts the **C** (or any of the **C**'s modifiers) and also predicts **b**'s misperception, non-perception, misprediction, or non-prediction.

These are some common and familiar instances of intentional deception:

Deception in everyday communication: If a listener **a** nods during a verbal interaction to indicate agreement or understanding, even when he does not agree or understand, the speaker **b** may³ be deceived into misperceiving the effect he is having. The **a** in the **b**'s upper left quadrant indicates that the listener would predict this misperception.

Deception regarding the valence: In many instances of deception, the deceived party misperceives or mispredicts not the consequence itself, but its valence, as when offered a fake (for a fuller discussion of this distinction, see Appendix A, no. 18; Mechner, 2008a, pp. 128; and also the section below *Selling a counterfeit*). In the diagram at the right, deceiver **a** would predict that the deceived party **b** would perceive the **C**, and would, at the same time, misperceive the **C**'s negative valence (Note the **as** in the **bs**' upper left quadrants, which indicate the intentionality of the deception). Misperception of the valence can also involve misperception of the valence's magnitude. Examples are **a** predicting that **b** would mispredict the **C**'s negative valence but perceive **C** correctly, as when offering a poisoned food item or an overvalued mortgage.

Masquerading or impersonation is said to occur if **a** performs an act **A₁** that causes **b** to misperceive that **a** is the agent of act(s) **A₂**, and **a** predicts **b**'s misperception. Party **a** could be a suicide bomber donning a friendly uniform (**A₁**) and then posing as a friendly soldier (**A₂**).

False promises usually involve some type of deceptive statement **aA**. If **a** made such a statement with intent to deceive, **a** would predict that **b** would mispredict the promised event **C** and/or one of **C**'s modifiers, like its valence for **b**. In the diagram at the right, a legend referencing **aA** → ^{ab^x}**C^{b-}** subscript 1 may explain that **b** would predict the occurrence of a **C** that has a certain positive valence. The same contingency also describes many types of military operations and fighting, where deception is employed to cause the enemy to mispredict an action, as in WWII when the Allies intentionally caused the Germans to mispredict the Normandy landing sites (Haswell, 1979). If the invasion itself had come as a complete surprise, with the Germans not predicting any landing at all, the ^{ab^x} modifier would be formulated as ^{ab}. Any surprise can be conceptualized as a deception in the limited sense of an unpredicted event occurring in circumstance **C**.

A false promise can also involve an action that creates a misprediction or non-prediction of the length (magnitude) of a time delay of a desired **C**, as when the boss promises a raise that does not materialize, or an investment advisor hypes an investment that does not work out within the promised time. Note that in these cases it would be the magnitude attribute **M** of the **T** that is being mispredicted.

A related contingency is the time bomb, where a mispredicted or unpredicted negative consequence occurs after a period of time, without having been signaled.

Indirect deception: In many types of deception, including false promises, the consequence **C₁** of **a**'s act is not itself detrimental to **b** but sets the occasion for an act by **b** whose consequence **C₂** (and/or its modifiers) would be detrimental to **b** and mispredicted, not predicted, misperceived, or not perceived by **b**. In the diagram at the right, note that **b** would perceive **C₁** accurately and would respond to it normally, but would mispredict the consequence **C₂** of **b**'s response to **C₁** (**bA**), as when walking into a trap. **a** would predict **b**'s (correct) perception of **C₁** as well as **b**'s misprediction of the consequence **C₂** of **b**'s action.⁴ A familiar contingency of this type is the booby trap, where **b** would perceive **C₁** accurately but mispredict the immediate or delayed negative effect of a certain act **bA**. Another example: if **a** sells **b** an unaffordable subprime home equity loan in circumstance **C₁**, which could include the small print in the contract (which **b** might not perceive or misperceive), then **b** would commit to the mortgage (**bA**), to **b**'s eventual detriment, and mispredict or not predict **C₂**.

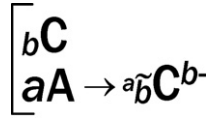
A closely related set of indirect deception contingencies are those in which **b** accurately perceives an immediate consequence of an act **bA** but would mispredict or not predict a delayed consequence **C₂**, as when being seduced or purchasing a bad investment. The misprediction or non-prediction could also be a modifier of the delay interval or of some attribute of **C₂** like its probability, its magnitude, or the magnitude of its valence.

² The current literature on deception focuses almost exclusively on misperception as the defining dynamic (e.g., Brumley et al., 2005; Pope et al., 2006; Vrij, 2008). The present analysis shows that there are also many common types of deception in which non-perception, misprediction, and non-prediction are involved.

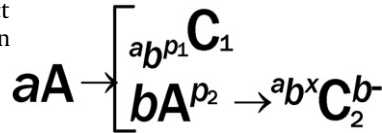
³ The contingency language can also express the nuance that deception is not certain to occur by including a probability symbol **p** as an attribute of the **C**, but this nuance will not be explored in the present analysis.

⁴ The term “action” is used in the sense of “act and its consequence.” The term “act” by itself does not imply a consequence.

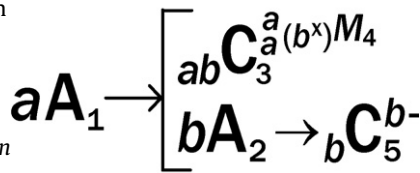
Disguising a situation, misrepresenting facts, hiding a danger: Here **b** would normally perceive situation **C**, but if **aA**, then **b** would not perceive C^{b-} (Note the \tilde{b}). Thus **aA** would prevent **b** from perceiving C^{b-} . *Examples:* a potential prey using camouflage, an employee looking busy when the boss is watching.



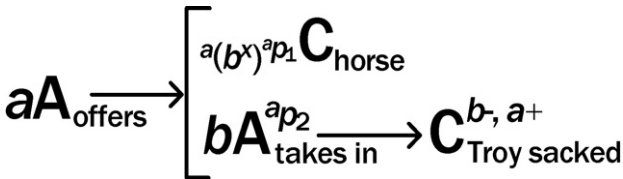
Deceptive advertising: This diagram of indirect deception has the added feature that *probabilities* modify **b**'s perception of **C**₁ and **b**'s response **bA**, to emphasize that **b** may not see the ad, and if **b** does, may still not perform act **bA**. Deceptive advertising can also involve a misrepresentation (in **C**₁) of the delivery time, causing **b** to *mispredict* or *not predict* the delivery delay.



Selling a counterfeit: When **a** tries to sell **b** a counterfeit, both **a** and **b** would perceive **C**₃ correctly, but **b** would *misperceive* attribute **M**₄ of **C**₃. **M**₄ can represent value or some other attribute of **C**₃ that **b** might care about. **a** would predict and perceive **b**'s *misperception* of **M**₄. **b**'s response **A**₂ could be the purchase of the counterfeit with consequence **C**₅ (perhaps then owning a worthless item).

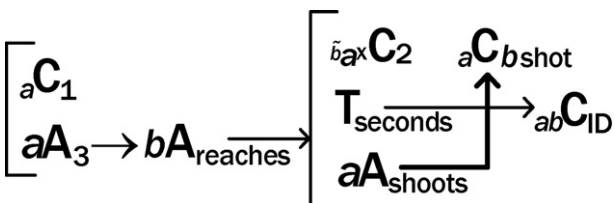


Trickery: Odysseus, when besieging Troy, is said to have conceived the following deception: If we (**a**) build a giant hollow wooden horse and leave it for the Trojans (**b**) to find, they may



misperceive the horse (as being empty rather than filled with our soldiers) and take it into Troy. Here Odysseus (**a**) is predicting **b**'s possible *misperception*. His uncertainties regarding the success of the deception, i.e., the Trojans' *misperception* of **C**_{horse} and their consequent action **bA**_{takes in} are reflected in his predicted (i.e., estimated) probabilities "**a**_{p1}" and "**a**_{p2}".

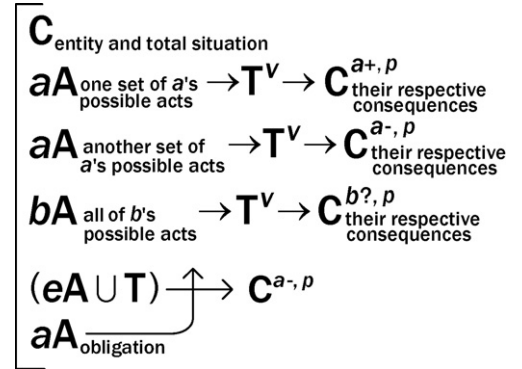
Unintentional deception: As mentioned, deception can also occur without intent, i.e., without any party predicting a misperception, non-perception, misprediction, or non-prediction. *Example:* if policeman **a** sees a suspicious character **b**, represented by **aC**₁, he may try to arrest him (**aA**₃). If **b** then reaches into his pocket (**bA**_{reaches}) to pull out his identification (**C**₂), then in the **T** seconds this would take, the policeman could *misperceive* **C**₂ and shoot **b**.



Clearly, **b** would not have predicted **a**'s misperception of **C**₂ (the consequence of **bA**_{reaches}) though that act deceived **a**. Unintentional deception can also occur without a negative consequence for any party (e.g., if the policeman's gun had been unloaded.)

Property transfers: A property transfer is a certain type of change in the behavioral contingencies that define an item of property. An item of property is always a set of contingencies. The contingencies include all of the potential acts of the "owner" **a** and of all non-owners **b** (i.e., the rest of the world), and the consequences of these possible acts, including their positive and negative valences, as well as their potential time delays and probabilities of occurrence.

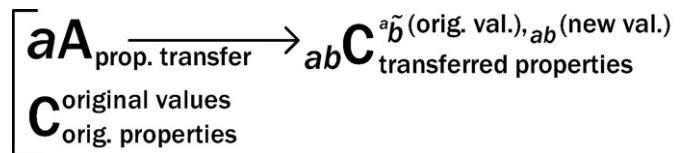
The diagram at the right shows that some of the acts available to **a** have positive and some have negative consequences for **a**. The diagram also shows that all of the action options available to **b** have indeterminate consequences for **b**—they may be negative, neutral, or positive. It also shows that certain acts by **a**, termed obligations, can avert negative consequences that might otherwise occur due to actions by external agents **e** and/or the passage of time. A property transfer can involve changes in some or all of **a**'s and **b**'s action options (rights, prohibitions, or obligations) and in their consequences, including their effective values. For a fuller explanation and discussion of the property contingency, see Mechner (2010), section "Deception in Economics and Finance."



acts by **a**, termed obligations, can avert negative consequences that might otherwise occur due to actions by external agents **e** and/or the passage of time. A property transfer can involve changes in some or all of **a**'s and **b**'s action options (rights, prohibitions, or obligations) and in their consequences, including their effective values. For a fuller explanation and discussion of the property contingency, see Mechner (2010), section "Deception in Economics and Finance."

Deception in property transfer: Many types of property transfer provide the transferor **a** with opportunities and vehicles for deception. The most important types of property transfer in the world of business and finance are aggregation, partitioning, and multiple-stage property transfers. Aggregation is putting multiple properties together into a single larger unit of property (e.g., bundling). Partitioning is splitting up properties into smaller units (e.g., subdividing a building into condo units, selling lottery tickets, issuing currency). All three of these types of property transfer inevitably blur and cloud the contingencies that defined the individual transferred properties prior to transfer, and thereby provide the transferor with the opportunity to deceive, by obfuscating (causing *non-perception* or *misperception*) the relevant contingency elements of the transferred properties.

In the general diagram of property transfer below, the transferor is **a** and the transferee is **b**. The property transfer may be



aggregation, partitioning, or multiple-stage. The **a** at the upper left of **b** shows that **a** would predict (therefore intend) this deceptive consequence.

Example: If lender **a** issues mortgages and, when some of these become inadequately secured, aggregates them into new securities, thereby obfuscating the true values and defining contingencies of the underlying mortgages, he may then aggregate these new securities into further aggregates which he then partitions into other new securities that **a** can then transfer (e.g., sell or offer as collateral) to other parties. The effect is that the values of the original transferred mortgages become increasingly obfuscated at each stage of trans-

fer, with the result that their original values become impossible to ascertain.

Ponzi schemes: If a fund manager like Bernard Madoff aggregates investments (properties) and then partitions this aggregate into (a) overvalued withdrawal rights and interest entitlements that he issues to his investors, and (b) funds that he takes for himself, the investors will be deceived. The acts of aggregation and partitioning obfuscate (cause the investors to *misperceive*) the value of their withdrawal rights and interest entitlements, and thus cause the investors to *mispredict* the consequence of trying to exercise those rights, all of which the transferor predicts.

An important conclusion that one can draw from the above analysis is that the most important instances of property transfer in the banking and financial sectors are driven by the rewards of some form of deception and cannot be made transparent, in principle or in practice. Such a conclusion may have implications for the design of regulatory policies.

Theory of mind situations: Behavioral phenomena described by this term always involve an individual perceiving and/or predicting another individual's perception of, prediction of, or reaction to a valence or other modifier of a situation or circumstance (Baron-Cohen, 1989; Wellman et al., 2001). Many instances of interpersonal deception involve individual **a** acting in a way that causes individual **b** to *misperceive*, *not perceive*, *mispredict* or *not predict* a perception or prediction, or a reaction to a valence (for a fuller discussion, see Mechner, 2010, section "The Recursive Syntactic Structure").

4. Progressive or gradual deception

Many types of deception involve repetitive acts by a deceiver, with every repeated occurrence of an act causing an incremental change in the magnitude or probability of a consequence. The cumulative effect of small increments may be to increase or decrease the deceived party's misperception, non-perception, misprediction, or non-prediction of the consequence, gradually or suddenly. Examples from nature that involve decreases include a prey's diminishing misperception of a stalking predator, with a growing and then sudden realization of a danger. Examples from human affairs include the growing trail of increasing evidence that can be created by a long-term pattern of embezzlement, and the long-term interpersonal dynamic sometimes termed disillusionment (a diminishing misperception). Examples that involve increasing misperception: the effects of repetitive exposure to a lie or false rumor, a victim being lulled into a false sense of security, or the changing perception of value during the formation of a market bubble. The formal contingency language provides a variety of techniques for codifying and analyzing these types of contingencies. The registration of cumulative effects of small incremental changes is illustrated in section 6 of Mechner (2008a,b) and in Mechner (2010), section "Recycling Contingencies and Changing Consequences."

Even when the change in the misleading situational cues is gradual and cumulative, a misperception or misprediction can occur suddenly and discontinuously as it becomes a correct perception or prediction, or vice versa. Such effects can be complex and, like all misperceptions or mispredictions, can be described in the diagram's legend as fully as desired.

5. Categorization of the forms of deception

The present behavioral contingency analysis of deception suggests that all forms of deception are based on some combination of misperception, non-perception, misprediction, or non-prediction.

Regardless of the particular category or combination of categories into which a particular form of deception may fall, it can be categorized further in terms of some combination of these six attributes:

- Disadvantageous to the deceived, or not.
- Direct or indirect.
- By an animate or inanimate agent.
- If animate, intentional or unintentional.
- Gradual or sudden.
- Involving an immediate or delayed consequence.

The diagram of an "intentional" deception would include an $^a b^x$ or $^a \bar{b}$ modifier. In summary, application of the formal symbolic language for the analysis of behavioral contingencies shows that deception is a clearly definable biological function that takes many specifiable forms, all of which fall into four behaviorally defined categories which are further subdivided into six others.

Appendix A.

1. $A \rightarrow$ means "If act **A** occurs *then* . . . (a consequence)."
2. Every **A** is preceded by an implied "if."
3. aA means act **A** would be performed by party **a**.
4. abA means act **A** would be performed jointly by **a** and **b**.
5. $A \rightarrow C$ means that **C** would be the consequence of act **A**.
6. Positive valence, C^+ , can mean beneficial, desired, positively reinforcing. Negative valence, C^- , can mean harmful, hurtful, aversive, punishing. The party(ies) that would be affected by the valence(s) are indicated in front of the valence sign: C^{a+} , C^{b-} , C^{ab-} .
7. $T \rightarrow C$ means "upon termination of time **T** . . .". Example: After the egg has boiled for 10 min, it will be hard boiled.
8. C^p Here **p** is the probability, in the analyst's estimation, that **C** would occur.
9. A bracket around vertically listed **As**, **Ts**, or **Cs** indicates *simultaneity*. The order of listing has no significance.
10. In A^M , the **M** could refer to effort level, effectiveness, duration, rate, frequency. In $C^{(a+)^M}$, **M** refers to the magnitude of the positive valence for party **a**. In C^M , the **M** attribute can refer to any scalable dimension of the consequence (e.g., loudness, amount of money).
11. Every entity **A**, **C**, **T**, **a**, **M**, or **p** can have modifiers. Modifiers are shown in the entity's four quadrants.
12. The attributes + and - (possible valences), **M**, or **p** are shown in the upper right quadrant. The subscript refers to a description or identification of the entity.

C

attributes:
+, -, p, M

subscript for
descriptors
13. Subscripts can be arbitrary numbers indexed to a legend, or, the entities can be described by words shown in the subscript position, as in the diagram. The analyst may also assign *different probabilities* to the possible performance of an act and to the occurrence of its consequence.

aA^{p_1}

\rightarrow

C^{p_2}

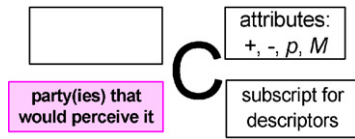
\rightarrow

C^{p_2}

Example: Shooting at a target versus hitting it.

- p_1 —probability that **a** would shoot (A_{shoots}).
- p_2 —probability of **C** (that the shot would hit the target).

14. aC means “party a would perceive consequence C .” “Perceive” can mean “see,” “hear,” “notice,” “respond to,” or “understand.”

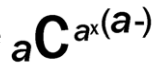


15. $b a A \rightarrow$ The b in the lower left quadrant of the a means that b would perceive that a is the agent of A .

16. $abA \rightarrow \tilde{a}bC$ Here the a has a tilde sign over it, meaning “not a .” This means that a would not perceive C but b would. Example: If a blind person with a seeing-eye dog steps into the street, he would not perceive the coming car (the C), but the dog b would perceive it.

17. $b a A$ means that b would perceive that a is A 's agent. $b^x a A$ means that b would misperceive the fact that a is A 's agent, as in false accusations or misperceiving the agent of a gift.

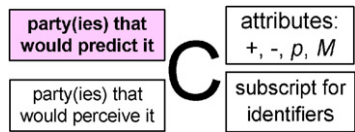
18. a may perceive C correctly and misperceive its valence, as when Adam and Eve might perceive the apple C correctly, but misperceive its negative valence (a^-) for them, and as one might perceive a painting or stamp accurately, but misperceive its value, the value being the valence.



19. The C_2 in the diagram is what the analyst believes would actually occur. The subscript can refer to an explanation of what a would (mistakenly) perceive instead.



20. $A \rightarrow aC$ means a would predict C . Prediction is always based on a history of prior contact with similar contingencies, or of a verbal communication. In $aA \rightarrow bC^a-$, b would predict that a would hurt himself.



21. In $aA \rightarrow a^x C^a-$, a would mispredict that he would hurt himself. In the diagram at the right, b would perceive that a would mispredict C^a- , as when b would perceive that a would unwittingly walk into a trap.



22. A vertical arrow (initiated by an A or a T) cutting a horizontal arrow terminates the contingency represented by that horizontal arrow.



References

Baron-Cohen, S., 1989. The autistic child's theory of mind: a case of specific developmental delay. *J. Child Psychol. Psychiatry* 30, 285–297.

Bergstrom, C.T., 2008. Dealing with Deception in Biology. At <http://octavia.zoology.washington.edu/publications/Bergstrom09.pdf>.

Brumley, L., Kopp, C., Korb, K., 2005. Misperception, Self-deception and Information Warfare. At <http://www.csse.monash.edu.au/~lbrumley/pubs/IWAR-2005.pdf>.

Depaulo, B., Friedman, H., 1998. Nonverbal communication. In: Gilbert, D.T., Fiske, S.T., Lindzey, G. (Eds.), *The Handbook of Social Psychology*, Vols. 1 and 2, 4th ed. McGraw-Hill, New York, pp. 3–40.

Haswell, J., 1979. *The Intelligence and Deception of the D-day Landings*. Batsford, London, 208 pp.

Mechner, F., 2008a. Behavioral contingency analysis. *Behav. Processes* 78, 124–144.

Mechner, F., 2008b. Applications of the Language for Codifying Behavioral Contingencies. At <http://mechnerfoundation.org/newsite/downloads.html>.

Mechner, F., 2009. Analyzing variable behavioral contingencies: are certain complex skills homologous with locomotion? *Behav. Processes* 81, 316–321.

Mechner, F., 2010. Behavioral Contingency Analysis: A Formal Symbolic Language for the Analysis of Complex Situations. A PowerPoint Presentation at <http://mechnerfoundation.org/newsite/downloads.html>.

Pope, S., Jøsang, A., McAnally, D., 2006. Formal Methods of Countering Deception and Misperception in Intelligence Analysis. At http://www.au.af.mil/au/awc/awcgate/ccrp/2006iccrts.countering_decep_slides.pdf.

Vrij, A., 2008. *Detecting Lies and Deceit: Pitfalls and Opportunities*, 2nd ed. John Wiley & Sons Ltd., New York, 488 pp.

Wellman, H.M., Cross, D., Watson, J., 2001. Meta-analysis of theory of mind development: the truth about false belief. *Child Dev.* 72, 655–684.