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Simplification of disjunctive antecedents: Insights from acquisition*

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Abstract Disjunctive antecedent conditionals (DACs), i.e., sentences of the form "if A or B, C", are the source of a long-standing puzzle. They are generally felt to be equivalent to the conjunction of their simplifications, "if A, C" and "if B, C", in accordance with the principle of *Simplification of disjunctive antecedents* (SDA). However, Lewis's influential theory of counterfactual conditionals invalidates SDA, as do several prominent theories of indicative conditionals. To explain the strong appeal of this principle, various accounts have recently been proposed: for some, SDA stems from the potential of disjunction to generate semantic alternatives; for others, it arises from a non-Gricean exhaustification operator.

To shed light on the status and source of SDA, we administered a picture-based binary forced choice task to 169 children (aged 4;1–9;11) and 28 adults, who were asked to evaluate indicative and counterfactual DACs.

Our results reveal that SDA emerges early, being the preferred interpretation already at age four to five. This is in line with the idea that SDA is tightly related to free-choice inferences, which also emerge early (Tieu et al. 2015). We found that subjects who derived SDA in indicatives also derived it in counterfactuals and vice versa, supporting the idea that SDA has the same status in both kinds of conditionals. We did not find any evidence of a shift from a pure Lewisian reading to an SDA reading, which may have supported the exhaustification account. Instead,

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our data reveal an interesting developmental trend from disjunctive to conjunctive interpretation of DACs, strictly parallel to a trend from existential to universal interpretation of plural definites (Tieu et al. 2019), supporting the idea that SDA involves homogeneity over the antecedent alternatives, as proposed by Santorio (2018) and Cariani & Goldstein (2020).

Keywords: simplification of disjunctive antecedents, conditionals, acquisition, homogeneity, free choice, exhaustification

1 Introduction

The topic of this study is the interpretation of conditionals with disjunctive antecedents, i.e., sentences of the form "if A or B, C", such as:

(1) a. If it rains or snows, the hike will be cancelled.
b. If it had rained or snowed, the hike would have been cancelled.

Such conditionals (henceforth called DACs, for *disjunctive antecedent conditionals*, following Khoo (2018)) are the source of a long-standing puzzle in semantics. Intuitively, a DAC "if A or B, C" is interpreted as equivalent to the conjunction of its so-called simplifications, "if A, C" and "if B, C". For instance, the conditionals in (1) sound equivalent to the conjunctions in (2).

(2) a. If it rains the hike will be cancelled, and if it snows the hike will be cancelled.
b. If it had rained the hike would have been cancelled, and if it had snowed the hike would have been cancelled.

The inference from a DAC "if A or B, C" to its simplifications "if A, C" and "if B, C" is called *simplification of disjunctive antecedents* (SDA, for short), and an interpretation of the DAC that renders it equivalent to the conjunction of its simplifications is called an *SDA interpretation*. The puzzle arises because the most canonical account of counterfactual conditionals like (1b), the minimal change semantics of Lewis (1973), does not validate SDA; the same goes for other influential accounts, such as those of Kratzer (1981) and Veltman (2005). While there is less consensus in the literature on the logic of indicative conditionals like (1a), SDA is similarly classified as invalid by many prominent theories, such as the classical accounts of Stalnaker (1968) and Adams (1975) and their modern descendants. In the face of this mismatch between theory and intuitions, researchers have recently been trying to provide different accounts of how SDA arises. These proposals fall into two camps. According to one type of approach, SDA is indeed logically valid,

at least under one reading of DACs. To deliver this prediction, these accounts build on a non-standard treatment of disjunction rooted in alternative semantics (Hamblin 1973, Kratzer & Shimoyama 2002) or inquisitive semantics (Ciardelli et al. 2018a). According to this approach, a disjunctive antecedent "if A or B" is interpreted as supplying, not a single proposition, but two separate propositions, one for each disjunct; the semantics of conditionals then makes sure that the conditional is true only if the consequent follows from the supposition of each of these propositions, leading to an SDA interpretation. Proposals in this camp include Alonso-Ovalle (2009), Ciardelli (2016), Santorio (2018), Khoo (2018), Cariani & Goldstein (2020). According to the second kind of approach, proposed by Bar-Lev & Fox (2020), SDA has the status of an implicature, which is generated not through standard Gricean reasoning, but through a grammatical exhaustification operator EXH. This operator, however, is non-standard in that it does not simply exclude (i.e., deny) certain alternatives to the sentence that was uttered, but also includes (i.e. asserts) other alternatives, via a recipe called *innocent inclusion*. As this discussion indicates, the puzzle concerning SDA is intertwined with some fundamental debates in semantics and pragmatics: SDA is taken by some to provide motivation for a refinement of the notion of meaning used in compositional semantics, moving from standard truth-conditional semantics to alternative semantics or inquisitive semantics, while others view it as evidence for a grammatical exhaustification operation of a kind radically different from anything resembling standard Gricean pragmatic reasoning. Elucidating the status and the origin of the SDA interpretation of DACs is thus a question of great importance, with broad implications not just about the semantics of conditionals and disjunction, but also about the general architecture of compositional semantics and the kind of mechanisms whereby implicatures are generated. To shed light on this question, we conducted a study on how DACs are interpreted by Italian monolingual children between 4 and 9 years of age. The study consists of a picture-based binary forced choice task in which the participants were asked to judge 16 DACs in which we manipulated the variable of mode (indicative vs. counterfactual).

The reason to be interested specifically in the way *children* interpret DACs is that, as we shall discuss in Section 3, different accounts of SDA lead to different expectations about the acquisition of SDA and about the sort of interpretations of DACs that we may find in children who do not yet display an SDA interpretation.

The paper is structured as follows. In Section 2 we provide the relevant theoretical background on SDA. In Section 3 we discuss the empirical questions that our study aims to address, and explain how they bear on the theoretical debate. In Section 4 we introduce the experiment we conducted and present the results. In Section 5 we discuss the interpretation of our findings. Finally, in Section 6 we summa-

rize our conclusions and outline some directions for future work. Our experimental materials, results, and analyses are available for review in our OSF repository.

2 Background

In this section, we survey various theories about the origin and status of SDA, and provide the theoretical background needed to frame the questions that we aim to investigate.

SDA in minimal change semantics The most influential account of counterfactual conditionals is the *minimal change semantics* of Lewis (1973). This account is cast within the framework of *intensional semantics*, which interprets a sentence A as receiving a truth value $[\![\mathsf{A}]\!]^w$ relative to each possible world w: true ($[\![\mathsf{A}]\!]^w = 1$) or false ($[\![\mathsf{A}]\!]^w = 0$). If A is true at a world w, we also say that w is an A-world. The proposition expressed by A may then be identified with the set of all A-worlds, denoted

$$\mathbf{A} = \{w \mid [\![\mathsf{A}]\!]^w = 1\}.$$

Lewis's account of counterfactuals makes use of a relation of *comparative similarity* between possible worlds: given a possible world w, this relation ranks worlds according to how "similar" they are to w.[1] If a world v is ranked as more similar to w than another world u, we also say that v is *closer* than u to w. Given a proposition $\mathbf{A}$, we can then define the set $\min_w(\mathbf{A})$ of worlds in $\mathbf{A}$ which are minimally different from w (i.e., those worlds in $\mathbf{A}$ such that no other world in $\mathbf{A}$ is strictly closer to w).

Lewis's account may then be stated simply as follows: a counterfactual conditional "if A, C" is true at a world w if C is true in all the A-worlds closest to w.[2] In symbols:

$$[\![\textsf{if A, C}]\!]^w = 1 \iff \min_w(\mathbf{A}) \subseteq \mathbf{C}$$

As we mentioned in the introduction, this account of counterfactuals does not validate the SDA inferences:

$$\frac{\textsf{if A or B, C}}{\textsf{if A, C}} \qquad\qquad \frac{\textsf{if A or B, C}}{\textsf{if B, C}}$$

To see why, recall first that by the standard Boolean semantics of disjunction, the proposition associated with the disjunctive antecedent "A or B" is the union $\mathbf{A} \cup \mathbf{B}$.

1 The nature of the relevant notion of similarity is a complex and controversial topic, but fortunately not one that is crucial for our present purposes.

2 This formulation relies on the so-called *limit assumption*, i.e., the assumption that for any proposition $\mathbf{A}$ we can always find some $\mathbf{A}$-worlds which are minimally different from the evaluation world w. This assumption is controversial, but it makes no difference to the points we will discuss and it greatly simplifies the discussion, so we will take it on board (as usual in the literature).

Let us say that a proposition $\mathbf{A}$ is *more realistic* than a proposition $\mathbf{B}$ relative to w if the closest $\mathbf{A}$-worlds are closer to w than the closest $\mathbf{B}$-worlds, as in Figure 1(b). If neither proposition is more realistic than the other, let us say that $\mathbf{A}$ and $\mathbf{B}$ are *equally realistic*, as in Figure 1(a). Now there are two cases to consider.

- Case 1: $\mathbf{A}$ and $\mathbf{B}$ are equally realistic relative to w. In this case, we have the identity $\min_w(\mathbf{A} \cup \mathbf{B}) = \min_w(\mathbf{A}) \cup \min_w(\mathbf{B})$, which implies:

$$\begin{aligned} [\![\textsf{if A or B, C}]\!]^w = 1 &\iff \min_w(\mathbf{A} \cup \mathbf{B}) \subseteq \mathbf{C} \\ &\iff \min_w(\mathbf{A}) \cup \min_w(\mathbf{B}) \subseteq \mathbf{C} \\ &\iff \min_w(\mathbf{A}) \subseteq \mathbf{C} \text{ and } \min_w(\mathbf{B}) \subseteq \mathbf{C} \\ &\iff [\![\textsf{if A, C}]\!]^w = 1 \text{ and } [\![\textsf{if B, C}]\!]^w = 1 \end{aligned}$$

  Thus, in this case the truth of the DAC "if A or B, C" is equivalent to the truth of both its simplifications, "if A, C" and "if B, C", in accordance with SDA.

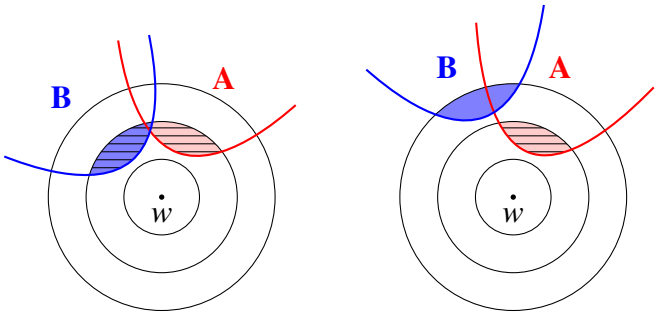
- Case 2: one among $\mathbf{A}$ and $\mathbf{B}$ is more realistic than the other relative to w; for concreteness, let us say it is $\mathbf{A}$. In this case, the closest worlds in which the disjunction is true are simply the closest $\mathbf{A}$-worlds: $\min_w(\mathbf{A} \cup \mathbf{B}) = \min_w(\mathbf{A})$. As a consequence, we have:

$$\begin{aligned} [\![\textsf{if A or B, C}]\!]^w = 1 &\iff \min_w(\mathbf{A} \cup \mathbf{B}) \subseteq \mathbf{C} \\ &\iff \min_w(\mathbf{A}) \subseteq \mathbf{C} \\ &\iff [\![\textsf{if A, C}]\!]^w = 1 \end{aligned}$$

  Thus, in this case the truth of the DAC "if A or B, C" is equivalent to the truth of the simplification "if A, C" involving the more realistic disjunct; it is thus compatible with the falsity of the other simplification, "if B, C", invalidating SDA.[3]

Summing up, then, Lewis's theory of counterfactuals predicts that when one disjunct is more realistic than the other, the corresponding DAC receives an *asymmetric reading*: the DAC is judged true or false by considering only the more realistic disjunct, ignoring the less realistic disjunct altogether.
Some evidence for the existence of this asymmetric reading comes from so-called *specificational DACs*, where the consequent coincides with one of the disjuncts in the antecedent. A famous example is (3):

3 Note that the fact that the worlds in $\min_w(\mathbf{A})$ are strictly closer to w than the worlds in $\min_w(\mathbf{B})$ implies $\min_w(\mathbf{A}) \cap \min_w(\mathbf{B}) = \emptyset$. Thus, the fact that $\mathbf{C}$ is true in all worlds in $\min_w(\mathbf{A})$ is compatible with the fact that $\mathbf{C}$ is false in some (or even all) worlds in $\min_w(\mathbf{B})$, as required for the falsity of the second simplification "if B, C".



(a) Case 1 (b) Case 2

Figure 1 The red area represents the closest A-worlds ($\min_w(\mathbf{A})$) relative to w, and the blue area the closest B-worlds ($\min_w(\mathbf{B})$). The regions with horizontal lined patterns depict the worlds that are closest to w within the union $\mathbf{A} \cup \mathbf{B}$.

(3) If Spain had fought either with the Axis or with the Allies in World War II, it would have fought with the Axis.

Obviously, from the truth of this conditional we cannot conclude, as per SDA, that if Spain had fought with the Allies, it would have fought with the Axis. Instead, the conditional seems true precisely because the possibility of Spain fighting with the Axis is more realistic than the possibility of it fighting with the Allies, so the closest worlds where the disjunction is true are all worlds where the first disjunct is true.

However, cases like (3) seem to be exceptional. As noted by Nute (1978), once we look at ordinary, non-specificational DACs, Lewis's prediction does not seem correct. The possibility of good weather is presumably more realistic than the possibility of the sun growing cold, and yet (4) is not judged true on the basis of the truth of its simplification in (4a); instead, it is judged false precisely because the other simplification in (4b) is false (since in the closest worlds where the sun grows, there is no bumper crop) in accordance with SDA and in contrast with Lewis's theory.[4] Nevertheless, in our experiment we will see that SDA interpretations are available to subjects whose judgment on other counterfactuals indicate that they regard one disjunct as more realistic than the other in the *relevant* sense.

4 One may try to resist this particular example by insisting that, while the first disjunct is clearly more realistic in the ordinary sense of the word, the two disjuncts are in fact equally realistic in the technical sense relevant to the semantics of counterfactuals.

(4) If we had had good weather or the sun had grown cold, we would have had a bumper crop.
   a. If we had had good weather, we would have had a bumper crop.
   b. If the sun had grown cold, we would have had a bumper crop.

This suggests that DACs can have an SDA interpretation even when the two disjuncts are not equally realistic, contrary to the predictions of Lewis's theory. To account for this fact, several theories have been put forward, which we will briefly survey in the rest of this section.

SDA via semantic alternatives. An influential approach, first pioneered by Alonso-Ovalle (2009) (see also Ciardelli 2016, Ciardelli et al. 2018b, Willer 2018), derives the validity of SDA from the potential of disjunction to generate alternatives. This approach builds on systems like alternative semantics (Hamblin 1973, Kratzer & Shimoyama 2002) or inquisitive semantics (Ciardelli et al. 2018a), which associate a sentence A with a set of propositions $\mathsf{Alt}(\mathsf{A})$, whose elements are referred to as (semantic) *alternatives*. Most sentences are still associated with a single proposition, i.e., we have $\mathsf{Alt}(\mathsf{A}) = \{\mathbf{A}\}$; crucially, however, disjunctions are typically associated with multiple alternatives, i.e., we have $\mathsf{Alt}(\mathsf{A\ or\ B}) = \{\mathbf{A}, \mathbf{B}\}$. The semantics of the conditional is then rendered alternative-sensitive in the following way. In symbols, if $\mathsf{Alt}(\mathsf{A})$ is the set of propositions associated with A, the semantics of a conditional is:

$$[\![\mathsf{if\ A,\ C}]\!]^w = 1 \iff \forall p \in \mathsf{Alt}(\mathsf{A}) : \min_w(p) \subseteq \mathbf{C}$$

When the antecedent is associated with a single alternative, this clause boils down to the standard clause of Lewis's semantics. However, if the antecedent is a disjunction "A or B", we have:

$$\begin{aligned}[\![\mathsf{if\ A\ or\ B,\ C}]\!]^w = 1 &\iff \forall p \in \{\mathbf{A}, \mathbf{B}\} : \min_w(p) \subseteq \mathbf{C} \\ &\iff \min_w(\mathbf{A}) \subseteq \mathbf{C} \text{ and } \min_w(\mathbf{B}) \subseteq \mathbf{C} \\ &\iff [\![\mathsf{if\ A,\ C}]\!]^w = 1 \text{ and } [\![\mathsf{if\ B,\ C}]\!]^w = 1\end{aligned}$$

In this way, the SDA equivalence between "if A or B, C" and "(if A, C) and (if B, C)" is obtained as a direct consequence of the interaction of disjunction and the conditional, regardless of the modal status of the disjuncts.

To deal with cases such as (3), these approaches assume that the logical form (henceforth: LF) of a DAC may contain a covert existential closure operator "!" which is responsible for collapsing the alternatives created by disjunction, leading from the set $\{\mathbf{A}, \mathbf{B}\}$ to the singleton set $\{\mathbf{A} \cup \mathbf{B}\}$ and thus recovering the interpretation that the DAC would receive in Lewis's theory. However, the insertion of existential closure is regarded in these approaches as a "last-resort strategy to avoid

interpreting examples like (3) as contradictions" (Alonso-Ovalle 2009: p. 239) (or, at any rate, as requiring contextual cues). Thus, while these approaches allow for the possibility that some DACs may receive an asymmetric reading, they also predict the SDA reading to be the preferred interpretation of DACs.[5]

Homogeneity. Recently, some authors (Santorio 2018, Cariani & Goldstein 2020) have combined the key idea of alternative-based accounts with an idea coming from the literature on plural definites (Löbner 2000, Križ 2019). Intuitively, a sentence like (5a) conveys that all children are home, while its negation (5b) conveys that none of them are.

(5) a. The children are home.
b. The children aren't home.

This is standardly explained by assuming that plural definites introduce a *homogeneity requirement* which, if violated, leads to a truth value gap: (5a) is true if all children are home, false if no children are home, and lacks a truth value (i.e., is neither true nor false) if the children are "mixed" with respect to the property of being home, in the sense that some of them are home, while others aren't.

Cariani & Goldstein (2020) have proposed that conditionals are similarly homogeneous with respect to the propositions introduced by their antecedent: "if A, C" only has a truth value provided all propositions associated with A, when supposed, lead to the same conclusion regarding C:

$$[\![\text{if } \mathsf{A},\ \mathsf{C}]\!]^w = \begin{cases} 1 & \text{if } \forall p \in \mathsf{Alt}(\mathsf{A}) : \min_w(p) \subseteq \mathsf{C} \\ 0 & \text{if } \forall p \in \mathsf{Alt}(\mathsf{A}) : \min_w(p) \subseteq \overline{\mathsf{C}} \\ \text{undefined} & \text{otherwise} \end{cases}$$

In particular, a DAC "if A or B, C" is true if both propositions $\mathbf{A}$ and $\mathbf{B}$ lead to the conclusion that $\mathbf{C}$ is true, it is false if both lead to the conclusion that $\mathbf{C}$ is false, and it lacks a truth value otherwise. Note that the truth conditions for the DAC are exactly the same as predicted by Alonso-Ovalle (2009): thus, SDA is validated by

5 An account of SDA along similar lines if defended by Khoo (2018): in this account, too, SDA arises when the antecedent provides a set of two propositions, over which the conditional quantifies universally. However, Khoo does not assume that disjunction itself is alternative-generating; instead, a disjunctive antecedent "if A or B" is viewed as ambiguous between two LFs, namely if $(\mathsf{A}$ or $\mathsf{B})$ and $(\text{if } \mathsf{A})$ or $(\text{if } \mathsf{B})$, where in the second LF the second "if" may be unpronounced. The first LF is associated with the singleton set $\{\mathbf{A} \cup \mathbf{B}\}$, leading to an asymmetric reading of the DAC, while the second LF is associated with the two-element set $\{\mathbf{A}, \mathbf{B}\}$, leading to an SDA reading. Thus, this view predicts that DACs are ambiguous between an asymmetric reading and an SDA reading; a priori, neither of these readings is predicted to be preferred.

this account. The difference only shows at the level of the falsity conditions, which are much more demanding in the presence of homogeneity.

The account of Santorio (2018) is similar, except that the above result is derived only in the presence of a covert distributivity operator DIST. In the absence of this operator, the propositions provided by the antecedent are instead collapsed by a default existential closure which is assumed to be part of the semantics of the conditional, leading to an asymmetric reading. Thus, Santorio's account predicts that DACs are systematically ambiguous between a simpler LF yielding an asymmetric reading and a more complex LF yielding an SDA reading.

SDA via exhaustification. A very different account of SDA is proposed by Bar-Lev & Fox (2020). This account builds on the grammatical theory of scalar implicatures (Fox 2007, Chierchia et al. 2012), according to which such implicatures are not generated by standard Gricean reasoning, but introduced by a covert operator EXH, akin to English *only*. Given a sentence A, a set of alternative sentences is generated by considering simplifications of the syntactic tree of A as well as replacement of a lexical item by a scalar alternative (note that this syntactic notion of alternative is distinct from the semantic notion of alternative employed by the semantic accounts discussed above). The role of EXH is to strengthen the meaning of A with the negation of all the alternatives that are "innocently excludable", i.e., that can be jointly denied without producing inconsistency (see Fox 2007: for a precise definition). Bar-Lev & Fox (2020) take on board this idea, but they propose that, in addition, the operator EXH performs a second strengthening as well: after having denied all the innocently excludable alternatives, it also asserts all the alternatives that are "innocently includable", i.e., which can be jointly asserted without producing inconsistency with the result of the previous innocent exclusion procedure.

Let us illustrate how this approach applies to a DAC "if A or B, C". The simplifications "if A, C" and "if B, C" are among the alternatives, since they are obtained by a pruning of the original sentence tree. They are not innocently excludable, since denying both leads to a contradiction with the literal meaning of the DAC (on the basis of a Lewisian semantics of counterfactuals, which is held fixed in the background); accordingly, they are not negated by EXH. However, at the second stage of the procedure, the simplifications are innocently includable, since they can be consistently conjoined with the original sentence. As a consequence, the literal meaning of the DAC is strengthened with the conjunction "(if A, C) and (if B, C)", leading to the SDA interpretation of the DAC.[6]

6 A challenge to this approach is presented by Santorio (2020), who points out that for consequents involving probability operators, the SDA reading of the DAC is not stronger than its asymmetric reading, but logically independent of it; thus, it cannot be obtained by means of a process of scalar

It should be noted that, also within this approach, a connection has be drawn between SDA and homogeneity. Building on Magri (2014), Bar-Lev (2021) has proposed that a sentence like (5a) ("the children are home") has a literal meaning which is purely existential ("some children are home"), which gets strengthened to a universal meaning ("all children are home") as a result of an innocent inclusion procedure. Thus, SDA and homogeneity can be seen as stemming from the same underlying exhaustification procedure.[7]

Disjunctive conditional reading. So far, we have seen that various theories predict one or both of the following readings for DACs.

- *SDA reading*: "if A or B, C" has the same truth value as the conjunction of its simplifications, "(if A, C) and (if B, C)".
- *Asymmetric reading* (AR): "if A or B, C" has the same truth value as the simplification involving the more realistic disjunct, if one disjunct is more realistic than the other; otherwise, if the disjuncts are equally realistic, it has the same truth value as the conjunction of the simplifications, as in the SDA reading.

One should, however, remain aware that a third reading is in principle possible for DACs. This is illustrated by the following discourse:

(6) If you press the red button or the blue button, the machine will explode. But I don't remember which.

In view of the continuation "I don't remember which", the most natural interpretation of the DAC in (6) is that either the machine will explode if you press the red button, or it will explode if you press the blue button. That is, in this case the DAC is interpreted as equivalent to the *disjunction* of its simplifications. We will refer to this reading of DACs as the *disjunctive conditional reading*.

- *Disjunctive conditional reading* (DCR): "if A or B, C" has the same truth value as the disjunction of its simplifications, "(if A, C) or (if B, C)".

It is natural to suppose that this reading arises when the disjunction takes wide scope over the conditional—a special case of the well-known ability of disjunction to take

strengthening of the literal meaning. We will not consider conditionals with probability operators in our study.

7 In both cases, one could also derive from this account a trivalent semantics if one assumes, with Bassi et al. (2021), Del Pinal et al. (2024), that the strengthening contributed by EXH has the status of a presupposition.

exceptional scope (Partee & Rooth 1983). This is compatible with each account of DACs discussed so far. However, DCR could also come about in a different way, as we will discuss in Section 3. Note that the three readings of a DAC are ordered as follows by logical strength:

$$\text{SDA} \geq \text{AR} \geq \text{DCR}$$

(where $\geq$ means "is at least as strong as"). This can be seen easily as follows:

- SDA logically entails AR: if both simplifications of a DAC are true, then in particular the simplifications with the most realistic antecedents must be true;
- AR logically entails DCR: if the simplifications with the most realistic antecedents are true, then some simplification is true.

SDA and free-choice inferences. It is widely believed that SDA is only a facet of a more general phenomenon, which manifests itself through a variety of cases in which disjunctions give rise to unexpected conjunctive interpretations (see, e.g., Lewis 1977). The most famous instance of this phenomenon is provided by *free-choice inferences* (Kamp 1973), illustrated in (7):

(7) You may have cake or ice-cream.
   $\rightsquigarrow$ You may have cake.
   $\rightsquigarrow$ You may have ice-cream.

Like SDA, free-choice inferences constitute a long-standing puzzle in semantics, since they are robustly supported by intuition, but not validated by the standard accounts of modals and disjunction. Most theorists believe that SDA and free-choice inferences have the same source and should receive a unified explanation, whether semantic or pragmatic. And indeed, the same strategies proposed to deal with SDA have been applied to free choice as well: it has been proposed that free-choice inferences stem from the potential of disjunction to generate alternatives (Simons 2005, Aloni 2007, Willer 2018, Booth 2021), possibly in combination with homogeneity (Goldstein 2019); or, alternatively, that free-choice inferences arise as grammatically generated scalar implicatures (Fox 2007, Bar-Lev & Fox 2020, Del Pinal et al. 2024).

3 Research questions

Our study is meant to assess competing hypotheses about the nature and origin of the *simplification of disjunctive antecedents* (SDA), teasing them apart based on

their predictions about acquisition. Our central empirical question is, what is the developmental trajectory of the SDA interpretation of *disjunctive antecedents conditionals* (DACs)? We unpack this broad question into five more specific question, each bearing on a different aspect of the theoretical debate surrounding SDA.

Question 1: At what age does SDA arise?

As mentioned above, it is widely believed that SDA and free-choice inferences are two facets of a single phenomenon, which requires a unified explanation. As demonstrated by Tieu et al. (2015), the ability to draw free-choice inferences arises early, being widely attested in 4- and 5-year-old children. If the same underlying mechanism is responsible for SDA, we similarly expect children of the same age to display an SDA-interpretation of DACs. An early emergence of SDA would thus support the hypothesis that SDA and free-choice inferences plausibly have a common source, while a late emergence would cast doubt on this hypothesis.

Furthermore, if a pragmatic story about SDA of the kind proposed by Bar-Lev & Fox (2020) is correct, this empirical question is an important test for a hypothesis about children's pragmatic skills. Indeed, the early emergence of free-choice inferences constitutes a challenge for a theory that explains such inferences as scalar implicatures, for it is known that children's ability to draw scalar implicatures is not yet adult-like at the relevant age (Noveck 2001, Chierchia et al. 2001, Guasti et al. 2005). In response to this, Tieu et al. (2015) have proposed that young children may in fact possess adult-like abilities to draw scalar implicatures, provided the alternatives involved in the pragmatic reasoning can be generated without accessing the lexicon. They dub this the *restricted alternative hypothesis*.[8] If SDA has a pragmatic source and this hypothesis is correct, we expect young children to have access to an SDA interpretation of DACs. This is because the alternatives involved in the derivation of SDA are generated syntactically, without any appeal to lexical replacement, and should thus be available to children.

Question 2: Do children shift from Asymmetric Reading (AR) to SDA with age?

As we saw, the account of Bar-Lev & Fox (2020) views SDA as resulting from a pragmatic strengthening of a sentence whose literal reading is Lewis's asymmetric reading, AR. If the relevant strengthening mechanism is not yet universally acquired at age 4/5, we expect to see some proportion of AR readings in younger children, decreasing with age in favor of an SDA interpretation. This is interesting as such a trend is not expected on the basis of semantic accounts of SDA (absent other stipulations) and thus, if observed, could be seen as reflecting the pragmatic nature of

8 While the precise formulations differ, the basic idea predates the work of Tieu et al. (2015): see, among others, Barner & Bachrach (2010), Barner et al. (2011), Singh et al. (2016).

this inference. The absence of such a trend, on the other hand, would not necessarily be evidence against the account of Bar-Lev and Fox; it would, however, imply that the pragmatic abilities involved in deriving SDA are universally present in children already at age 4/5.

Question 3: Do children shift from Disjunctive Conditional Reading (DCR) to SDA with age?

According to Santorio (2018) and Cariani & Goldstein (2020), DACs involve a homogeneous quantification over the alternatives associated with the disjunction: a DAC only has a well-defined truth value if each disjunct leads to the same conclusion about the consequent. This is assumed to be analogous to the kind of homogeneity associated with plural definites.

A recent study by Tieu et al. (2019) uncovered an interesting pattern in the acquisition of plural definites. While adults judge a sentence like (8) as true only in case *all* the circles are red, a significant proportion of 4- and 5-year old children (about one third) judge the sentence to be true as soon as *some* circles are red.

(8) The circles are red.

If DACs involve the same kind of homogeneity, with the disjunctive alternatives in lieu of the individuals in the plurality, we may expect to find the same pattern at work: adults would judge a DAC "if A or B, C" as true only in case *all* (i.e., both) disjuncts lead to the conclusion C, resulting in an SDA interpretation, while a certain proportion of children would judge the DAC to be true as soon as *some* disjunct leads to the conclusion C, resulting in a DCR interpretation. Thus, the homogeneity hypothesis leads us to expect a significant presence of DCR readings in younger children, which should gradually make way for SDA.

Absent other stipulations, a trend from DCR to SDA is not predicted by the other accounts we considered,[9] even by those that view both SDA and homogeneity as resulting from EXH. On such an account, the fact that children initially display an existential reading of (8) is regarded as evidence that some children still access the literal meaning of the sentence (Bar-Lev 2021). In the case of a DAC, however, the literal meaning assumed by Bar-Lev & Fox (2020) is AR, not DCR. Therefore, in this case the move from literal to exhaustified reading would show up as a shift from AR to SDA, as discussed above, not from DCR to SDA.

Summing up, an increase in SDA rates, accompanied by a corresponding fall in DCR rates, would provide support for theories of SDA that link SDA to a homogeneous quantification over the alternatives introduced by the disjuncts.

9 Any account could, of course, explain a proportion of DCR readings as deriving from an LF in which disjunction takes wide scope over the conditional, but there not seem to be any *a priori* reason to expect that children should favor this interpretation more than adults.

Question 4: Does SDA arise earlier, or with higher frequency, for indicatives than for counterfactuals?

Many theorists (see, e.g., Stalnaker 1968, Adams 1975, Khoo 2022) think that indicative and counterfactual conditionals obey the same (or a very similar) logic; in this case, presumably the origin and status of the SDA is the same in both cases. Many others (see, e.g., Veltman 1985, Gauker 2005), by contrast, maintain that indicative and counterfactual conditionals obey radically different logic: in their view, indicatives, but not counterfactuals, are monotonic with respect to the antecedent, validating the inference from "if A, C" to "if B, C" whenever B entails A. If this position is correct, the status of SDA is very different in the two cases: for indicatives, SDA is a plain logical validity, while for counterfactuals it must be explained as resulting from a more complex mechanism, involving the computation of semantic alternatives or scalar implicatures.

If we were to find that SDA arises earlier and/or with higher frequency in the case of indicatives as compared to counterfactuals, that would provide an indication that SDA indeed has a different status in the two cases, thus supporting the view that indicative and counterfactuals obey different logic. By contrast, if the emergence of SDA were completely analogous in the two cases, that would indicate that SDA has the same source in indicatives and counterfactuals, supporting the hypothesis that a single logic underlies both kinds of conditionals.

Question 5: Does SDA require the disjuncts to be equally realistic?

As we saw in the previous section, Minimal Change Semantics (Lewis 1973) predicts that the SDA interpretation should arise only if the disjuncts are equally realistic with respect to the world of evaluation; otherwise, the DAC should be judged true or false by considering only the more realistic disjunct, ignoring the less realistic disjunct altogether. As we discussed, Nute's bumper crop example in (4) seems to disconfirm this prediction; however, this counterexample hinges on the assumption that cold-sun worlds are less realistic than good-weather worlds—an assumption that could be disputed on the ground that the technical notion of realism (and similarity) involved in the evaluation of counterfactuals need not align with the ordinary notion (see Lewis 1979). In our experiment, we will not simply rely on an intuitive understanding of similarity to determine how realistic the disjuncts are; instead, we will infer how realistic they must be—according to Lewis's theory—based on the subjects' judgment on other counterfactuals. In this way, it will be possible to subject the above prediction of Minimal Change Semantics to a more rigorous test.

4 Experiment

The aim of the experiment was to investigate the interpretation of DACs in Italian monolingual children (aged 4-9 years) and adults. To achieve this, a picture-based binary forced choice task was designed, where participants were asked to judge sentences uttered by a Panda as either true (T) or false (F),[10] knowing that Panda sometimes lies.[11]

The experiment consisted of 40 items, comprising 16 DACs and 4 pre-test items designed to assess task comprehension, particularly the interpretation of present indicative sentences containing disjunctions in the main clause. Additionally, 16 *control* items featuring simple conditionals (e.g., "if A, C") were included, along with 4 *closeness evaluation* items that presented conditionals with negated antecedents (e.g., "if not A, B").

With the exception of the pre-test items, the mode variable was manipulated, resulting in the presentation of 18 items in indicative mode and 18 items in counterfactual mode.[12]

Participants A total of 169 Italian monolingual children, aged between 4;1 (4 years and 1 months) and 9;11 (9 years and 11 months), participated in the experiment, along with 28 adults.[13]

10 Homogeneity-based theories predict DACs to lack a truth value when one simplification is true and the other false. In view of this, one may think that it would have been more natural to offer participants a ternary choice between "true", "false", and "neither true nor false". However, it is known that lack of semantic value is not reliably reflected as a "neither true nor false"-judgment (von Fintel 2004). It has also been suggested that "true" and "false" are sometimes used by speakers to express attitudes of acceptance and rejection, rather than to ascribe *bona-fide* semantic values (Ciardelli 2022). In a previous experiment on conditionals offering a choice between "true", "false", and "indeterminate", judgments on cases where the antecedent failed to yield a verdict on the consequent were split in roughly equal proportions between "false" and "indeterminate" (Ciardelli et al. 2018b). In view of these difficulties in reliably detecting truth-value gaps experimentally, we opted for the simpler binary choice setup. Nevertheless, in future work it might be interesting to conduct a variant of our experiment including the "neither true nor false" option.

11 We manipulated the standard methodological approach of the character making mistakes as a result of his learning (e.g., Crain & Thornton 1998), by explicitly telling participants to be careful as the panda sometimes lies and asking to be cooperative with the experimenter in detecting his lies. Children are reported to have strong cooperative tendencies, often discussed under the Principle of Charity (Quine 1960, Crain & Thornton 1998), which may lead to a bias towards DCR and against SDA; to mitigate this tendency, our experiment was designed to reduce children's cooperation towards the panda, while increasing it towards the experimenter.

12 A comprehensive list of the experimental items can be accessed in our OSF repository.

13 All children who participated in our study did so with their parents' consent, and were classified as typically developing.

Age group	Eligible participants	Mean age (months)	Standard deviation (months)
4;1–4;11	8	53.4 (4;04)	±3.0
5;0–5;11	28	65.3 (5;04)	±3.4
6;0–6;11	28	78.3 (6;05)	±3.8
7;0–7;11	28	88.6 (7;04)	±3.4
8;0–8;11	28	101.3 (8;04)	±3.7
9;0–9;11	28	112.1 (9;03)	±3.5
19;9–60;7	28	329.7 (27;05)	±124.4

Table 1 Eligible participants

The exclusion criteria were as follows: either failing to judge correctly one of the four pre-test items[14], or failing three or more of the 16 control items[15], or choosing not to continue at any point during the test. A total of 21 participants were excluded from the sample: eighteen did not meet at least one of the first two eligibility criteria (10 from the 4;0–4;11 age group, 7 from the 5;0–5;11 group, and 1 from the 6;0–6;11 group)[16] and three 4-year-old children were excluded because they failed to complete the test session. Consequently, the final sample included 148 children who successfully passed the inclusion criteria. The breakdown of the participants by age is given in Table 1. The mean age of the child group is 87.2 months (7;3), with a standard deviation of 18.3.

Procedure The experiment consisted of three phases: an introduction, a pre-test phase, and a testing phase. In the introduction, the Experimenter (E) outlined the context and explained the task to the participant.

14 The pretest items counted towards our inclusion criteria because they assessed participants' comprehension of the task and the comprehension of the simple present conditional and of disjunction in main clause, two crucial ingredients of DACs. Accordingly, only participants who correctly answered 4/4 trials in the pretest (and met all eligibility criteria) were included in the final dataset for our analysis, as suggested by a binomial test (p= 0.062) (given two possible answers, T/F).

15 To compute this threshold, we considered positive (i.e., T) and negative (i.e., F) control items separately. Since young children are known to display a "yes-bias" when answering yes/no questions and each scenario contained 2 negative and 2 positive control trials, this choice allowed us to detect precisely and exclude children who exhibited a response bias. The calculation of the threshold for passing the control items was thus based on 7/8 negative controls and 7/8 positive controls, as suggested by a binomial test (p=0.035). The soundness of our choice is supported by the observation that, when children did not reply correctly to the control items, they exclusively or more consistently did so to the negative trials. It is further supported by the asymmetry we found in the incorrect responses: 68 incorrect responses in the negative control items vs. 32 in the positive ones.

16 Two children (aged 5 and 6) did not pass the pretest, responding 2/4 true instead of false. Five 4-year-old and six 5-year-old children made errors in both the pretest and the control trials. Two 4-year-old children, one 5-year-old child and two 6-year-old children gave incorrect responses in the control trials only.

> **E**: Oggi è un giorno molto speciale per il mondo degli animali: è il giorno delle Olimpiadi! Gli animali si sfideranno in una serie di gare e il vincitore verrà premiato da un giudice severissimo. Ecco il nostro giudice: il Signor Coniglio. Ti presento anche il mio amico Panda. Bisogna stare attenti a ciò che dice: ogni tanto dice le bugie. Ti andrebbe di aiutarmi a capire quando dice la verità e quando dice una bugia?
>
> **E**: "*Today is a very special day for the animal world: it's the day of the Olympics! The animals will compete in a series of races and the winner will be chosen by a very strict judge. Here is our judge: Mr. Rabbit. Meet my friend, Panda. You have to be careful about what he says to you: sometimes he lies. Can you help me understand when he is telling the truth and when he is lying?*"

This part was followed by the presentation of the first scenario, which illustrated the prizes each competitor could win. Subsequently, the pre-test phase was introduced to assess participants' understanding of the task, with a specific focus on their interpretation of simple conditionals in the present indicative form and disjunctions in main clauses. The final instruction of the pre-test was as follows:

> **E**: Ora ti chiedo un piccolo aiuto. Il mio amico Panda non dice sempre la verità. Mi aiuteresti a capire quando dice la verità o una bugia, per favore? Se non ti ricordi i premi, te li lascio qui [compare una freccia lampeggiante rossa che indica i premi]. Proviamo.
>
> **E**: "*Now I am going to ask you for a little help. My friend Panda doesn't always tell the truth. Could you please help me understand when he is telling the truth or when he is lying? If you don't remember the rewards, I leave them here [a red flashing arrow will appear, indicating the rewards]. Let's try.*"

The test phase involved four race scenarios: two running races, one swimming race, and one wheel race. Each race featured three competitors, each linked to an iconic prize (e.g., a lettuce leaf for the tortoise, a hazelnut for the squirrel, and a carrot for the hare). At the outset, it was made clear that only one competitor could win the race, with no possibility of ties. The three competitors were assigned to different speed categories (e.g., the tortoise for low speed, the squirrel for medium speed, and the hare for high speed; see Figure 2).[17]

17 To avoid bias, the lane positions of the competitors on the racetrack were varied across scenarios: the medium-speed competitor always remained in the middle lane, while the winner and the third-place

At the beginning of each scenario, after the competitors and their corresponding prizes were presented, participants answered questions to assess their recall of the prizes. One such question was, "*If the squirrel wins, what is his prize?*". However, since memory recall was not the primary focus of the experiment, in all subsequent phases, a flashcard displaying the competitors and their prizes remained visible in the top right corner of the screen to reduce the cognitive load during sentence judgment.

Following this, the Panda appeared on the computer screen in the top left corner and uttered 9 sentences about the race, one at a time. After each sentence, participants judged whether it was true or false before proceeding to the next one. Once all 9 sentences in a scenario were evaluated, the experiment moved to the next scenario.

Each participant was tested individually in a quiet room, and the entire experiment took approximately 20-25 minutes.

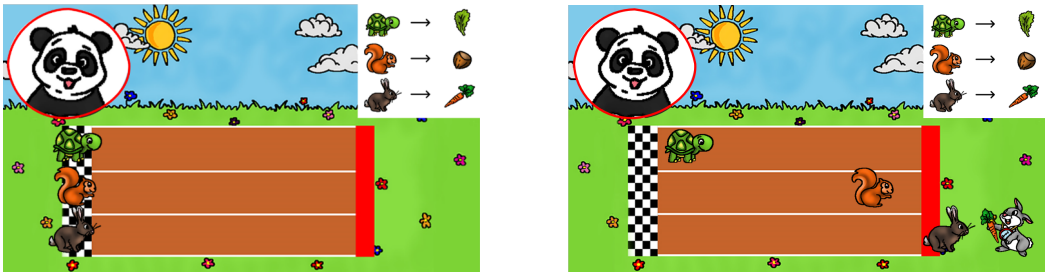
The experiment was put together using a PowerPoint presentation in order to better manage the timing according to the participant's needs. The narrator's voice and the voice of the Panda, clearly distinct from each other as the former is a female voice and the latter a male voice, were recorded using a mobile phone. Cleaning, cutting, and rendering were performed using REAPER. To avoid having a particular prosody favor one reading over another, the speaker who recorded the voice of the panda maintained an unmarked intonation, in particular, avoiding focus marking on the disjunction.[18] REAPER was used to standardize the speaking rate of all the tracks.

Materials Two out of four scenarios were presented in the indicative mode and two in the counterfactual mode, alternated. In the indicative scenarios, all competitors were at the starting line (Figure 2(a)). In the counterfactual scenarios, a photo finish was shown (Figure 2(b)): the hare had won, the squirrel was close to the finish line, and the tortoise had barely crossed the start line.
Each scenario comprised a total of 9 sentences presented in the following order: 4 target items (DACs), 4 control items, and a closeness evaluation item.

- **Target items**. The term *target items* refers to sentences that test the interpretation of the DACs. The target sentences were presented in blocks of four at the beginning of each scenario. Among the target items, two sentences

competitor switched lanes depending on the scenario. For example, in scenarios one and four, the winner was in the third lane from the top, while in scenarios two and three, the winner was in the first lane. This ensured that participants could not rely on lane position to detect any patterns, especially since the runner-up was not revealed until the last item of each scenario. This forced participants to evaluate the sentences independently of any lane-based cues.

18 Indeed, according to the studies of Khoo (2018), Larralde et al. (2021), a pitch on the disjunction in the antecedent of the target sentences could have influenced the interpretation of sentences.



(a) Indicative mode

(b) Counterfactual mode

Figure 2 Scenarios

presented the prize of the second runner-up (e.g., the squirrel's prize, the hazelnut), and two presented the prize of the third runner-up (e.g., the tortoise's prize, the lettuce leaf). Crucially, the prize was linked to only one of the two competitors mentioned in the antecedent. Here are two examples of our target sentences:[19]

Ind. Se lo scoiattolo o la tartaruga vincerà la gara,
If the squirrel or the tortoise win.FUT.3SG the race,
avrà in premio una nocciola.
get.FUT.3SG as prize a hazelnut.
If the squirrel or the tortoise wins the race, it will get a hazelnut.

Ctf. Se lo scoiattolo o la tartaruga avesse vinto
If the squirrel or the tortoise have.SBJV.IPFV.3SG win.PTCP.PST
la gara, avrebbe avuto in premio una nocciola.
the race, have.COND.3SG get.PTCP.PST as prize a hazelnut.
If the squirrel or the tortoise had won the race, it would have got a hazelnut.

- **Controls**. We used controls with a simple antecedent without a disjunction in order to determine whether participants had difficulties with such conditionals in a particular mode, with particular items or in particular scenarios. To avoid facilitating access to the simplifications of the DACs, control sentences were presented after the target items. The control sentences were

19 Note that in our context, the disjuncts of our DACs are explicitly presented as mutually exclusive. This is desirable since it makes it implausible that children would mistakenly interpret the disjunction in the antecedent as a conjunction (Singh et al. 2016, Tieu et al. 2016, Cochard et al. 2025).

structured as follows: the antecedent contained one of the two disjuncts presented in the antecedent of the *target* items (specifically, the second and third runners), while the consequent mentioned either the second or third runner's prize. Two *control* items correctly associated the competitor with the prize (e.g. "If the squirrel wins, it will get a hazelnut", which is true), whereas two control *items* presented an incorrect association between the competitor and the prize (e.g. "If the squirrel wins, it will get a lettuce leaf", which is false). Regarding the order of the sentences, two response patterns were alternated to keep attention high: TFTF and TFFT. Controls in first and third scenarios had a TFTF pattern, while in second and fourth scenarios had the TFFT pattern. Therefore, scenarios with the same mode had the same pattern of negative and positive controls.

Ind. Se lo scoiattolo vincerà la gara, avrà in premio una
If the squirrel win.FUT.3SG the race, get.FUT.3SG as prize a
nocciola.
hazelnut.

If the squirrel wins the race, it will get the hazelnut.

Ctf. Se lo scoiattolo avesse vinto la gara,
If the squirrel have.SBJV.IPFV.3SG win.PTCP.PST the race,
avrebbe avuto in premio una nocciola.
have.COND.3SG get.PTCP.PST as prize a hazelnut.

If the squirrel had won the race, it would have got a hazelnut.

- **Closeness evaluation item**. The ninth sentence of each scenario was the *closeness evaluation item*, a sentence of the kind exemplified below.

Ind. Se non vincerà la lepre, vincerà lo scoiattolo.
If NEG win.FUT.3SG the hare, win.FUT.3SG the squirrel.

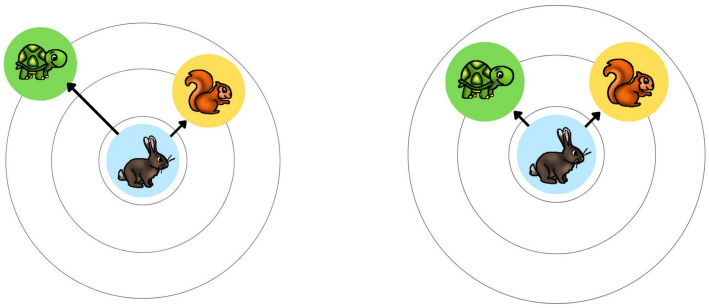
If the hare doesn't win, the squirrel will win.

Ctf. Se non avesse vinto la lepre,
If NEG have.SBJV.IPFV.3SG win.PTCP.PST the hare,
avrebbe vinto lo scoiattolo.
have.COND.3SG win.PTCP.PST the squirrel.

If the hare hadn't won, the squirrel would have won.

This item was used to test whether the participant regarded the two disjuncts in the test item as equally realistic, in the sense introduced in Section 2. To see why, suppose a participant judges the test items above to be true. According to Minimal Change Semantics, this means that all the closest worlds

where the hare does not win are worlds where the squirrel wins; this implies that the closest worlds where the squirrel wins are strictly closer to actuality than the closest worlds where the tortoise wins, as in Figure 3(a); so, acceptance of the closeness evaluation item reveals that the participant regards the proposition that the squirrel wins as more realistic than the proposition that the tortoise wins. By contrast, if the participant judges the test item false, this may be because they take the two propositions to be equally realistic, so that the closest worlds where the hare does not win include worlds where the squirrel wins as well as worlds where the tortoise wins, as in Figure 3(b). Since this is only one among several possible reasons why the closeness evaluation item might be rejected, in case of a "false" response we also asked the participant to provide an explanation.



(a) Non equally realistic condition

(b) Equally realistic condition

Figure 3 Bonus conditions.

The experimental items were distributed across two lists, each differing only in the order of scenario modes, with each participant receiving only one list. In *List 1*, the first and third scenarios were presented in the indicative mode, while the second and fourth scenarios were presented in the counterfactual mode. In *List 2*, the order was reversed, with the first and third scenarios in the counterfactual mode and the second and fourth scenarios in the indicative mode.

To build our stimuli, we employed only unambiguously representable lexemes (names and transitive verbs), ensuring they were part of children's vocabulary ac-

cording to the Primo Vocabolario del Bambino (PVB, "First Vocabulary of the Child"), provided by the National Research Council (CNR).[20]

Interpretation coding. Our goal is to discriminate between three theoretically predicted interpretations of DACs, summarized in the following table:

Interpretations		(if A or B, C) **is equivalent to:**
SDA	Simplification of Disjunctive Antecedents	(if A, C) and (if B, C)
DCR	Disjunctive Conditional Reading	(if A, C) or (if B, C)
AR	Asymmetric Reading	(if A, C), if A is more realistic than B

Table 2 Predicted interpretations of DACs according to theory

In our experiment, these interpretations were distinguished based on a participant's pattern of responses to four target items. The structure of these items is visualized schematically in (9): in the antecedent, the unique competitor associated with the prize in the consequent is highlighted in boldface, as is the prize itself.

(9) a. if **Squirrel** or Tortoise, then **Hazelnut**
b. if Tortoise or **Squirrel**, then **Hazelnut**
c. if Squirrel or **Tortoise**, then **Lettuce**
d. if **Tortoise** or Squirrel, then **Lettuce**

Interpretive patterns of target sentences predicted by theories were:

i. *Simplification of disjunctive antecedents* (SDA). All target sentences are judged false. This matches the SDA interpretation which requires both simplifications to be true, while in our target sentences one of the simplifications was always false. For example, in (9a) the participant derived a reading equivalent to (if Squirrel, then Hazelnut) and (if Tortoise, then Hazelnut), which is false since the second conjunct is false, and similarly for the other three items.

ii. *Disjunctive conditional reading* (DCR). All target sentences are judged true. This matches the DCR interpretation which requires at least one of the simplifications to be true, which was always the case for our target sentences. For example, in (9a) the participant derived a reading equivalent to (if Squirrel, then Hazelnut) or (if Tortoise, then Hazelnut), which is true since the first simplification is true, and similarly for the other items.

20 The PVB can be consulted here: https://www.istc.cnr.it/it/group/lacam/risorse/PVB_it. As the youngest children tested were aged 4;1, we ensured that all the lexical items used had been acquired by 36 months of age.

iii. *Asymmetric reading* (AR). The participant judged a target sentence true if its simplification involving the medium-speed animal was true. This matches the asymmetric reading of the conditional, under the assumption (tested by means of the closeness evaluation item) that the participant regarded a victory of the medium-speed competitor as more realistic than a victory by the slow competitor. For example, in judging one of the sentences in (9), the evaluation begins by selecting the more realistic winner between the squirrel and the tortoise. Given that the tortoise is notoriously slow, we may expect the squirrel to be judged a more realistic winner than the tortoise (which will be confirmed by a positive answer to the closeness evaluation item). If so, the participant will judge the DAC as true just in case its simplification involving the squirrel is true, i.e., just in case the prize in the consequent is the hazelnut. This means that (9a) and (9b) will be judged true, and (9c) and (9d) false.

The following table summarizes these interpretive patterns:

	SDA	DCR	AR
(9a) if **Squirrel** or Tortoise, then **Hazelnut**	F	T	T
(9b) if Tortoise or **Squirrel**, then **Hazelnut**	F	T	T
(9c) if Squirrel or **Tortoise**, then **Lettuce**	F	T	F
(9d) if **Tortoise** or Squirrel, then **Lettuce**	F	T	F

Table 3 Interpretation pattern of *target sentences*

All patterns not belonging to the above interpretations were labeled as *Other*.

The decision to present participants with four test items was motivated by the need to distinguish the interpretations we are interested in (SDA, DCR, and AR) not just from each other, but also from potential deviant interpretations influenced by the order of the disjuncts. Testing only items (9a) and (9c), for instance, would have been sufficient to distinguish SDA, AR, and DCR from each other, but not to distinguish AR from a potential *left disjunct preference* reading, i.e., an interpretation whereby only the first disjunct of the antecedent is taken into account. With our experimental design, such an interpretation would show up as the pattern of judgments TFFT, which differs from each of the patterns in Table 3. Similarly, our design allows us to discriminate the patterns in Table 3 from a potential *right disjunct preference* reading, which would show up as the pattern FTTF.

Analysis We first examined children's and adults' responses to the target items (DACs). Second, we analysed results of the closeness evaluation items in order to assess whether or not the disjuncts are regarded as equally realistic.

Analysis of Target Items (DACs) across children and adults The data indicate that the simplification of disjunctive antecedents reading (SDA) is the preferred reading for both children and adults, although while among adults it is near-universal, in children it accounts for only 45% of responses. Notably, the asymmetric reading (AR) is nearly unattested: only 2.3% of children exhibited this reading[21], and only one adult derived AR, exclusively in the two counterfactual scenarios, opting for the disjunctive conditional reading (DCR) in the other two scenarios. The second most preferred reading is DCR, with a preference rate of 18.2% among children and 5.4% among adults.

Children exhibit a broader range of interpretations compared to adults, with 34.5% of responses categorized as *Other*[22]. Interestingly, 26.5% of the responses in this category (9.14% of the total) consisted of cases in which a child, while being asked to judge the target sentences as true or false, nevertheless declined to do so (often stating that the sentences were "half true and half false") consistently across the four items of at least one scenario. Notably, 10 children maintained this response pattern consistently across all four scenarios[23], while 6 other children did so in at least one scenario (see Appendix_A). The remaining cases classified under the category 'Other' involved patterns not aligned with any theory-predicted interpretation (SDA, DCR, AR), none of which accounted for a significant proportion of responses.[24]

Looking at the pattern rates for each age group in the bar chart (Figure 4), an interesting trend emerges: SDA rates increase with age, while DCR decreases after age 6;0. Figure 4 answers our question (1), showing that the SDA interpretation of DACs is already available to children at age 5 and, to the extent that our results on

21 Only one child 8;0 years old and one 9;7 years old consistently adopted this reading in all 4 scenarios. Six children displayed the AR pattern in only one of the four scenarios: two in the indicative mode and four in the counterfactual mode.

22 A complete breakdown of the category *Other* and of the response patterns of each participant included in this percentage is presented in Appendix_A uploaded in the OSF folder.

23 Namely, one child aged 5;4, three children aged 6 (6;05, 6;08, 6;11), one child aged 7;6, two children aged 8 (8;0, 8;4), and three children aged 9 (9;0, 9;1, 9;5).

24 When children declined to judge a sentence as true or false, we coded their response as "Undefined" and classified the corresponding scenarios as "Other". Undefined responses were included in our dataset as they held relevance for our discussion. To check whether this inclusion had any effect on our statistical analyses, we performed an additional analysis treating undefined responses as missing data. However, the results did not differ from those reported below. All this material is uploaded in the OSF folder.

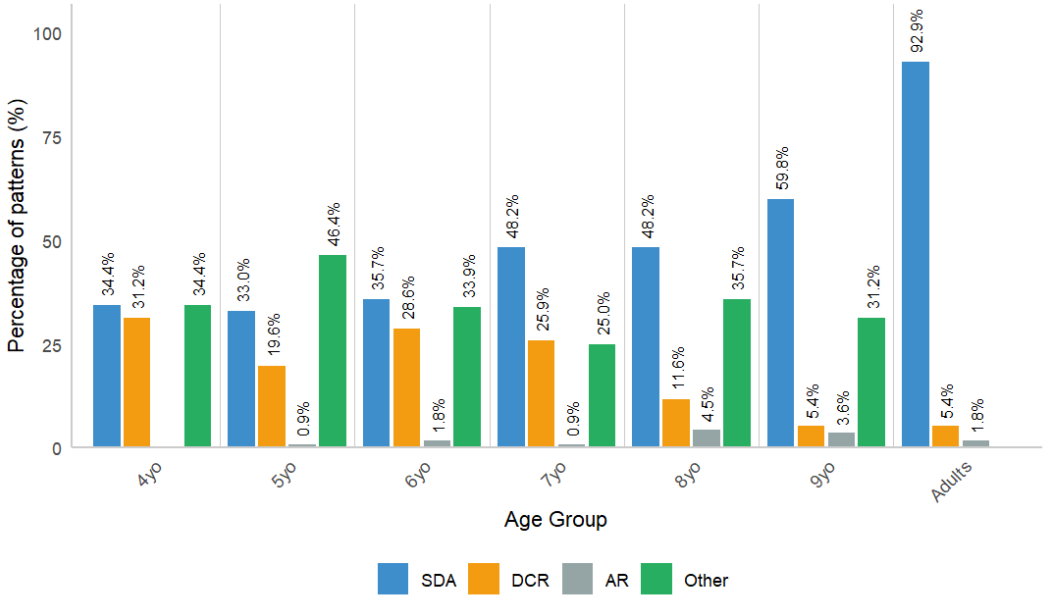


Figure 4 Interpretive patterns of target items among age groups

the few 4-year-olds can be generalized, at age 4 as well. The distribution of interpretive patterns per mode (indicative vs. counterfactual) doesn't show any interesting trend: it seems that no pattern is preferred in one mode over the other (Figure 5).

To answer our research questions (2–4), our data were analyzed using mixed-effects multinomial logistic regression models, fitted in R with the *mblogit* function from the *mclogit* package (Elff 2022). The package was installed directly from https://melff.r-universe.dev/mclogit, as the latest functionalities (e.g., inner optimization control) were not yet available on CRAN. The internal optimizer was set to BFGS, since the default optimizer failed to converge and issued warnings related to inner iterations. Competing models with different fixed and random effects structures were compared using the Akaike Information Criterion (AIC).[25]

The final model included `Pattern`-response as the multi-categorical dependent variable with four levels: SDA, DCR, AR, and Other, with SDA set as the reference level. Each scenario is associated with a unique value of the variable `Pattern`, based on the responses that emerged in the four target items. The predictors were `Mode` (two levels: counterfactual vs. future indicative) and `Age` (in months) and their interaction. Orthogonal sum-to-zero contrasts were used for the categorical predictor `Mode` (Counterfactual = $-1/2$, Future Indicative = $+1/2$), while `Age` was stan-

25 We refer the reader to Section A of the R-script in the OSF repository. The chosen model is m3: AIC = 1425.481; BIC = 1534.844; Approximate residual deviance = 1377.

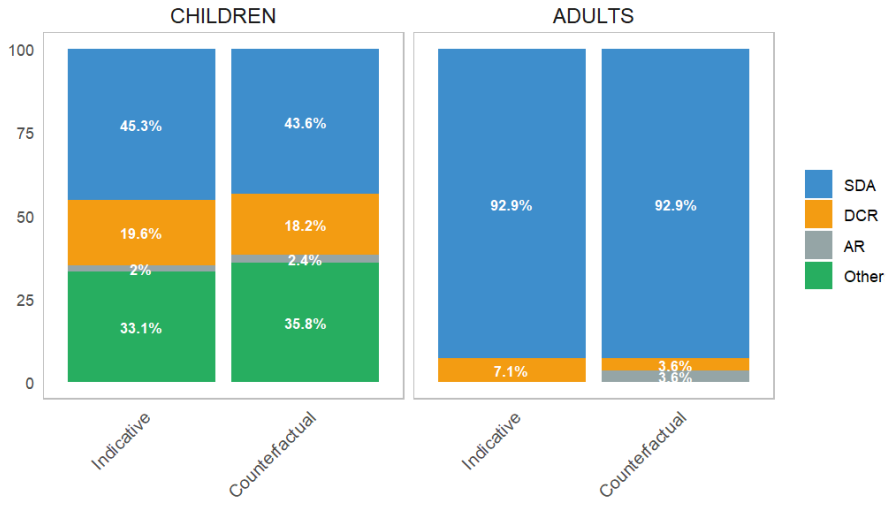


Figure 5 Interpretive patterns of target items per *Mode* in children and adults

dardized by capping at 216 months for adults and by scaling and mean-centering on children's average.[26]

Additional contrasts between factor levels were further checked using post-hoc pairwise comparisons with Tukey's correction. The results are summarized in Table 4 and Figure 6.[27]

For the DCR–SDA comparison, the intercept is significant ($p < 0.001$), with a value of -7.006, indicating that SDA occurs more frequently than DCR. While `Mode` did not have a significant effect ($p = 0.869$), `Age` significantly affected the rate of DCR and SDA responses, suggesting that increasing age reduces the likelihood of the DCR interpretive pattern compared to SDA. The interaction `Mode` $\times$ `Age` also did not show significance ($p = 0.206$).

In the case of the AR–SDA comparison, the intercept is significant, with a value of -10.328 ($p < 0.001$), indicating a low probability of the AR interpretive pattern.

26 We acknowledge that treating `Age` as a continuous variable was the only option that allowed the models to converge. When we treated `Age` as categorical or when we treated it continuous for children adding a categorical `Age` predictor (children vs adults), all models failed to converge (see Sections C-E of the R-script in the OSF repository). Random intercepts for `Participants` and `Items` were also included to account for variability between subjects and stimuli, as suggested by exploratory plots.

27 To improve readability, while `Age` was standardized in the statistical model, Figure 6 considers `Age` in months, as it is in the dataset, but capped at 216 months for adults.

Comparison	Estimate	SE	Z value	p
DCR vs SDA				
Intercept	-0.81357	0.11612	-7.006	$< 0.001^{***}$
Age	-0.41848	0.07279	-5.749	$< 0.001^{***}$
Mode (Count vs Ind)	0.03716	0.22581	0.165	0.869
Age * Mode	0.18430	0.14559	1.266	0.206
AR vs SDA				
Intercept	-3.0547	0.2958	-10.328	$< 0.001^{***}$
Age	-0.1431	0.1220	-1.174	0.241
Mode (Count vs Ind)	-0.1790	0.5897	-0.304	0.761
Age * Mode	-0.2523	0.2439	-1.034	0.301
Other vs SDA				
Intercept	-0.26508	0.09658	-2.745	0.00606^{**}
Age	-0.48278	0.06462	-7.470	$< 0.001^{***}$
Mode (Count vs Ind)	-0.13769	0.19097	-0.721	0.47090
Age * Mode	0.07531	0.12924	0.583	0.56006

Table 4 Parameter Estimates (Fixed Coefficients)

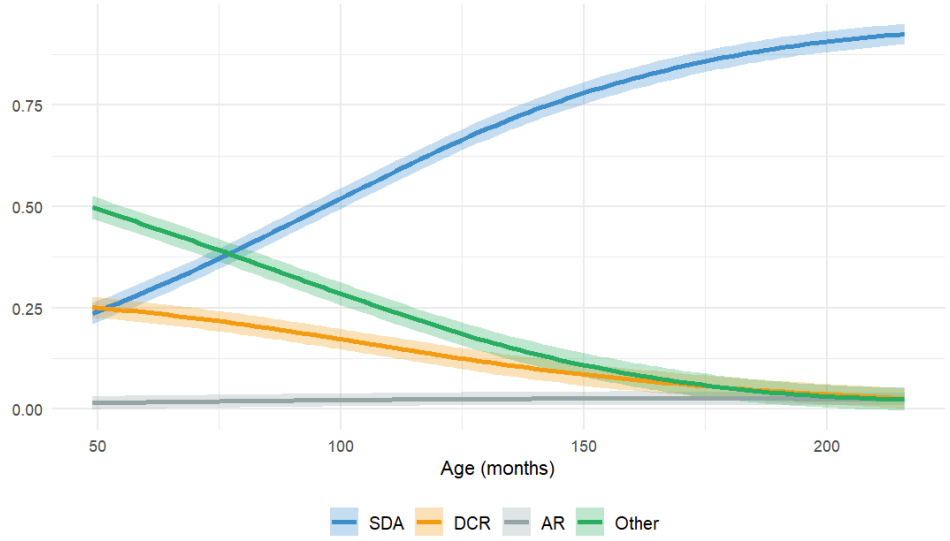


Figure 6 Trend of interpretive patterns based on continuous *Age* variable (in months)

The predictors `Mode` ($p = 0.761$), `Age` ($p = 0.241$), and their interaction ($p = 0.301$) all lacked significance.

Lastly, for the Other–SDA comparison, the intercept recorded a significant value of -2.745 ($p = 0.006$), indicating a low rate for Other level. The variable `Mode` displayed a p-value of 0.47, thus not significant, while `Age` exhibited a significant negative effect ($p < 0.001$). Consistent with previous comparisons, the interaction term did not reveal significance ($p = 0.56$).

Post-hoc comparisons were performed to test whether the response patterns were dependent on `Mode` (Counterfactual vs. Future Indicative). All contrasts lacked significance (SDA: Est=-0.008, SE=0.095, z=-0.09, p=0.93; DCR: Est=0.0, SE=0.0, z=-0.113, p=0.91; AR: Est=-0.008, SE=0.095, z=-0.09, p=0.93; *Other*: Est=0.0, SE=0.0, z=-0.108, p=0.91).[28]

In summary, the results indicate that (i) SDA interpretations are more frequent than DCR, AR, and Other patterns; (ii) the likelihood of the DCR and Other patterns (compared to SDA) decreases with `Age`, while SDA increases; (iii) no difference dependent on `Age` was detected in the comparison between SDA and AR readings; (iv) the interpretation of DACs is not significantly affected by `Mode`.

Individual analysis To further verify the robustness of our participants' interpretations, we performed an individual analysis. The two tables below offer a detailed examination for each participant (see Children in Table 5 and Adults in Table 6). These tables assess whether participants exhibit consistency between the scenarios in the indicative mode and those in the counterfactual mode. To the four responses previously discussed, i.e., SDA, DCR, AR, Other, we also added a fifth category, namely the *Mix* category which indicates that a participant derived two different interpretations for the two scenarios of the same mode.

Excluding the *Mix* column and row, what is striking is that all but one of the participants are distributed along the diagonal of the tables, confirming their tendency to derive the same interpretation across modes—regardless of the particular interpretation chosen. In conclusion, the absence of a *Mode* effect detected by the statistical analyses is further supported at the individual level.

Analysis of Closeness evaluation items The closeness evaluation items (e.g., "If the hare doesn't win, the squirrel will win") were meant to detect whether a subject regards one of the disjuncts in the antecedent of our target items as more realistic

28 We note that the output of the model did not substantially differ when it was fitted with children's responses exclusively (see Section B of the R-script in the OSF repository, m5), treating `Age` as a continuous variable. We therefore decided to present the results on the comprehensive dataset, which also included the adults.

		Indicative				
		SDA	**DCR**	**AR**	**Other**	**Mix**
Counterfactual	**SDA**	**52**	0	0	0	3
	DCR	0	**15**	0	0	3
	AR	0	0	**2**	0	0
	Other	0	0	0	**29**	7
	Mix	9	1	0	10	9

Table 5 Children's profiles (total: 148)

		Indicative				
		SDA	**DCR**	**AR**	**Other**	**Mix**
Counterfactual	**SDA**	**26**	0	0	0	0
	DCR	0	**1**	0	0	0
	AR	0	**1**	**0**	0	0
	Other	0	0	0	**0**	0
	Mix	0	0	0	0	0

Table 6 Adults' profiles (total: 28)

than the other. This is relevant since it is only in this case that we may reasonably expect to find an AR interpretation. In particular, a non-equally realistic interpretation of the disjuncts would manifest itself as a "true" judgment to the closeness evaluation item.

The proportion of T-responses to the closeness evaluation item was 70.8% among children and 43.8% among adults. Table 7 presents the responses by age group. In-

Group	**T**	**F**	**No answer**
4;0-4;11	43.75%	56.25%	0.00%
5;0-5;11	58.62%	41.38%	0.00%
6;0-6;11	63.96%	36.04%	0.00%
7;0-7;11	75.00%	23.21%	1.79%
8;0-8;11	87.50%	11.61%	0.89%
9;0-9;11	76.79%	23.21%	0.00%
Adults	44.25%	55.75%	0.00%

Table 7 Percentage of T, F, *No answer* in closeness evaluation items by age group.

terestingly, the T-responses peak at age 8;0-8;11, while adults' answers are more similar to those of younger children.[29]

In order to zoom in on those cases where one disjunct was regarded as more realistic than the other, we further restricted our investigation to scenarios whose closeness evaluation item was judged as true, examining the interpretation of the associated target items. As shown in Table 8, the distribution of the results is very similar to the general one: SDA remains the preferred interpretation, while AR is only marginally attested.

	Adults	**Children**
Simplification of Disjunctive Antecedents (SDA)	87.76%	39.34%
Disjunctive Conditional Reading (DCR)	8.16%	22.99%
Asymmetric Reading (AR)	4.08%	2.84%
Other	0.00%	34.83%

Table 8 Interpretive patterns of participants who answered T to the closeness evaluation item

5 General discussion

We now come back to the research questions described in Section 3, discussing how our results adjudicate them and what theoretical conclusions can be drawn.

Question 1: At what age does Simplification of Disjunctive Antecedents (SDA) arise? Our data indicate that the SDA interpretation of Disjunctive Antecedents Conditionals (DACs) is already available to children at age 5, and plausibly at age 4, constituting the preferred interpretive pattern and accounting for the majority of non-deviant responses. This matches the findings of Tieu et al. (2015) about the early acquisition of free-choice inferences, supporting the hypothesis that SDA and free-choice inferences have a common source.

In addition, supposing that a pragmatic explanation of SDA along the lines proposed by Bar-Lev & Fox (2020) is correct, our data also provide support for the

29 However, the reasons given for rejecting the closeness evaluation item differ between adults and younger children. In the case of adults, all but one motivated their judgment with the consideration that both of the other participants have some chance of winning, thus indicating that they regarded the disjuncts of our DAC as equally realistic (in the relevant, similarity-based technical sense). By contrast, the reason for younger children to reject the closeness evaluation item seemed to be linked to difficulties with supposing the negation of something they accepted (though note that the same children correctly answered the control items, which also required them to entertain something contrary to what they accepted, albeit not in the form of an explicit negation).

restricted alternative hypothesis put forward by Tieu et al. (2015): on the assumption that SDA arises as a scalar implicature, the fact that it is already widely attested at age 4/5 confirms that at that age, children are able to derive scalar implicatures that do not require access to the lexicon.

Question 2: Do children shift from Asymmetric Reading (AR) to SDA with age? Our data do not show a shift from AR to SDA. In fact, the AR interpretation is almost absent from our results; furthermore, the only two subjects that consistently adopted this interpretation were in fact older children, aged 8;0 and 9;7, and so their judgments are unlikely to be due to under-developed pragmatic skills. Thus, our data do not provide evidence for the view that SDA derives from a pragmatic strengthening of AR.

As discussed in Section 3, this is not to say that our data provide evidence *against* the view: the absence of AR interpretations may be explained by assuming that the pragmatic skills involved in deriving SDA are already fully developed at age 4/5. However, in this case we may expect the rate of SDA interpretations at age 4/5 to be already adult-like. This is not what we found: the prevalence of SDA *does* increase with age; this increase, however, is not accompanied by a fall of in AR rates, but by a fall in DCR rates—a finding which is unexpected on Bar-Lev and Fox's view.

Question 3: Do children shift from Disjunctive Conditional Reading (DCR) to SDA with age? As explained in Section 3, an account that views SDA as resulting from a homogeneous quantification over the alternatives introduced by the disjunctive antecedent predicts, based on what is known about the case of plural definites (Tieu et al. 2019), that we should observe a significant proportion of DCR readings in young children, due to an existential reading of the relevant quantification; this proportion should then decrease with age as SDA rates increase, owed to the shift to a universal reading of the quantification.

Strikingly, this is exactly the pattern we found, as can be seen in Figure 4: in our data, the prevalence of DCR is higher in younger children (around 25% of responses from children aged 4-7), decreasing then sharply until age 9, when it reaches the same rate attested in adults (5.4%). As mentioned above, this developmental trend is statistically significant. As far as we can see, no other existing account of SDA offers an explanation of this trend. Thus, our results can be seen as evidence in favor of semantic theories that link SDA to homogeneous quantification over semantic alternatives (Santorio 2018, Cariani & Goldstein 2020).[30]

30 Of course, other accounts—semantic and pragmatic—could offer an explanation based on *ad-hoc* assumptions, for instance assuming that children favor a wide-scope LF for DACs more than adults.

Further support for this hypothesis may come from the fact that a significant number of children (9.6%), while being asked to judge the sentence as true or false, refused to do so, explaining that they regarded it as "half true and half false". Recall that homogeneity-based accounts of SDA predict that, when one simplification of a DAC is true and the other false, as in our target items, the DAC lacks a definite truth value. One possible interpretation of our data is that those participants who judged the DACs as *false* (SDA reading) were thereby expressing their rejection of Panda's untrue claim, while those who refrained from judging the DACs as *true* or *false* were accessing intuitions about the actual semantic value of these sentences.[31]

Question 4: Does SDA arise earlier, or with higher frequency, for indicatives than for counterfactuals? As can be seen from Figure 5, SDA does not seem to arise earlier or with higher frequency for indicatives as compared to counterfactuals. Furthermore, as can be seen from Table 5, no children systematically adopted one interpretation for indicatives and a different one for counterfactuals; in particular, no children consistently adopted an SDA interpretation for indicatives and an AR interpretation for counterfactuals. This casts doubt on those accounts of conditionals which imply a different status or origin for SDA in the two cases, supporting instead those uniform accounts that assign the same kind of logic to indicatives and counterfactuals.[32]

The question is whether these assumptions can be empirically confirmed, in the same way as the shift from existential to universal readings of homogeneous quantifiers is empirically attested.

31 Assuming that SDA and free choice inferences have the same source, we also expect to see a similar trend when we look at disjunctions embedded under modals, as in (i).

(i) Liz can buy a croissant or a donut. Cochard et al. (2025)

More precisely, we expect some younger children to display what we might call a "disjunctive modal reading" of (i), judging it true as soon as *one* option among buying a croissant and buying a donut is permissible (in modal logic notation, this reading could be expressed as $\Diamond C \vee \Diamond D$, or equivalently, $\Diamond(C \vee D)$); this reading should then gradually make way for a free choice reading, which is true only if *both* options are permissible ($\Diamond C \wedge \Diamond D$).

Interestingly, a recent study conducted by Cochard et al. (2025) on sentences like (i) confirms at least the first part of this prediction. Testing 4–6-year-olds on sentences like (i), Cochard et al. identified three distinct response profiles: 11 children (25% of the sample) had a modal conjunction profile, i.e., they interpreted (i) as conveying that Liz is allowed to buy both ($\Diamond(C \wedge D)$); 22 children (50%) had a free-choice profile; and, finally, 11 children (25%) displayed a disjunctive modal profile.

Strikingly, the proportions of disjunctive modal readings and free choice readings found in this study are very similar to the proportions of DCR and SDA readings observed in our experiment for the same age group, and to the proportions of existential and universal readings of plural definites observed by Tieu et al. (2019) at roughly the same age.

32 As one reviewer rightly notes, our data are compatible with the view that there are two kinds of conditionals with different logic, but if so, they suggest that the distinction is not between indicatives

Question 5: Does SDA require the disjuncts to be equally realistic? As explained in the previous section, a positive answer to the closeness evaluation item in our scenario indicates whether a subjects regards one of the disjuncts of our test items as more realistic than the other (in the technical sense of Section 2). Thus, according to Lewis's theory, participants who accepted the closeness evaluation item should display an AR interpretation of our target sentences. As can be seen from Table 8, this prediction is not borne out: these participants still derived SDA at nearly the same rate as other participants, and still failed (with *very* few exceptions) to display the AR interpretation predicted by Lewis's theory. Thus, our experiment confirms the need for an account—whether semantic or pragmatic—that derives SDA without relying on the assumption that the disjuncts are equally realistic.

6 Conclusion and further work

Our results show that the SDA interpretation of DACs arises early, being the preferred interpretation already at age 4/5. This is in line with the assumption that SDA is related to free-choice inferences, which also arise early (Tieu et al. 2015). Moreover, we confirmed that the SDA interpretation is not confined to the case in which the disjuncts are regarded as equally realistic (*contra* Lewis 1973), and we did not find any significant difference in SDA rates between indicatives and counterfactuals, contrary to the predictions of dichotomous theories of conditionals that classify SDA as logically valid for indicatives but not for counterfactuals. While the prevalence of the SDA interpretation increases with age, this increase is not accompanied by a drop in the rates of the Lewisian Asymmetric Reading (AR), contrary to what we might expect based on the pragmatic account of Bar-Lev & Fox (2020). Instead, the emergence of SDA is accompanied by a drop in the proportion of Disjunctive Conditional reading (DCR) rates; this trend is parallel to one that has been observed in the case of plural definites, where we similarly see a shift from existential to universal interpretations (Tieu et al. 2019); in our case, DCR corresponds to

and counterfactuals. Indeed, the indicatives we tested in our experiment are all *will*-conditionals, i.e., conditionals of the form "if A happens, B will happen". In the literature, there has been a debate over whether *will*-conditionals should be classified with past-tense indicatives ("if A happened, B happened") (as argued by Gibbard 1980, Edgington 1995, Bennett 2003), or with counterfactuals ("if A had happened, B would have happened") (as argued by Dudman 1984, Bennett 1988). Recently, Ciardelli & Ommundsen (2025) have argued that *will*-conditionals are in fact ambiguous between an "epistemic" reading, shared with past-tense indicatives, and a "historical" reading, shared with counterfactuals. If this is right, it is possible that our data all reflect intuitions about a single kind of conditionals, viz., historical ones; they are thus compatible with the view that epistemic and historical conditionals have a different logic. One way to probe this would be to look at whether SDA arises earlier or more strongly in the case of past-tense indicatives ("if the squirrel or the tortoise won, it got a hazelnut"), which are typically assumed to have only an epistemic reading. We leave this for future work.

an existential interpretation of the DAC (for *some* disjunct, the consequent follows), while SDA corresponds to a universal interpretation (for *every* disjunct, the consequent follows). Thus, among the existing theories of SDA, our data seem to fit best with those of Santorio (2018) and Cariani & Goldstein (2020), which integrate an alternative-generating treatment of disjunction with a homogeneity requirement on the resulting alternatives.

One crucial thing that remains to be explained for these theories is *why* some younger children gravitate towards existential interpretations of plural definites and DACs. One attractive hypothesis is that this stems from a general difference in the way children and adults react to assertions that are neither true nor false, but have a kind of intermediate status ("half true", as some of our subjects described them): it is possible that, in these cases, some younger children adopt a resolution strategy which results in a higher degree of acceptance.[33] This hypothesis finds independent support in data showing that children are more likely than adults to accept claims involving vague terms in borderline situations (Panzeri & Foppolo 2012, Weicker & Schulz 2020).[34]

In future work, the hypothesis that cooperativity plays a role in children gravitating towards DCR may be tested by replacing our scenario, where the speaker is presented as a potential liar, with one where the speaker is presented as cooperative but potentially prone to errors. This setup may lead children to be more charitable towards the speaker, yielding higher rates of DCR.

A second aspect of our data that remains in need of explanation is the near-absence of the Lewisian AR. In the account of Santorio (2018) DACs are associated with two different LFs, a complex one delivering SDA and a simpler one delivering AR. Santorio conjectures that the dominance of the SDA reading may stem from a general preference for stronger readings; however, this conjecture does not square well with the fact that a significant proportion of our participants *did* exhibit DCR, a reading which is even weaker than AR. The absence of AR is less problematic for Cariani & Goldstein (2020), since they assume, with Alonso-Ovalle (2009), that SDA stems from the default LF for DACs, while AR is only derived in the presence of a non-inquisitive closure operator "!" in the antecedent, whose insertion may be dispreferred or subject to constraints; in this case, more remains to be said about the circumstances that can trigger or license the presence of this operator.

33 Thanks to an anonymous reviewer for suggesting this hypothesis.

34 This greater tendency of children towards acceptance may possibly be linked to the well-known acquiescence bias (Quine 1960, Crain & Thornton 1998). Note however that DCR judgments are not merely due to a tendency to unreflective acceptance on the part of younger children: all the children included in our dataset were required to correctly answer some negative controls as false (at least 7 out of 8); moreover, as shown in Table 7, younger children were in fact *less* likely than older ones to accept the closeness evaluation item.

It is worth noting that, while no existing implicature-based account of SDA fully fits our data, it seems possible to build such an account by combining existing ideas. Bassi & Bar-Lev (2018) have proposed a theory on which bare conditionals (i.e., conditionals not involving modals or other quantifiers) express a restricted existential quantification over possible worlds, which gets strengthened to a universal quantification via exhaustification. As far as we can see, adopting a similar existential entry for counterfactuals and future-oriented conditionals in combination with the exhaustification procedure proposed by Bar-Lev & Fox (2020), one may obtain an account that predicts that the literal meaning of a DAC is DCR, while its exhaustified meaning is SDA. One could then explain both the absence of AR (since AR is not among the predicted readings), and the developmental trend from DCR to SDA (as resulting from the acquisition of EXH).

A detailed investigation of this kind of pragmatic account, and a comparison with the semantic theories of Santorio (2018) and Cariani & Goldstein (2020) must be left for future work. Here, we limit ourselves to pointing out some relevant recent work by Ramotowska et al. (2025), which suggests that the basic semantics of conditionals is not existential or universal, but *selectional*, in the sense of Stalnaker (1968): a conditional is true if the consequent is true in a single selected antecedent world. If this is right, it is problematic for a pragmatic account that relies on the assumption that conditionals start out with an existential semantics that gets strengthened to a universal one. By contrast, it is not problematic for the accounts of Santorio (2018) and Cariani & Goldstein (2020): while these accounts assume a universal semantics for conditionals, they may be combined straightforwardly with a selectional semantics while preserving the account of SDA and all predictions about DACs that played a role in our experiment.[35]

In future research, the hypothesis that the SDA interpretation is linked to homogeneity could be tested more directly. One possible approach would be to ask the same children to judge both DACs and sentences involving plural definites. If a systematic correlation is observed between an existential (or universal) interpretation of plural definites and a DCR (or SDA) reading of DACs, this would provide robust empirical support for the hypothesis.

It would also be interesting to run a variation of our experiment offering participants a ternary choice including "neither true nor false" as a possible answer in addition to "true" and "false", comparing the results to those of our binary forced choice task; high rates of "neither true nor false" judgments would further support the homogeneity hypothesis (but see Footnote 10 on some reasons for caution in interpreting the results).

35 Yet another option, as a reviewer suggests, is to merge the semantic and pragmatic approaches, combining the idea that disjunction semantically denotes a set of propositions with the idea that homogeneity over these alternatives arises from exhaustification, along the lines of Bar-Lev (2021).

Another promising avenue of investigation involves looking at the effect of agreement between disjunctive subjects and verbs. In Italian, it is possible to have either singular or plural agreement between the verb and disjunctive subjects, even when each disjunct is singular. Notably, plural agreement seems to block an *ignorance reading*.

(1) Se il tasto rosso o il tasto blu viene premuto, il computer
if the key red or the key blue come.3SG pressed.PTCP.SG the computer
esplode. Non mi ricordo quale dei due.
explodes.3SG not CL.1SG remember.1SG which of.the two

If the red key or the blue key is pressed, the computer explodes. I don't remember which one.

(2) Se il tasto rosso o il tasto blu vengono premuti, il computer
if the key red or the key blue come.3PL pressed.PTCP.PL the computer
esplode. #Non mi ricordo quale dei due.
explodes.3SG not CL.1SG remember.1SG which of.the two

If the red key or the blue key are pressed, the computer explodes. #I don't remember which one.

Assuming that ignorance readings arise from LFs in which disjunction takes wide scope (see Fusco 2015), this suggests that plural agreement blocks the possibility of disjunction taking wide scope over the conditional construction. It would then be interesting to test children's interpretation of DACs with plural agreement: if children still derive DCR readings in this case, this is an indication that this reading is not derived by considering an LF with wide-scope disjunction, but in some other way—possibly through an existential reading of the homogeneous disjunctive antecedent.

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