CONNECTIVES: ORDER, CAUSALITY AND BEYOND [*]

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Abstract

It is often pointed out that different so-called causal connectives have different causal orders associated with them, for instance **non-iconic** (consequence-cause) for *because*, **iconic** (cause-consequence) for *so* and *and*. The objective of this contribution is to determine whether this phenomenological observation has some deeper theoretical explanation by examining what the order really refers to beyond causality. The hypothesis put forward is that the order imposed by connectives does not pertain to causes and consequences as it is usually assumed but to the order of implication (antecedent-consequent) induced by laws, in the sense of non-accidental generalizations. It will be demonstrated that in the case of connectives, laws have the function of the contextual assumptions tacitly invoked as premises in the reasonings that speakers perform when using utterances with connectives such as *because, so* and, in some cases, *and*.

1. Introduction

It is well known that so-called causal connectives or causal uses of connectives have specific orders of presentation of causes and consequences associated with them. For instance, *because* is called a backward causal connective since its order is consequence-cause or non-iconic, i.e. backward to naturally occurring causal scenarios (1)a while *so* is called forward causal connective since its order matches the natural order of events (first cause then consequence, i.e. cause-consequence or iconic order as in (1)b. When the conjunction *and* is used with a causal connotation, the cause-consequence order has to be respected.

> (1) a. John fell **because** Mary pushed him.   (non-iconic or consequence-cause)
> b. Mary pushed John **so** he fell.   (iconic or cause-consequence)
> c. Mary pushed John **and** he fell.   (iconic cause-consequence)

However, the same connective allows for different orders depending on what is commonly called the "domain of use" following Sweester (1990). According to Sweetser's classification, most connectives can be used in three domains: content, epistemic and speech act. The content domain involves the description of a (physical) reality external to the speaker (2)a, the epistemic domain relates to speaker's internal capacity of argumentation (2)b and speech acts domain includes the use of a performative act of language (a speech act) (2)c.

> (2) a. John fell **because** Mary pushed him.   (content)
> b. The neighbours are at home, **because** the lights are on. (epistemic)
> c. Hurry up! **Because** we are late.   (speech act)

It is important to underline that the prototypical order attached to different connectives is related to their use in the content domain. For instance, *because* exhibits the consequence-cause order while *so* and *and* exemplify the cause-consequence in their content domain[1]. The speech act domain exhibits the same order pattern as the content domain, but this is outside the scope of the current contribution. What I will be focusing on instead in comparison to the content domain is the epistemic domain in which connectives can be used in both orders. For instance, the speaker can infer an unknown cause on the basis of a known consequence, as in (2)b repeated in (3)a, or she can infer an unknown consequence on the basis of a known cause, as in (3)b. Two terminological notes have to be made here. First, it might happen that in absence of any additional markers (like modals, a coma or prosodic clues) one of the epistemic uses, namely the one in the non-iconic order like in (3)b, has the form which is similar with the content use (3)c. Such mix-up can never occur in the iconic order[2]. For convenience, I will call the unambiguous reading the pure epistemic.

(3) a. The neighbours are at home, **because** the lights are on. (pure epistemic)
    b. The lights are on, **because** the neighbours are at home. (epistemic)
    c. The lights are on **because** the neighbours are at home. (content / basic)[3]

Second, as we will see shortly, since my definition regarding uses of connectives in their content domain is larger that the one originally proposed by Sweetser, I will call it the basic domain of use of connectives, or, for short, basic uses of connectives or just basic *because*, basic *so*, etc.

In this work I will tackle two *prima facie* independent questions. Firstly, what does the parameter order really refer to and can we derive the paradigmatic orders related to different connectives in a principled way or do we have to stipulate them? Secondly, is it all about causality? Does the rigid association of causality with causal connectives reduce their full meaning and does it leave aside an important part of their meaning necessary for their interpretation?

2. Order in different approaches to connectives

It seems that order is quite an important parameter in the characterization of different uses of connectives, on the one hand and of differentiation between different connectives conveying similar (e.g. causal) information, on the other. Thus, a clear establishment of the mechanisms that govern the parameter order and of the role it plays in the meaning of connectives are crucial for their accurate and fully explanatory analysis. In what follows we will consider definitions of two connectives from different approaches, Blakemore's and Levinson's, and see their insufficiency in providing an explanation of the order displayed by connectives in general.

One of the theoretical frameworks in which connectives are analysed is Relevance Theory with the notion of conceptual-procedural distinction. Blakemore (1987; 2002) put

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[1] See Moeschler 2011 who argues that also the French *parce que* (because) can only introduce a cause in the consequence-cause order and Moeschler 2009 for argumentative *parce que* with cause-consequence order.
[2] See also Moeschler 2014 for an explanation of the non-iconic order of causal discourses.
[3] See also Blochowiak 2010, 2014a for another type of content / basic use of *because*, the conjectural one, which concerns a speaker's belief about possible causes of some event (and crucially not about reasons a speaker can have to infer a cause or consequence, as it is the case with epistemic *because*).

forward the thesis that connectives typically encode procedures. Blakemore put forward the hypothesis that contrary to plain conceptual items such as nouns, adjectives or verbs which have some conceptual representations associated with them, connectives typically encode procedures, as they are rather devoted to putting some constraints on the inferential processes of the hearer's comprehension in order to guide him towards a correct utterance interpretation. For instance, in (4)a and b *so* indicates to treat its second segment as a conclusion (one of) whose premise(s) is provided in the first segment.

(4) a. John is an Englishman so he is brave.
 b. Bill is a bachelor so he does not have a wife.
 c. Treat what follows *so* as a conclusion

However, it is also possible to utter (5)a and b where a purely procedural account will give the same analysis as in previously (5)c.

(5) a. John is brave so he is an Englishman.
 b. Bill does not have a wife so he is a bachelor.
 c. Treat what follows *so* as a conclusion

Crucially, if the procedural definition of *so* is complete, then both (4) and (5) could count as the basic order for *so*. In other words, such an analysis cannot establish whether there exists an order specifically dedicated to *so* and, if yes, what it is due to.

Another interesting case is represented by the temporal and causal interpretations of sentences with the connective *and*. In the standard Gricean approach, the meaning of *and* was claimed to be the same as the meaning of the conjunction in classical logic and all other meanings (like temporal) were pragmatically inferred via general pragmatic principles of conversation (Grice 1989). For instance, the temporal interpretation of (6) is the result of the application of the maxim of order *Be orderly!* according to which participants of a conversation narrate things in the correct order.

(6) John took off his boots and went to bed.

However, as it is often the case there is causality which adds itself to temporality, as in (7) where in addition to temporal sequence, the events described are linked causally.

(7) John pushed Mary and she fell.

Grice himself didn't treat this aspect of the conjunction but his followers proposed several solutions. For instance, Levinson (1983:146) conceived an algorithm designed to account for temporal and causal interpretations of *and*. His suggestion is that the meaning arises incrementally as follows:

(8) Levinson's incremental algorithm
 Given *p and q*, try interpreting it as:
 (i) *p and then q*; if successful, try:
 (ii) *p and therefore q*; if successful try also:
 (iii) *p, and p is the cause of q.*

Levinson's proposal can solve some of the problems related to causal connotations of *and* but there are examples which escape his analysis. For instance, the cases that are problematic are

the ones where we do not deal with events whose temporal succession can be established, as in (7) above, but with states that are simultaneous, as in (9) below.

(9) The atmospheric pressure is low and I have a headache.

It is clear that the state described by the first conjunct is the cause for the state described by the second conjunct, nevertheless, there is no temporal succession between the two which would allow to achieve the first step of the incremental algorithm, necessary to arrive at the third step delivering the causal interpretation. These are the type of examples Levinson's approach cannot handle (Wilson & Sperber 1998, Blochowiak 2014a, 2014b). In other words, Levinson's approach presupposes or rigidly relates causal interpretations of *and*, and a fortiori the parameter order, with temporal sequencing of eventualities that prevents providing an explanation for all the examples, even for a restricted set of causal cases.

In sum, the most popular classification of connectives assigns the orders to specific connectives without explanation (Sweetser 1990; see also Sanders et al. 1992 for a discourse relations model where they treat the parameter order as one of the primitives of their model). Furthermore, as we have just seen, the existing definitions, like Blakemore's procedure attached to *so* or Levinson's incremental algorithm for *and*, have problems in identifying which order is basic. Therefore, there is a missing explanatory link for why we should consider cause-consequence as being the basic order attached to *so* and *and*, for instance. In other words, the classifications of connectives stipulate which order is basic for which connective and the definitions are not able to properly determine which order is which and, thus, have to rely on stipulations provided by classifications. However, before these issues can be addressed it is necessary to ask another important question, namely, is it all about causality alone? As we will see in next sections, the so-called causal connectives attest non-causal uses, which nevertheless display an order as in causal examples. In order to elucidate this point, we will first provide some elements for the definition of causality in the next section and then we will turn to the analysis of non-causal examples.

3. Causality

The relation of causality is probably the most frequently studied with respect to the so-called causal connectives. Yet the focus on causality seems to miss some important generalizations concerning the parameter order as well as the meaning of the connectives themselves. Obviously, in order to analyse language devices employed to talk about causal relations one has to provide at least a basic definition of causality. It should be stressed that enlarging the concept of causality to a relation of dependence of any sort between two eventualities is not worthy from theoretical point of view as such reduction will render impossible a coherent analysis of the reference to causality in natural language. Therefore, even if the disentanglement might seem too meticulous, it is nevertheless a necessary step towards a fully explanatory theory of causality in natural language. In what follows I will examine three basic components necessary for pinpointing the causal relation in the world and also for defining the causality in natural language, i.e. the manner in which natural language makes reference to the causal relations.

Firstly, a causal relation can only obtain between eventualities. These include all sorts of events but also states (cf. Asher 1997 and Moeschler 2003 for a causal model of dynamic relations between events and states and Blochowiak 2009 for more details on causality between states). The essential property of eventualities composing a given causal relation is their spacio-temporal character.

Secondly, the eventualities that are causally linked are necessarily non-identical, i.e. distinct one from another. This second criterion is especially important to keep in mind when analysing descriptions of causality in natural language, since one single eventuality can be described by several descriptions (Anscombe 1959; Davidson 1963).

And the third component necessary for defining the causal relation concerns the nature of the causal relation itself. It is not the case that any kind of link between two spacio-temporal eventualities can be called causality. Thus, what type of dependency does the causality refer to exactly? One of the most popular characterisations of the nature of causal relation was provided by Lewis who proposed an analysis of causal relations in terms of counterfactuals. In essence, according to the first version of Lewis's analysis, event *E2* is counterfactually dependent on event *E1* if and only if the following counterfactual was true: *Had E1 not occurred, E2 would not have occurred* (Lewis 1973).

Lewis's theory of causation has undergone several modifications and is still under debate. What should be clear here is that it is not necessary to choose Lewis's approach to causation in order to properly analyse causality in natural language but it is necessary to choose *a* theory that quite clearly characterises the nature of causal relation. Nevertheless, these elements of definition of causality are enough for our purpose, as they will allow teasing apart causal from non-causal uses of connectives.

4. Causality and beyond

Consider the following examples.

> (10)   a. John is an Englishman so he is brave.
> b. Coccelle is a car so Coccelle is a vehicle.
> c. 8 is an even number so 8 is a natural number.
> d. Sam is Max's cousin because Sam's mother and Max's mother are sisters.
> e. Bill is a bachelor because he doesn't have a wife.
> f. This is a triangle because it has three edges and three vertices.
> g. 5 is a prime number because 1 and 5 are its only divisors.

It seems clear that the relations expressed by the connectives in (10) are not causal or not only causal. For instance, being an Englishman does not properly *cause* John to be brave, nor does the fact that Sam's mother and Max's mother are sisters *cause* Sam and Max to be cousins. Having three edges and three vertices does not *cause* an object to be a triangle either. What relations do these examples point at? All these non-causal relations that are perfectly expressible by the means of the so-called causal connectives pertain to set-subset relations or definitions of concepts (see Künne 2003 for conceptual *because* and Blochowiak 2006 for a synthesis). Let us analyse both groups in more details.

The first group (10)a-c clearly exemplifies a set-subset relationship also called class inclusion or concept subordination (cf. Gardies 1985: 96) : the set of Englishmen is presented as a subset of brave people, the set of cars as a subset of vehicles and the set of even numbers as the subset of natural numbers[4]. One could however try to identify a causal dimension in these examples in various degrees. As for (10)a one could imagine that somebody's being an Englishman corresponds to a state where is expressed a set of, say, genetic features which is causally responsible for the braveness of its owner. Or in a milder way, being an Englishman makes people predisposed to being brave, a predisposition that may never manifest itself. In

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[4] Note that there is also a belonging to the class relation in these examples. For instance, the individual John belongs to the class of Englishmen.

other words, this particular set-subset relation can be seen as having a causal flavour. But the second example of the series cannot be analysed in causal terms, as it is difficult to imagine that the descriptions *Coccelle is a car* and *Coccelle is a vehicle* refer to two independent spacio-temporal eventualities, the condition that is necessary to be fulfilled in order for a causal relation to be applicable at all. Thus, Coccelle's being a car cannot *cause* Coccelle's being a vehicle. Finally, the third example cannot receive a causal interpretation either because it talks about mathematical truths, and mathematical truths are claimed to be beyond space and time. Since they cannot be considered as spacio-temporal eventualities, the pre-condition for causality is not satisfied. In sum, the two last cases are pure examples of belonging to the class relation with no causal dimension whatsoever.

The second group of examples point to conceptual and definitional dependencies. Indeed, the relation signalled by the connectives in (10)d-g is not causal but it is of certain type of dependence between terms and concepts expressed by them, where one concept is defined by other concepts, i.e. we deal here with the dependence between a *definiendum* (that which is defined, i.e. the concept to be defined) and its *definiens* (that which does the defining, i.e. the definition). In general, the concepts used in a definition are known and/or are simpler than the concept to be defined which are unknown. This is one sub-type of definition called semantic (Bocheński 1993) or nominal definition (cf. Gupta 2015).

One could suggest however that it is possible to detect a causal relation in these examples if one considers that (10)d does not take this particular example as a way to provide a definition but describes a concrete situation. In such cases we can treat the descriptions given in each segment of *because* as referring to spacio-temporal eventualities: the state where Sam is Max's cousin and the state where Sam's mother and Max's mother are sisters. In such a setup one could be tempted to affirm that the latter *causes* the former. Nevertheless, this interpretation is certainly incorrect as it is in opposition with the second component of definition of causality which requires the non-identity of causally linked eventualities. Indeed, both descriptions point to the same net of family relations, one using a concept *cousin* as an abbreviation and the other employing a longer form being a definition of this concept, but crucially they refer to the same state in which Max, Sam and their mothers stay in certain family relationships with one another. Similar remarks hold for the bachelor example. Additionally, the spacio-temporal event-like interpretation of these examples is not the only possible one as we will see in more details in the next section. Concerning the examples referring to the concepts of triangle and prime number, they describe mathematical truths among which there are no causal relationships whatsoever.

5. Order beyond causality

Now the important point is that even if causality is not primarily involved in the examples discussed above, there is still an order that has to be preserved.

For instance, in the Englishman example, the part concerning being an Englishman has to be stated before *so* and the part about the braveness after. Here the connective *and* in its basic use (not Horn-like) is a good detector of the incongruities in the application of the parameter order.

(11)   a. John is an Englishman so he is brave.
          b. John is an Englishman and he is brave.
          c. John is brave and he is an Englishman.

(11)b is synonymous to (11)a in stating that being brave is somehow a consequence of being an Englishman whereas (11)c looses this interpretation as it says that John is brave and, in

addition, he is an Englishman, without making a link between the two. Clearly, in (11)b, contrary to (11)c *and* receives an explanatory interpretation that can be made explicit by adding to *and* the expression *that is why*.

(12) a. John is an Englishman and that's why he is brave.
     b. #John is brave and that's why he is an Englishman.
     c. Coccelle is a car and that's why Coccelle is a vehicle.
     d. # Coccelle is a vehicle and that's why Coccelle is a car.

The case of definitions is interesting as it seems *prima facie* that they cannot be clearly disambiguated via the explanatory expression *and that's why* or *because*.

(13) a. Bill is a bachelor and that's why he does not have a wife.
     b. Bill does not have a wife and that's why he is a bachelor.
     c. Bill is a bachelor **because** he does not have a wife.
     d. Bill does not have a wife **because** he is bachelor.

One can be tempted to think that *because* goes in two directions ((13)c and (13)d) due to the underdetermined meaning of the content of the first segment of *because*. Obviously, it is possible to interpret *Bill is a bachelor* as referring to an eventuality, more precisely a state, and also *Bill does not have a wife* as referring to a state but the causal relation cannot hold in such a scenario since we deal here with two different descriptions of the same state, which violates the second component of the definition of causality we saw earlier. More importantly, the spacio-temporal event-like interpretation is crucially not involved in the case of definitions and, *ipso facto*, in all the cases where a particular instantiation of a definition is expressed, as this is the case in our examples. In general, definitions state that something is or can be *called* such and such if and only if it has such and such properties. This precision solves the problem of order in definitions, as it is demonstrated in (14), where one of the *because*s is blocked.

(14) a. Bill does not have wife and that's why he is called bachelor.
     b. # Bill is called bachelor and that's why he does not have wife.
     c. Bill is called bachelor **because** he does not have a wife.
     d. # Bill does not have a wife **because** he is called bachelor.

In other words, definitions also have a dedicated direction which is able to detect a basic reading of *because* (14)c. Now, it should be noted that a causal scenario is also possible but the difference between causality and definitions is important as it is pointed out in (15), where in (15)a *because* is causal and in (15)b the conceptual meaning of *because* is blocked because *having an awful character* does not constitute a definition of *bachelor*.

(15) a. Bill is a bachelor because he has an awful character.
     b. # Bill is called bachelor because he has an awful character.

Crucially, (14)c and (15)a target two different universes: the latter describes the real world of relations between eventualities (here causal ones) and the former refers to the world of semantic relations (here definitions).

In sum, even in non-causal examples, there is an internal order of segments the connectives are sensitive to. The question is to know what this order refers to given that there are no causal or even temporal relations involved here.

6. Law-like knowledge

The thesis defended in this chapter is that there is a tight relation between different orders presented by the connectives and the logical form of laws, rules and regularities that the speakers have in their backgrounds and which interact with and often are part of the meaning of various linguistic expressions.

For instance, as it was convincingly argued for modal expressions (see Kratzer 2012 for a synthesis), there is an important difference to be drawn between the factual and the law-like knowledge as these two types of information work quite differently in the calculation of the meaning of linguistic expressions. While facts feed the modal base, the rules, laws and regularities have the role of ranking of the content of modal base.

Also in the Relevance Theory framework, one can and should draw among the contextual assumptions an important difference between those that have a form of general rules and those that do not[5]. In particular, the contextual assumptions of the type of general rules function as major premises in reasonings and here is the point of meeting with connectives. The contextual assumptions with the form of general rules, for which I use the technical term *laws*, are rarely said overtly, nevertheless they play a crucial role in the definition and interpretation of connectives, especially in their causal uses. What is the particularity of these laws?

First of all, it should be noted that we do not restrict the notion of law presented here to only strict laws of exact sciences although they are also part of speaker's background knowledge (the more somebody is a specialist in a given domain, the more precise the corresponding laws in his background would be). The laws speakers have in their background and employ (often unconsciously) in their everyday talk, are all sorts of regularities ranging from the strictest laws of science as mathematics to less strict disciplines as physics to even less strict ones as economics or sociology and at the top there are everyday rules based on folk naïve sciences, as naïve physics or psychology. Clearly, there is a gradient of strictness that is different depending of the type of law and this gradient can be measured in the number and type of exceptions they admit. What should be stressed is that the thesis defended here is not that everyday folk-science rules are almost equal to real laws of science except in the number of exceptions but the thesis is that all types of laws (from strict and folk science) have at some level of abstraction similar logical form and they are employed in natural uses of the language in the same manner.

Formally, for predominant majority of laws, they do not hold universally in the logical sense of universal quantifier since they admit all sorts of exceptions. One of the possible formal proposals to such fuzzy laws treats them within a larger approach whose aim is to analyse *generic statements* (cf. Carlson and Pelletier 1995). For instance, in order to pinpoint the exceptional character of laws, one of the possibilities consists in defining a specific quantifier *Gen* that would be able to grasp the meaning of the word *normally* referring to the conditions that have to be fulfilled for a generic statement to be true (Chierchia 1995; Greenberg 2002 and 2007). The present work does not take a stance on the theoretical treatment that should be reserved for the laws due to the lack of space. Here, for the sake of the simplicity I will adopt the rough formal analysis of laws, which treats them by simple

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[5] My proposal here is in accordance with the Relevance Theoretical approach which considers the contextual assumptions to be crucial for the interpretation of temporal and causal discourses (Wilson and Sperber 1998; Carston 2002). The novelty of my analysis is that it takes a formal turn that allows exploring in more depth problems linked to order of temporally and causally related discourses with connectives.

means of universal quantification. This approximation avoids the unnecessary complications and is largely sufficient to demonstrate the point at stake[6]. Therefore, a simple law of 'folk-science' stating that raining causes wetting of the ground will be formulated as follows:

(16)   (Normally) If it rains, then the ground is wet.

Even if this point is not important for the purpose of this contribution, the word *normally* was left in (16) to indicate that we still deal here with a generic interpretation. What is crucial for the demonstration that will be presented in this contribution is that there is an internal order of antecedent and consequent in laws, the order which is reflected in the use of connectives.

What does the internal order of laws refer to? Let us look in more details into a causal example. In order for a causal law to be correctly formulated, the antecedent of the conditional has to refer to a cause (more precisely a class of eventualities describing a type of cause) and the consequent to a consequence (more precisely a class of eventualities describing a type of consequence) as in (16). Importantly, in such a setup the conditional is employed in its basic use. Now, if we switch the causes and consequences around, we end up with the epistemic use of conditional, as in (17), where the wetting of the ground serves as premise to conclude that probably the rain was its cause.

(17)   If the ground is wet, then it is raining / it must have rained.

In other words, the only correct conditional formulation of causal laws necessitates the mention of the cause in the antecedent of the conditional and the causal consequence in the consequent.

The internal order between antecedents and consequents in the formulation of laws is not restricted to causal dependencies. Obviously, all the laws and rules constructed with the belonging-to-the-class relations also naturally translate into conditionals with an internal order, as exemplified below[7].

(18)   a. If x is a car, then x is a vehicle.
         b. If x is an even number, then x is a natural number.

Now, what is interesting concerning the definitions is that they are typically formulated with the help of biconditionals, as illustrated in (19).

(19)   a. x is (called) bachelor iff x is a male and x does not have wife.
         b. x is (called) triangle iff x has three edges and three vertices.

Logically, the definition means that one term or expression can always be replaced *salva veritate* by another term(s) or expression(s), and *vice versa*. However, definitions also have an order, which means that there is one direction of conditional which is identifiable as the bearer of the essence of definitional meaning. As we briefly saw earlier, the direction of definitions is typically determined by the simplicity, i.e. the basic character of concepts, on the one hand, and the complexity, on the other or by the known-unknown opposition. On one side of the definition there is *definiendum* – an unknown or more complex concept (usually

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[6] For instance, Bromberger (1966/1992) analyzes laws of science taking into account their exceptions in predicate logic and Blochowiak (2014a) extends the Brombergerian view to 'everyday' laws and provides an analysis in the Possible Worlds Semantics framework.
[7] In all the examples presenting sentential formulae the universal quantifier is assumed.

referred to by a simpler expression, a sort of abbreviation) – and on the other side there is *definiens* – a composite of simpler concepts that are known (usually a logical combination of simpler concepts). For instance, the concept of cousin is defined in terms of simpler concepts of being a mother and being a sister but not *vice versa*. Trying to define a concept of being a mother or being a sister in terms of the concept of being a cousin would be twisted from definitional point of view, what can be pinpointed with *and that's why* expression we saw earlier.

(20)   a. Sam's mother and Max's mother are sisters and that's why they are cousins.
         b. #Sam is Max's cousin and that's why their mothers are sisters.

In brief, even if formal construction of definitions necessitates the use of the biconditional, there is nevertheless a distinctive direction which corresponds to the *definiendum – definiens* asymmetry: *if this definiens, then such definiendum*, but not *vice versa*, especially that there are cases of more than one definiens for a given definiendum.

The formal procedure consisting of passing from a conditional to a biconditional and *vice versa* is not specific to definitions but can be found for more basic phenomena as causality. Speakers in their everyday reasonings and *a fortiori* in the use of connectives that evoke laws (cf. Blochowiak 2014a) have a tendency to interpret conditionals as biconditionals. The famous examples come with the so-called invited inferences: *If you wash my car, I will give you 10 euros* is usually understood as *If and only if you wash my car, I will give you 10 euros* (Geis and Zwicky 1971; Horn 2000). As I have argued elsewhere (Blochowiak 2014a), the pragmatic mechanisms behind such operations of biconditionalisation are supported by the logical law of a closed system of sentences or Hauber's law (cf. Tarski 1995)[8]. In some cases, like mathematical or conceptual definitions, a closed system of sentences is formed naturally, as the consequent of the law (*definiens*) uniquely determines its antecedent (*definiendum*), what gives rise to biconditional statement. But speakers also tend to construct the closed system of sentences for contextual reasons, if, for instance, there is only one possible or very frequent cause for a given consequence, speakers are inclined to form a closed system out of such 'unique' causes and their consequences. As a result, we deal with a transformation from conditional to biconditional formulations of causal laws. For instance, if a speaker assumes that the unique cause (or contextually the most salient one) for the ground to be wet is the rain, then she is ready to adopt the biconditional formulation of the "rain law". Logically, such cases of uniqueness of a certain type of cause for some type of consequence lead to supply the original law formulated in conditional manner (21)a by its negation (21)b which gives rise (here by contraposition) to a biconditional statement (21)c.

(21)   a. If it rains, then the ground is wet.
         b. If it does not rain, the ground is not wet.
         c. The ground is wet iff it rains.

However, it is crucial to underline that the procedure of biconditionalisation of a conditional law does not erase the fundamental asymmetry between the cause and its effect for causal

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[8] The law of closed systems says that given a set of conditional sentences proved to be true, we are authorized to infer that the corresponding converse sentences are also true under the following conditions: (i) if the antecedents of the conditional sentences taken together exhaust all possible cases and (ii) at the same time their consequents have the property to exclude one another (cf. Tarski 1995: 176).

laws[9]. Importantly the same holds for conceptual definitions. The biconditional formulation should not obscure the asymmetry that exists between *definiendum* and its *definiens*. In fact, such biconditionals veil two different conditional statements: one is basic and expresses causal or definitional dependency (22)a and (22)c respectively, and the other one is epistemic in its nature (22)b and (22)d.

(22)   a. If it rains, then the ground is wet.   (basic *if...then*)
         b. If the ground is wet, then it rains.   (epistemic *if...then*)
         c. If x is bachelor, then he is a non-married man. (basic *if...then*)
         d. If x is a non-married man, then he is bachelor. (epistemic *if...then*)

The crucial point is that the order of implication from the laws is directly responsible for the order displayed by connectives, which will be discussed in the next section.

7. What does the parameter order refer to?

As we have seen, the order the connectives seem to be sensitive to goes well beyond causality. The order exemplified in utterances using various connectives cannot pertain directly to causes and consequences since this would cover only a subset of data. The order in the use of connectives points to the antecedents and consequents from the laws. In particular, as we have seen, for the causal laws, the antecedents always refer to causes and the consequents to consequences.

        Now, we are ready to answer the question why the basic order for *so* is iconic (what correspond to cause-consequence in causal cases). Recall our example:

(23)   a. John is an Englishman so he is brave.
         b. John is brave so he is an Englishman.

As we have seen, there is nothing in the existing theories and definitions that could motivate one order over the other as basic. In particular, the procedural definition of *so* having the form of a simple instruction: *Treat what follows* so *as conclusion*, does not have the potential to determine a basic form for this connective.

        The basic order can be established with the help of laws that function as hidden premises in production and interpretation of utterances with connectives. The first step is to determine what law or general rule is tacitly invoked in the present example. In generic form the law says something like *Englishmen are brave*, what is translatable into the following simplified logical form: *If x is an Englishman, then x is brave*. What is crucial to note here is the direction of the implication: the law does not say: *If x is brave, then x is an Englishman*. In set theoretical terms, English people constitute the subset of brave people, but importantly not *vice versa*. In other terms, one of these conditional statements is basic and the other epistemic as in (24)a and b respectively.

(24)   a. If x is an Englishman, then x is brave.   (basic *if...then*)
         b. If x is brave, then x is an Englishman.   (epistemic *if...then*)

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[9] It is interesting to observe that speakers are sensitive to the cause-consequence asymmetry. Indeed, Moeschler et al. 2006 and Blochowiak et al. 2010 provided experimental evidence for the cognitive priority of the non-iconic order in some type of causal discourses with no connectives.

The basic form of *so* is an implementation of an inference that is valid, that is, the one whose major premise is the instantiation of the law (25)a, the basic form of conditional (24)a, its minor premise is the instantiation of the antecedent of the law (25)b and its conclusion is the instantiation of the consequent (25)c.

(25)   a. If John is an Englishman <antecedent>, then John is brave <consequent>.
        b. John is an Englishman.
        c. John is brave.

In other words, the basic form of *so* is (23)a and it corresponds to the iconic order, that is, in causal cases, the cause is described in the antecedent of the corresponding law and the consequence in the consequent of such law. And precisely, the first segment of *so* describes the instantiation of the antecedent and the second one the instantiation of the consequent, that corresponds to a valid inference.

(26)   a. John is an Englishman <antecedent> so he is brave <consequent>.

What does the reverse order of *so* refer to? The reverse, i.e. non-iconic order corresponds to, what is called in the literature, the epistemic use of *so*, where in causal cases the consequence is provided as a reason for accepting a cause related to it. What is important to note is that the inference leading to epistemic reading in the non-iconic order strictly speaking is a fallacy from the classical logic point of view.

(27)   a. If John is an Englishman <antecedent>, then John is brave <consequent>.
        b. John is brave
        c. John is an Englishman.

Indeed, (27) presents the fallacy known under the name of the affirmation of the consequent unless the law underwent the procedure of biconditionalisation analysed in the previous section. However, in non-monotonic logics this type of reasoning is known as abduction and it seems that natural language has strategies to signal such departure from standard logic by marking an uncertain character of the conclusion with either a modal modification or just by some prosodic clues. (28) presents a possible full form of non-iconic epistemic *so*.

(28)   John is brave so he *must be* an Englishman.

The same analysis can be applied to conceptual definitions. Basic *so* is determined by *definiendum – definiens* order (29)a and, by consequence, the epistemic *so* corresponds to the inversion of the basic order (29)b.

(29)   a. Max is a bachelor so he does not have a wife.
        b. Max does not have a wife so he is a bachelor.

It is important to note that the claim here is not that the basic *so*, correctly applying the rule from classical logic will always result in a true proposition and the epistemic *so*, based on uncertain abductive reasoning, will be the only to allow for falsity. In fact, both basic and epistemic *so* (and also other connectives, especially *because*) can be equally true or false but for different reasons. The form of reasoning in basic uses guarantees the truth of its conclusion *provided that* the premises are true, for instance the law used as a major premise is

applicable to the situation at hand. In epistemic cases the form of the reasoning itself does not guarantee the truth of its conclusion but only its more or less high degree of probability.

This demonstrates that the basic logical operations are reflected in the language (especially in connectives) through (i) the implicit knowledge of basic rules of inference, for instance *Modus Ponendo Ponens* and (ii) the knowledge of laws that are used in reasonings as premises, and in particular the implicit knowledge of their internal order, i.e. what is the antecedent and what is the consequent of a given law. The last point is directly responsible for the parameter order found in connectives, since, as we saw, we do not deal directly with causes and consequences but rather with what these causes and consequences point to, that is, with the antecedents and consequences of the corresponding laws.

8. Conclusions

The aim of this chapter was to demonstrate how the parameter order attested in different connectives and different uses of the same connective is related to causality on the one hand and to laws, rules and regularities, on the other. First of all, it has been shown that the order displayed by connectives, which is often referred to as cause-consequence vs. consequence-cause order, is not restricted to causality since the so-called causal connectives are employed by speakers to express non-causal relations, as definitional or set-subset relations, which also impose an order on the presentation of connected objects. Therefore, the source of the parameter order is necessarily to be found beyond causality. I have argued in this paper that the candidate that fulfils this requirement pertains to a sub-class of contextual assumptions that I called laws, which works in a background providing necessary information for the use and interpretation of connectives. In particular, the basic use of *because* corresponds to the consequent-antecedent order of a basic conditional expressing an underlying law, while the basic *so* and *and* (for their uses involving the laws) pertain to the antecedent-consequent order of such a conditional.

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