■ ■ ■ **Laws of Form – Laws of Logic** (the use of the syllogism in the intellectual-verbal communication)

Leon Conrad

The Academy of Oratory Ltd, London, United Kingdom.

Abstract. This two-part paper builds on previous work by L. Kauffman and J. Mingers [Kauffman; Mingers] arguing that Spencer-Brown's 'calculus of indications' (hereinafter CoI) outlined in his book *Laws of Form* [Spencer-Brown] provides a powerful way of notating and validating classical logical syllogisms. Part 1 gives a background to the CoI and to classical logic, showing that the CoI has clear advantages in terms of speed, clarity, and ease of use in comparison with other forms of notation such as text or Venn diagrams. Part 2 shows how Brownian notation can facilitate working with education via obversion and conversion; and working with sorites, with a note on the implications of Brownian notation for the question of existential import.

Keywords: logic, George Spencer-Brown, calculus of indications, laws of form

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Inf. about the author: Leon Conrad, independent researcher, co-founder and lead trainer of The Academy of Oratory Ltd., coach-communications consultant. Address: 202 Grangewood House, Essex, IG10 3TZ. Email: leon@academyoforatory.co.uk.

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A foreword by editor-in-chief Felix Sharkov

Syllogism, as a model of deductive reasoning, is widely used in the intellectual-verbal communication. As a way of influencing the consciousness in the process of communication, syllogisms play a justifying role. Syllogisms (for example, in the discourse of Kant) are also worn and are comprehensively-propositional (textual) character and is a composite form of organization of text. In everyday communication people use syllogisms that are not expanded, but reduced, i.e. when one of the assumptions or the conclusion is omitted.

For development and semantic enrichment of communication that is carried out in a syllogistical form, the study of co-founder and lead consultant of the Academy of oratory England Leon Conrad should help the communicants to communicate in any situation to the best of their abilities. His research and practical activity are based on an integrated approach to the Liberal arts, the Laws of by George Spencer-Brown, as well as oral communication. The author has tested previously tested some of the materials and results of this paper in social networks[1].

[1] E.g.: http://www.academia.edu/12103235/Laws_of_Form_Laws_of_Logic

Introduction

In *Laws of Form* (hereinafter *LoF*) [Spencer-Brown] George Spencer-Brown outlines a 'calculus of indications' (hereinafter *CoI*), derived from a single mark, called a cross. The cross can be applied like brackets in algebra; circles in Venn diagrams; or grids in truth tables or in Lewis diagrams allowing the formation of value-based expressions in minimal form. In *LoF*, Spencer-Brown outlines how the *CoI* can be applied to algebra and, in Appendix 2 of *LoF* [Spencer-Brown: 90-108], to logic, showing how 2 valid syllogistic forms, *Bocardo* (OAO-3) and *Baroco* (AOO-2) can be derived from *Barbara* (AAA-1), claiming 24 logically valid syllogistic forms can be derived from the latter. Kauffman has illustrated how this might be done [Kauffman] but his method deliberately excludes universal negative (**E**-form) propositions (e.g. 'no *a* is *b*'), making it difficult (but not impossible) to use his 24 notational forms with syllogisms which include **E**-form propositions. Kauffman's work was developed by [Mingers], who tested all possible forms that could be derived from *Barbara* using truth tables. He found that 83 forms known to be invalid turned out to be valid.

By revising Spencer-Brown's notation of **I** and **O** propositions, he successfully reduced this number to 32, showing that 15 of these were notational mirror images of the 15 uncontroversially valid forms of classical logic, with the 2 remaining mirrored forms (AAO-4/OOA-4) remaining unexplained mavericks.

Section 1.1 of part 1 of this paper examines Mingers' findings, provides a possible explanation for and a means of dealing with the invalid forms, and reevaluates Kauffman's and Mingers' work in this light. Section 1.2, which readers who are familiar with the CoI may wish to start from, demonstrates how Brownian notation can successfully provide simpler, quicker options for notating and working with categorical propositions when used in conjunction with the rules for classical logic. It outlines two quick and reliable methods for validating all 24 valid types of categorical syllogisms, including the 9 syllogisms recognised as being controversially valid in addition to the group of 15 uncontroversially valid syllogisms dealt with by Mingers. Part 2 shows how Brownian notation can facilitate inference in relation to Aristotelian and Boolean views of the logical square of oppositions; eduction via obversion and conversion; and working with sorites.

In order to explore the application of the *CoI* to logic, a brief overview of the calculus is given for those unfamiliar with the approach before discussing Kauffman's and Mingers' work.

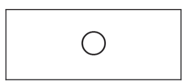
Background to the CoI

In *LoF*, Spencer-Brown takes two things as given:

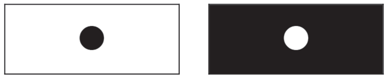
1 – The act of distinction;

2 – The act of indication [Spencer-Brown: 1]

A circle drawn on a sheet of paper creates a distinction which involves total continence:

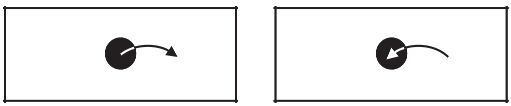


This allows one side of the distinction to be indicated, or marked. Whether the inside or the outside of the border is marked is irrelevant. If ‘black’ = ‘marked’ and ‘white’ = ‘unmarked’, the following arrangements are possible:

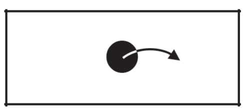


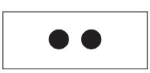
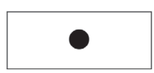
It is more convenient (and it has become conventional) to indicate the inside of the distinction as the marked state. This convention will be followed from here on in this paper. Spencer-Brown uses the following symbol (called ‘cross’) to indicate the marked state [Spencer-Brown: 3-4]:

The establishment of the marked state makes it possible for crossings to occur from one side of the distinction to the other:



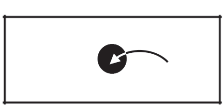
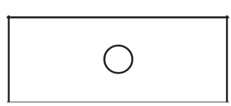
If the crossing is from the marked state to the unmarked state, then a copy (or ‘token’, to use Spencer-Brown’s term) of the marked state is produced, which is equivalent to—or, as Spencer-Brown states, can be confused with—(con-fused = mixed together)—the marked state, thus:



results in  which is equivalent to 

or, in notational form, as an arithmetic initial, ⏋ = ⏋ ⏋.

This is like calling, “Leon! Leon!” with reference to one person. However, many times you call the name, the reference is to only one Leon. If the crossing is from the unmarked state to the marked state, then this has the effect of cancelling the cross, thus:

 results in 

or in notational form, again, as an arithmetic initial, ⏋⏋ =

This is like calling, “Leon!”, realising it was a mistake and saying “Oh! I didn’t mean that”.

The Arithmetic Initials

Spencer-Brown [Spencer-Brown: 4-10]. refers to these acts of crossing thus:

Initial 1. Number (I1)	$\overline{\ \ }|\ \overline{\ \ }| = \overline{\ \ }|$.	condense ⇌ confirm	Initial 2. Order (I2)	$\overline{\overline{\ \ }|}| = \quad$.	cancel ⇌ compensate

These starting points can be seen as basic acts of thought. Thinking about something creates an act of distinction and, at the same time, an act of indication. You can't think about something without not thinking about what it isn't, thus *distinguishing* the two. And you can't think about something being without also implying that it isn't not being, thus *indicating* its state of being.

Application to sentential logic

In sentential logic (the logic of sentences), categorical propositions can be formed with logical terms as subjects and predicates in four relationships, arranged by quality (affirmative or negative) and quantity (universal 'all' or particular 'some') using the verb 'to be' as a pure copula resulting in statements one can agree or disagree with. The forms are referenced **A**, **I**, **E**, **O**, from the Latin words **A**ff**I**rmo (I affirm) and n**E**g**O** (I negate):

A	all *a* is *b*	Universal affirmative
I	some *a* is *b*	Particular affirmative
E	no *a* is *b*	Universal negative
O	some *a* is not *b*	Particular negative

Spencer-Brown makes no distinction between 'all a is b' and 'a implies b'. The symbol '⊃' indicates implication: $(a \supset b) =$ all a is $b = \quad a \mid b$.

A = all *a* is *b* = *a* implies *b* = $a \supset b = \overline{a}|\ b$

I = some *a* is *b* = not all *a* is not *b* = It is not the case that *a* implies $\sim b = \sim(a \supset \sim b) = \overline{\overline{a}|\ \overline{b}|}|$

E = no *a* is *b* = *a* implies $\sim b = a \supset \sim b = \overline{a}|\ \overline{b}|$

O = some *a* is not *b* = not all *a* is *b* = It is not the case that *a* implies $b = \sim(a \supset b) = \overline{\overline{a}|\ b}|$

Background to syllogistic logic

In order to explore how Spencer-Brown notates syllogisms using propositions in the above forms, an outline of some of the basic principles of classical syllogistic logic is provided here before examining Spencer-Brown's approach to it.

In classical syllogistic logic, two categorical propositions which share a common term (known as the middle term) are put together to produce a conclusion in the form of a third proposition, jointly forming a syllogism. For example:

All animals are warm-blooded
All monkeys are animals
Therefore all monkeys are warm-blooded
If monkeys = *a*, animals = *b*, and warm-blooded = *c,* the syllogism is:
All *b* are *c*
All *a* are *b*
Therefore all *a* are *c*

There are 4 possible arrangements of the terms *a*, *b* and *c*, known as moods. These are distinguished numerically, as shown in the table below, arranged according to the relative positions of the shared or middle term. The proposition which includes the subject term of the conclusion is called the minor premise. The proposition which includes the predicate terms of the conclusion is called the major premise. The moods are presented in Table 1 as in Joseph [Joseph:135], with the minor premises first.

Table 1. Distribution of terms in the 4 figures of classical logic.

	figure 1		figure 2		figure 3		figure 4	
Minor premise	S	M	S	M	M	S	M	S
Major premise	M	P	P	M	M	P	P	M
Conclusion	S	P	S	P	S	P	S	P
Key: S = subject of conclusion; P = predicate of conclusion; M = middle term.								

In the example given above, the (AAA-1) pattern is known as B**A**rb**A**r**A**). The vowels in the traditional names represent, in order of appearance, the major premise, the minor premise, and the conclusion of a syllogism. The number represents the figure which describes the terms' positions within the syllogism. Of the 256 possible combinations of propositions and figures, 24 forms are accepted as valid – 15 of these uncontroversially so.

In the application of the calculus of indications to classical logic, Spencer-Brown puts the minor premise first when notating syllogisms, as do Russell and Whitehead [Russell, Whitehead, Couturat] and Joseph [Joseph]:
All *a* are *b*
All *b* are *c*
Therefore all *a* are *c*

Furthermore, Spencer-Brown uses the following conventions for transcription:

in words	*in the sentential calculus*	*in the primary algebra*	*in words*	*in the sentential calculus*	*in the primary algebra*
not *a*	$\sim a$	$\overline{a\,}\rvert$	*a* and *b*	$a \wedge b$	$\overline{\overline{a\,}\rvert\ \ \overline{b\,}\rvert\,}\rvert$
a or *b*	$a \vee b$	ab	*a* implies *b*	$a \supset b$	$\overline{a\,}\rvert\ b$

Kauffman's wheel

Kauffman produces his 24 valid syllogisms, which he arranges in a wheel, by following Spencer-Brown's instructions [1]. He deliberately avoids any reference to **E**-form propositions, which can be seen to be ambiguous:

$$\text{E} = \text{no } a \text{ is } b = a \text{ implies } {\sim}b = a \supset {\sim}b = \overline{a\,}\rvert \quad \overline{b\,}\rvert$$

Kauffman consistently interprets propositions notated in this format as **A**-form propositions, reading them as 'all *a* is *not b*'. This means, however, that no syllogisms with **E**-form propositions appear in Kauffman's wheel, even though they do appear in some syllogisms known to be valid (e.g. *Camestres, Cesare, Celarent*, etc).

Mingers has suggested that Kauffman's 24 valid *CoI*-based notational forms are mappable to the 15 uncontroversially valid categorical syllogisms of classical logic. His table is reproduced as Tab. 2 below.

Table 2. The 24 syllogisms obtainable from Barbara according to Mingers [Mingers: 14].

Kauffman Reference	a	b	c	I Barbara	II Bocardo	III Baroco
.1	a	b	c	Barbara	Bocardo	Baroco
.2	not a	b	c	Barbara	Bocardo	Baroco
.3	a	not b	c	Barbara	Bocardo	Baroco
.4	not a	not b	c	Barbara	Bocardo	Baroco
.5	a	b	not c	Celarent Cesare	Disamis Dimatis	Festino
.6	not a	b	not c	Calemes	Bocardo	Fresison
.7	a	not b	not c	Camestres Calemes	Ferison Fresison Festino Ferio	Darii Datisi
.8	not a	not b	not c	Barbara	Baroco	Bocardo

Mingers states that 'Where more than one is generated in a box they are obtained by permuting the terms within one of the propositions.' [Mingers: 14] This nevertheless raises some questions – While *Baroco* and *Bocardo* are only valid in figures 2 and 3 respectively, yet the reference numbers in the table heading are reversed. The Roman numerals apply to Kauffman's transposition patterns, rather than syllogistic forms [Kauffman: 4]. Furthermore, it is unclear how Mingers derives *Calemes* (AEE-4) from Kauffman Reference (hereinafter KR) 1.6, unless the premises are switched and only one crossed variable (~*c*) is converted rather than both; nor is it clear why a process of switching premises in notation was performed in the cases of KR 2.8 and KR 3.8 (In the bottom row where *Bocardo* appears in the 'III Baroco' column, and *Baroco* in the 'II Bocardo' column). As shown in Appendix I, these result in the inverse forms AOA-3 and OAA-2 respectively.

Mingers' interpretation of Kauffman's wheel thus merits further examination. In the table above, the syllogistic form given KR 1.3 appears in Kauffman's wheel as follows:

$$\overline{\overline{a\,}\rvert \ \ \overline{b\,}\rvert}\rvert \qquad \overline{b \ \ c}\rvert \qquad \overline{a\,}\rvert \ c$$

and is interpreted by Kauffman as:

All *a* are *not b*
All *not b* are *c*
———————————
All *a* are *c*

In line with Kauffman, Mingers interprets this as being in *Barbara* form.

The syllogistic form KR 1.5 ('I Barbara' column, row 5 in the table above) appears in Kauffman's wheel as follows:

$$\overline{\overline{a}\rceil\ b}\rceil \qquad \overline{\overline{b}\rceil\ \overline{c}\rceil}\rceil \qquad \overline{a}\rceil\ \overline{c}\rceil$$

and is interpreted by Kauffman as:

All *a* are *b*
All *b* are *not c*
———————————
All *a* are *not c*

The conclusion of KR 1.5 (all *a* are *not c*), its major premise (all *b* are *not c*) and the minor premise of KR 1.3 (all *a* are *not b*) are all **A**-type propositions, and are notated consistently by Kauffman. The cross over the premise appears as a result of the process of notation and simplification. In Spencer-Brown's notation, conclusions never appear crossed.

Mingers, however, sees KR 1.5 as EAE-1, changing two **A** forms to **E** forms (by obversion) and interprets it as the syllogism known as *Celarent*.

KR 3.5 is shown differently in Kauffman's wheel and in the subsequent section in his paper. I have taken the version in the wheel which is consistent with the treatment of negated terms across the other modes in his paper.

The questions which arise from Mingers' paper seem to be related to an inconsistency in the treatment of crossed variables, where negation and distribution are confused, leading to substitution of terms and propositions in ways which alter their quality. Mingers' primary interpretation of KR 1.7 as *Camestres* or KR 3.7 as *Darii*, for instance, result from an inconsistent treatment of the middle term, as shown in the table in Appendix I.

In his paper, Mingers noted that when attempting to validate syllogisms using the consequences which arise from the calculus of indications, 83 syllogisms known to be invalid appeared to be valid. He then proposed adjustments to Spencer-Brown's notation, inspired by Zellweger's logical garnet [Mingers: 17; Zellweger]:

A = all a is b = a implies b = ~a or b = $\overline{a}\rceil\ b$ (not changed)

I = some a is b = ~a implies b = a or b = $a\ \ b$ (changed)

E = no a is b = a implies ~b = ~a or ~b = $\overline{a}\rceil\ \overline{b}\rceil$ (not changed)

O = some a is not b = ~a implies ~b = a or ~b = $a\ \overline{b}\rceil$ (changed)

As a result, Mingers found that the number of invalid syllogisms shown to be valid was reduced from 83 to 17. An improvement, but still a concern.

However, it should be noted that Mingers' proposed notational changes provide an advantage over Spencer-Brown's original forms in that they provide a clearer, and thus more useful visual indicator of the distribution of terms in categorical propositions, which will be expanded upon below.

Revisiting Spencer-Brown's assertion

If Kauffman's approach is taken, but the negated terms are all reinterpreted as positive variables that are crossed and the notation reduced to no more than 3 levels using Mingers' revised notation, it will be seen that a set of 24 apparently valid forms emerge (see Appendix I, Example 6), as Spencer-Brown claims. Twelve pairs are valid/invalid notational mirror images of 12 of the 15 uncontroversially valid forms of classical logic and the invalid forms can easily be eliminated by applying one of the rules for validity. The resulting table of 24 forms (in which the 12 invalid forms are shown with their valid mirror image forms in italics and brackets) is as shown below in Table 3:

Table 3. 24 Syllogisms derived from Barbara as demonstrated in Appendix I.

Kauffman Reference	a	b	c	I Barbara	II Bocardo	III Baroco
.1	a	b	c	AAA-1 Barbara	OAO-3 Bocardo	AOO-2 Baroco
.2	~a	b	c	AII-1 Darii	EIO-3 Ferison	AEE-2 Camestres
.3	a	~b	c	IEA-1 *(Ferio)*	OEE-3 *(Datisi)*	IOI-2 *(Cesare)*
.4	~a	~b	c	IOI-1 *(Celarent)*	EOE-3 *(Disamis)*	IEA-2 *(Festino)*
.5	a	b	~c	EAE-1 Celarent	IAI-3 Disamis	EIO-2 Festino
.6	~a	b	~c	EIO-1 Ferio	AII-3 Datisi	EAE-2 Cesare
.7	a	~b	~c	OEE-1 *(Darii)*	IEA-3 *(Ferison)*	OII-2 *(Camestres)*
.8	~a	~b	~c	OOO-1 *(Barbara)*	AOA-3 *(Bocardo)*	OAA-2 *(Baroco)*

Examining the relationships of terms in the table above, it can be seen that negating the '*b*' variable—irrespective of its position in the syllogism or the state of the other variables around it—results in invalid forms, and that the pattern of the mirror image forms is related directly to the inverse relationship between the patterns of negated variables. This makes perfect sense when you consider the role of the predicate term in the minor premise within a syllogism in relation to the question of distribution and validity. If *b* is negated, the minor premise will be negative (**E** or **O**) and the only valid form for the major premise will be an **I** form, and the only conclusion negative (**E** or **O**).

So far, we have generated 12 valid syllogisms and their mirror forms from the *Barbara* syllogism with the figures retained in each column. Spencer-Brown implies that the 24 forms (12 recognised and 12 mirror forms) should be seen as valid, noting that 'In this *Barbara* prototype, not only can we transpose each complex, we can also independently cross each literal variable, finding, by a combination of these means, a set of 24 distinguishable valid arguments. Formally there is no difference between them. If we distinguish any, we should distinguish all. In fact not all twenty-four are distinguished in logic, which arrives somewhat arbitrarily at the number fifteen' [Spencer-Brown: 106]. Leaving the validity issue to one side, can the full range of 24 syllogisms recognised as valid, including those in figure 4, be generated from *Barbara* using Brownian notation?

A further 12 forms can be generated by switching propositions in syllogisms, ensuring that terms in the conclusion are also switched. Neither of these moves affects the validity of the syllogism. When, once again, the rules of validity are applied, the forms are reduced to 6 valid forms, 4 of which are duplicates of forms shown in the table above, along with 2 new forms in the fourth figure (*Dimatis* and *Calemes*, shown in bold in Table 4 below):

Table 4. Derivation of syllogisms from Barbara (AAA-1) by switching propositions.

From		**To**		**From**		**To**	
AAA-1	Barbara	AAO-4	×	EAE-1	Celarent	AEE-4	***Calemes***
OAO-3	Bocardo	AOA-3	×	IAI-3	Disamis	AII-3	*Datisi*
AOO-2	Baroco	OAA-2	×	EIO-2	Festino	IEA-2	×
AII-1	Darii	IAI-4	***Dimatis***	EIO-1	Ferio	IEA-4	×
EIO-3	Ferison	IEO-3	×	AII-3	Datisi	IAI-3	*Disamis*
AEE-2	Camestres	EAE-2	*Cesare*	EAE-2	Cesare	AEE-2	*Camestres*

Furthermore, a switching of terms in **E** and **I** propositions in the 11 valid syllogistic forms which contain them which have resulted so far, and adjusting the terms in the conclusion where necessary, adds the remaining fourth-figure syllogism (*Fresison)* as shown in Table 5:

Table 5. Derivation of syllogisms from Barbara by switching terms in E and I propositions.

From		**To**		**From**		**To**	
AII-1	*Darii*	AII-3	*Datisi*	EIO-1	*Ferio*	EIO-4	***Fresison***
EIO-3	*Ferison*	EIO-2	*Festino*	AII-3	*Datisi*	AII-1	*Darii*
AEE-2	*Camestres*	AEE-4	*Calemes*	EAE-2	*Cesare*	EAE-1	*Celarent*
EAE-1	*Celarent*	EAE-2	*Cesare*	IAI-4	*Dimatis*	IAI-3	*Disamis*
IAI-3	*Disamis*	IAI-4	*Dimatis*	AEE-4	*Calemes*	AEE-2	*Camestres*
EIO-2	*Festino*	EIO-3	*Ferison*	EIO-1	*Ferio*	EIO-4	***Fresison***

This demonstrates that all 15 uncontroversially valid classical logical syllogisms can be derived from AAA-1 *Barbara*, which is in line with the spirit, if not the letter, of Spencer-Brown's claim. It is hard to see how the 9, which involve a change of mood in the conclusion, can be generated from it.

In Appendix II, where Spencer-Brown's notation is used, and Appendix III, where Mingers' revised notation is used, the 15 forms can be seen to be equally generated by putting together all combinations of major and minor propositions in all figures, resulting in 64 potential syllogisms. Eliminating sets in which the middle terms appear the same in both propositions reduces these to 32 sets. In the remaining figures, the subject and predicate terms from the minor and major premises can be paired to form a conclusion in the forms and order in which they appear in their respective propositions. Placing the minor premise first makes it easy to visualise and perform these moves. The moods of the conclusions can be ascertained from their notation, and the syllogisms checked against the rules of logic. This procedure shows that 17 syllogisms violate rules which disallow 2 particular or negative premises, or that disallow affirmative conclusions that result from negative premises, universal ones from particular premises, or a negative conclusion from 2 universal affirmative premises. In Appendix II, the AAO-4/OOA-4 forms which appear as mavericks in Mingers' paper have no notational equivalents and can be dismissed on methodological grounds. They also violate the rules of logic, and can therefore be dismissed on grounds of invalidity.

The advantages Brownian notation has over other forms of notation and validation *in conjunction with* established rules of logic when working with *potentially valid* syllogisms, not least in terms of checking the validity of a figure, will be demonstrated below. ***However, it is vital to maintain a distinction between negation and distribution when using Brownian notation.***

How might Brownian notation be used for transcription, validation, inference, and eduction in logic?

Syllogisms can easily be notated in the way Spencer-Brown proposes (as outlined above), while taking advantage of Mingers' simplified notational forms, which provide greater visual clarity with respect to the distribution of terms in categorical propositions. If the variables and crosses in Spencer-Brown's notational forms for **I** and **O** type propositions are read from the top down, and double crosses eliminated using I2, they will be seen to be equivalent to Mingers'. It is therefore worth using Mingers' forms when using Brownian notation for logical purposes as they have the advantage of being more condensed than Spencer-Brown's, and, as will be shown, provide distinct advantages with regards to distribution and validation.

A distributional advantage

A simple way of thinking of distribution in terms of *LoF* is that, in the form, if you're thinking about 'all' of something (the distributed state), then it's as if you're standing outside it and can see it as being completely enclosed within a boundary. If you're thinking about 'some' of something (the undistributed state), then the boundary of the whole is not visible from your vantage point. Thus, in *LoF* notation, the distributed element of a proposition [4, p. 99] takes a boundary cross, giving the following:

A = all *a* is *b*: the subject (*a*) is distributed; the predicate (*b*) is undistributed $\overline{a\,}|\ b$

I = some *a* is *b*: the subject (*a*) is undistributed; the predicate (*b*) is undistributed $a\ \ b$

E = all *a* is not *b*: the subject (*a*) is distributed; the predicate (*b*) is distributed $\overline{a\,}|\ \ \overline{b\,}|$

O = some *a* is not *b*: the subject (*a*) is undistributed; the predicate (*b*) is distributed $a\ \ \overline{b\,}|$

These simpler forms allow moods to be recognized very quickly once familiarity with working with Brownian notation is acquired.

A validation advantage

In practice, the 256 potential syllogistic forms can be reduced to a more manageable 32 with the application of some common sense. As Joseph notes, the four propositional forms (**A**, **E**, **I**, **O**) can be combined to form 16 pairs of premises as shown in Table 6 below [Joseph: 134]:

Table 6. The 16 pairs of propositions which can form the premises of syllogisms.

minor	major	minor	major	minor	major	minor	major
A	A	A	I	A	E	A	O
I	A	I	I	I	E	I	O
E	A	E	I	E	E	E	O
O	A	O	I	O	E	O	O

The rules of classical logic forbid the pairing of two negative propositions. Thus, **EE**, **EO**, **OE**, and **OO** can be eliminated. Three further forms can be eliminated under the rule which forbids the pairing of two particular propositions, eliminating **II**, **IO**, **OI**. Two further rules state that (a) if one premise is negative, the conclusion must be negative, and (b) if the conclusion is negative, the major premise must be universal. In the pairing with minor premise **E** and major premise **I**, because the minor premise is negative, the conclusion must be negative. But the major premise is particular, not universal. Thus this minor/major **EI** pairing can also be eliminated. As shown in Table 7 below [4: 133]:

Table 7. Invalid pairings are eliminated from the group.

minor	major	minor	major	minor	major	minor	major
A	A	A	I	A	E	A	O
I	A	~~I~~	~~I~~	I	E	~~I~~	~~O~~
E	A	~~E~~	~~I~~	~~E~~	~~E~~	~~E~~	~~O~~
O	A	~~O~~	~~I~~	~~O~~	~~E~~	~~O~~	~~O~~

No further eliminations can be made. This reduces the number of valid pairings to 8 (**AA**, **AI**, **AE**, **AO**, **IA**, **EA**, **OA**). The 4 figures for each of the 8 pairings results in 32 potentially valid syllogisms as mentioned above.

The following should be noted in relation to the 15 syllogisms of classical logic:

1. Where a universal affirmative (**A**) premise is present, whether major or minor, the conclusion always takes the mood of the second premise:

AAA, AII, AEE, AOO, IAI, EAE, OAO

2. Where a universal negative (**E**) proposition is present along with a particular affirmative (**I**) proposition, the conclusion always takes the mood of a particular negative (**O**) proposition:

EIO

The following should be noted in relation to the 9 controversially valid logical syllogisms:

3. Where two universal premises (**AA**, **AE**) are found (the **EE** form is not valid), the conclusion (the mood of which is established by rule 1) may be adapted from universal to particular 'to avoid a potential fallacy' [Joseph, p. 134]:

AAA to AAI, AEE to AEO, EAE to EAO

This rule differs from the Boolean approach [Copi, Cohen: 235-236]. What remains is to establish whether the particular figure the potentially valid syllogisms appear in renders it as valid or invalid.

The validation process outlined by Meguire [Meguire: 50], which is based on the middle term being shown in two states (marked and unmarked) across both premises seems to be unreliable, as will be demonstrated in relation to four categorical syllogisms AAA-1 to AAA-4, only one of which (AAA-1) is valid.

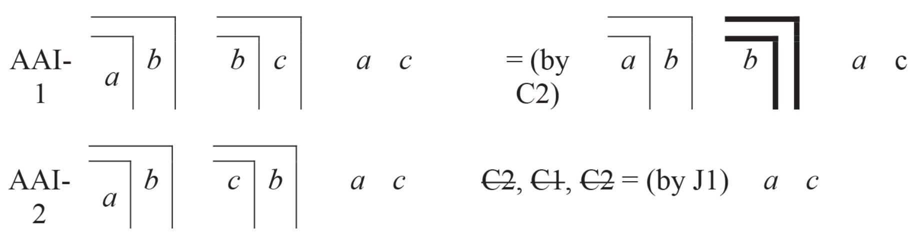
The syllogisms are shown here without the double cross for conjunction (AND) and implication (IF) over the premises which is cancelled by I2.

Brownian notation can be used for validating the figures of potentially valid syllogistic forms. The approach outlined works consistently across the 32 forms dealt with above, which emerge from the 8 valid pairings, within which groups the 15 uncontroversially valid syllogistic forms appear. Verifying this may prove useful as an exercise for readers wishing to become more familiar with using this approach.

So much for the 15 uncontroversially valid syllogistic forms. What about the nine 'contentious' ones?

Validating the nine 'contentious' syllogisms

For the validation of the nine 'contentious' syllogisms which have universal premises and conclusions adapted from universal to particular, a second approach needs to be taken. Once C1 has been applied, as in the examples above, it is sufficient to apply C2. If this results in an expression which contains a single variable with a double cross over it (as shown in thicker lines below), the syllogism will turn out to be valid. The validation steps for AAI-1 (*Barbari*) (valid) and AAI-2 (invalid) are shown below.



The second approach should only be used with the nine 'contentious' syllogisms. It does not prove a reliable validation tool for the 15 standard ones.

In reviewing the proposed methodology for establishing the validity of the 15 uncontroversially valid syllogisms subsequent to working out the shorter pathway to validating the 9 controversially valid ones, I noted that the following rule holds for the former group of 15:

If, *having successfully applied C1* ***and*** *C2* to a syllogism, the middle terms appear crossed differently (singly and doubly), then the syllogism is valid.[1] It is at this point that Meguire's test can be applied consistently, giving a quick and easy way to establish validity across the 32 potentially valid syllogistic forms covered in this paper.[2] In fact, it will be found that when working with any of the 8 pairings of propositions outlined above (AA, AI, AE, AO, IA, EA, OA, EI), the premises do not need to be crossed, and that both notation and validation processes are further simplified as a result, as the conclusions emerge naturally from the premises. The propositions will need to be crossed for the purposes of validation in the case of syllogisms where the conclusion has been modified, or cannot immediately be seen to have been derived from the propositions, as can be seen from Appendix III.

So far it has been demonstrated that Brownian notation can be used effectively to notate and validate syllogisms; that Mingers' 17 invalid forms can be eliminated if a distinction is maintained between marks and negated variables; and that it is possible to employ an informed, common-sense approach to using Brownian notation when working with categorical syllogisms in classical logic in order to benefit from the modifications proposed by Mingers which provide advantages—admittedly once familiarity with the notation is acquired—over other notational approaches in terms of speed and visualisation. Brownian notation makes it easier to see whether logical terms are distributed or undistributed. If the clear validation methodology outlined above is followed, it will be found to be much quicker, easier, and more intuitive than, say, using Venn diagrams.

Using Venn diagrams and Brownian notation to test the validity of valid and invalid syllogisms: a comparison

Testing the validity of a syllogism in AEE-1 form (invalid) – 2-level notational form:

It is evident that the treatment of the middle term in the pair of premises renders the syllogism invalid. There is no point proceeding beyond the notation of the 2 premises.

If validating the syllogism using Venn diagrams:

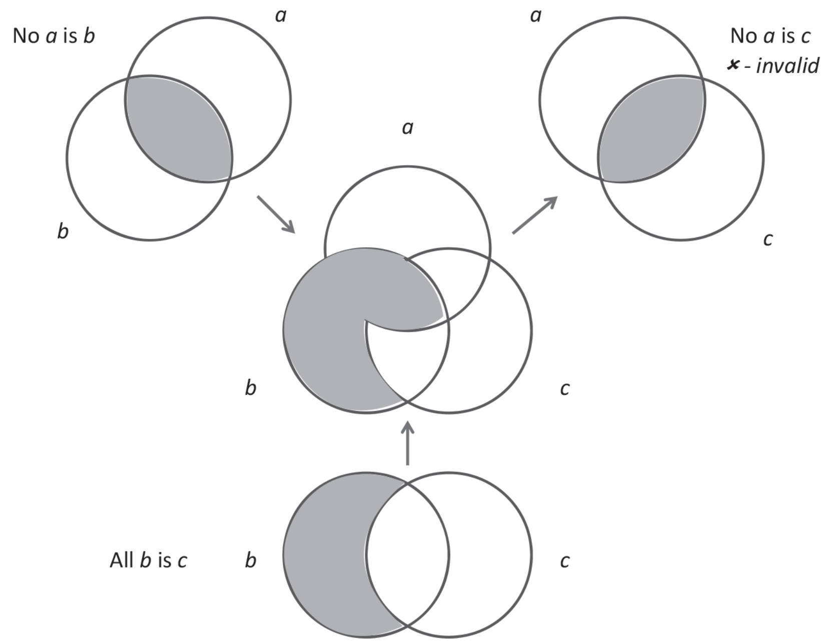
1. Nine circles would have to be drawn to start with, or a template used.

2. The relationships would have to be mapped, with large segments coloured in or marked as appropriate, with greater margin for error.

3. The conclusion would need to be asserted.

[1] AOO-2 is the only form which may need the procedure to be done twice for this to become immediately apparent visually. Over time, the process may well enable the 'laws of logic' to become more obvious through familiarity with working with the system, ultimately rendering the second move unnecessary.

[2] It is important that C2 be applied, as this approach to validation does not work if it cannot be, as in the validation of AAA-4, outlined above.



4. The diagram would need to be checked visually to see whether the conclusion appeared from the relationship of the premises.

5. The validity of the syllogism would need to be deduced.

Testing the validity of a syllogism in AEE-4 form (valid) – 2-level notational form:

$$\overline{a}\rceil \;\; \overline{b}\rceil \quad \overline{c}\rceil \;\; a \quad \overline{b}\rceil \;\; \overline{c}\rceil$$

It is evident that the treatment of the middle term in the pair of premises renders the syllogism potentially valid. Crossing out like terms leaves both a crossed and an uncrossed term, which renders the syllogism valid. The notation is more elegant. The process of testing validity takes a few seconds. Using a Venn diagram for testing takes far longer and is less visually obvious, as parts of the central diagram which are not relevant need to be isolated mentally before the correspondence can be verified, and offers a greater margin for error.

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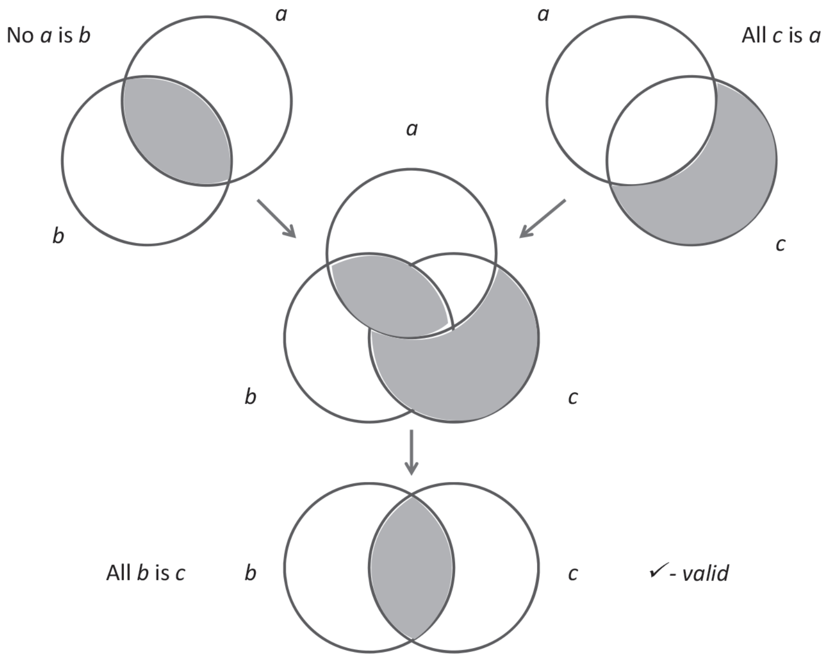
I am grateful to Professor George Spencer-Brown for mentoring me through the process of getting to grips with the *CoI* in a regular series of weekly; and to Louis Kauffman and John Mingers for their helpful comments on an early draft of this paper.



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ЗАКОНЫ ФОРМЫ – ЗАКОНЫ ЛОГИКИ
(применение силлогизма в интеллектуально-речевой коммуникации)

Леон Конрад

Академия ораторского искусства, Лондон, Великобритания.

Аннотация. В статье показывается, что исчисление различений (индикаций) Спенсера-Брауна (ИР) имеет явные преимущества с точки зрения интуитивно более понятной системы записи, которая позволяет ясно визуализировать распределение терминов в пропозициях и силлогизмах; работать с ним легче и быстрее чем, скажем, с диаграммами Венна, диаграммами Кэрролла, или Булевыми системами в ходе записи и проверки силлогизмов.

В части I определяется основа для исчисления различений и для классической логики, показывая, что исчисление различений имеет явные преимущества в плане оперативности, наглядности и простоты использования по сравнению с другими формами записи, такими как текст или диаграммы Венна. В части II раскрывается, как Броуновское обозначение может облегчить работу с выявлением через преобразование; работа с отметкой о последствиях Броуновского обозначения экзистенциального импорта. Показывается, как ИР может облегчить процессы выведения по сравнению с Аристотелевой и Булевой точками зрения на логический квадрат оппозиций; адукции посредством превращения и преобразования; а также работы с соритами.

Ключевые слова: логика, Джордж Спенсер-Браун, исчисление различений (индикаций), законы формы

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Сведения об авторе: Леон Конрад, соучредитель и ведущий консультант Академии ораторского искусства, тренер-консультант по коммуникации. Юридический адрес: Дом 202, Грандевуд, Эссекс, IG10 3TZ. E-mail: leon@academyoforatory.co.uk.

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Краткое предисловие главного редактора Феликса Шаркова

Силлогизм, который является образцом дедуктивного умозаключения, широко используется в интеллектуально-речевой коммуникации. Как способ воздействия на сознание в процессе осуществления коммуникации, силлогизмы играют аргументирующую роль. Силлогизмы (например, в дискурсе Канта) также носят комплексно-пропозициональный (текстовый) характер и являются композиционной формой организации текстового материала. В повседневном общении люди используют силлогизмы не в развернутом виде, а сокращенные, где одна из посылок или заключение опускаются.

Для развития и смыслового обогащения коммуникаций, осуществляемых в силлогистической форме, исследование сооснователя и ведущего консультанта Академии ораторского искусства Великобритании Леона Конрада, поможет коммуникантам общаться в любой ситуации наилучшим образом. Его исследовательская и практическая деятельность основаны на комплексном подходе к Либеральным искусствам, Законах формы Джорджа Спенсера-Брауна, а также устной коммуникации. Автор статьи апробировал некоторые материалы результаты приводимого здесь анализа в социальных сетях[1].

[1] Например: http://www.academia.edu/12103235/Laws_of_Form_Laws_of_Logic