

programme, this seems to me to raise a large question mark against the claim that the probability axioms have anything intrinsically to do with truth-accuracy at all.⁸

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The puzzle of the changing past

LUCA BARLASSINA AND FABIO DEL PRETE

The past has changed. We shall show this by putting together a platitude about truth and the past with a true story you already know.

1. Here is the platitude: we say true (false) things about the past, and the truth (falsity) of what we say depends on how the past is. For example, if you now say that Obama was born in 1961, you say something about the past, and what you say is true because the past is such that Obama was born in 1961.

To make the point more precise, let’s introduce the following terminology:

- A. People utter sentences at *contexts*, which are minimally constituted by the world and the time at which the sentence is uttered. Thus, if you uttered sentence (1) ‘Obama was born in 1961’ on the 1st of January 2000 at the actual world @, the context of your utterance is <@, 1st January 2000>.

- B. Sentences express *propositions* at contexts. For example, sentence (1) at context $\langle @, 1st\ January\ 2000 \rangle$ expresses the proposition *that Obama was born in 1961*.¹
- C. A sentence S is *temporally specific* if and only if, for any context c , the proposition expressed by S at c ascribes a property to a specific time.² Sentence (1) is temporally specific given that, for any context c , the proposition it expresses at c ascribes to the year 1961 the property of being a time in which Obama was born.³
- D. A sentence is *about a past time* in a context c if and only if the proposition it expresses at c ascribes a property to a specific time that precedes the time of c . Accordingly, sentence (1) is about a past time in $\langle @, 1st\ January\ 2000 \rangle$, since the year 1961 precedes the time of this context.

With A–D at hand, we can express our initial platitude as the following semantic principle:

TAP: Truth about past times

Let S , c , p , Q , t be such that: S is a temporally specific sentence that is about a past time in context c , p is the proposition expressed by S at c , and Q is the property that p ascribes to the specific time t . Then, S is true in c if and only if t has property Q relative to the past of c .⁴

For example, sentence (1) is true in $\langle @, 1st\ January\ 2000 \rangle$ because, relative to the past of $\langle @, 1st\ January\ 2000 \rangle$, the year 1961 has the property of being a time in which Obama was born.

2. And here is the true story. It is the 23rd of July 2000. Being the rider with the lowest overall time at the end of the last stage, Lance Armstrong is declared the winner of the Tour de France by *Union du Cyclisme*

- 1 There are many theories of propositions on the market. For our purpose, it is unnecessary to choose one. Pick the one you like the most.
- 2 The definition of temporally specific sentence is based on the referential analysis of tense originally proposed by Partee (1973) as an alternative to Prior's (1967) operator-based account. According to the referential analysis, the logical form of (1) is roughly as follows:
 - (i) $[t \leq \text{now} \ \& \ t = 1961 \ \& \ \text{Obama-be-born}(t)]$

Despite the strenuous resistance of some supporters of the operator-based account (Recanati 2007; Brogaard 2012), Partee's proposal has become the default position on the semantics of tense (Abusch 1997; Heim 1994; King 2007; Kratzer 1998; von Stechow 1995).

- 3 Notice that the definition does not require that the time and the property be the same at all contexts. Thus, the sentence 'Yesterday I was in Rome' counts as temporally specific on our definition.
- 4 It is trivial to see that *TAP* directly results from a combination of the classical Kaplanian notion of Truth-in-Context (Kaplan 1989) with the referential analysis of tense.

Internationale (UCI). On <@, 25th December 2002> (hereafter, Context A), Frank utters (2):

(2) Lance Armstrong won the Tour de France in 2000.

There is a clear intuition that Frank said something true. Time goes by. Having discovered that Armstrong made use of banned substances, on 22 October 2012 UCI withdraws all of Armstrong's wins at Tour de France. As Frank is not aware of this fact, he utters (2) again at <@, 25th December 2012> (hereafter, Context B). This time, it seems that Frank said something false.

What's the moral of this story? (2) is a temporally specific sentence that is about a past time in both Context A and Context B. Moreover, since (2) does not contain any context-sensitive element – there are no demonstratives, indexicals, gradable adjectives, etc. in it – it expresses the same proposition at both Context A and Context B, namely, (3):⁵

(3) *that Lance Armstrong won the Tour de France in 2000.*

Since (2) is *true* in Context A, it follows from *TAP* that, relative to the past of Context A, the year 2000 has the property of being a time in which Armstrong won the Tour de France. And since (2) is *false* in Context B, it follows from *TAP* that, relative to the past of Context B, the year 2000 does not have the property of being a time in which Armstrong won the Tour de France. However, Context A and Context B are located in the same world, that is, the actual world. This means that, in moving from Context A to Context B, *the past* (of the actual world) *has changed*: the year 2000 had a certain property on Christmas 2002, but did not have that property on Christmas 2012 any longer.

If one thinks that the conclusion that the past has changed is too crazy to be true, one will have to impugn one or more of our premises. Which ones? We take it that one cannot but accept that Context A and Context B are located in the same world, and also that sentence (2) is a temporally specific sentence that is about a past time in both contexts. Moreover, *TAP* is a quite uncontroversial way to capture a pre-theoretical intuition about what it takes for a sentence about a past time to be true.⁶ Therefore, if one intends to avoid the conclusion that the past has changed, one will probably have to resist one

5 One might point out that, on the referential analysis of tense we are adopting, the tense is a context-sensitive element, that is, a variable which picks out a contextually relevant time. Fair enough. Still, the past tense in (2) is an instance of a bound variable – the time adverb 'in 2000' binds it to the year 2000. Hence, (2) expresses proposition (3) at both Context A and Context B.

6 If one favours an operator-based account of tense over a referential analysis, one might argue that *TAP* is in fact controversial, since it is based on the latter analysis. This objection won't do, since an even more serious puzzle emerges if one adopts an operator-based account of tense. On the latter, the logical form of (2) is (ii):

or the other of the following premises: first, the intuition that (2) is true in Context A and false in Context B; second, the claim that (2) expresses the same proposition at both Context A and Context B. Let's consider these two objections in turn.

3. The objection that (2) has not changed its truth value from Context A to Context B comes in two variants. The first goes like this: Armstrong managed to have the lowest overall time at the Tour de France in 2000 only by doping himself, thus by cheating; but since one cannot be the winner if one cheated, (2) was *already false* in Context A.

This objection rests on a confusion, by which the property *being the winner* is conflated with the property *being the person who deserves to win*. True enough, one cannot enjoy the latter property if one cheated; however, one can enjoy the former even if one cheated, since the possession of the property *being the winner* is determined solely by a declaration of a competent authority, and a competent authority may, for one reason or another, declare a cheater the winner. Consider, for example, the match between Argentina and England at the FIFA World Cup in 1986. Argentina won the match 2–1. However, the crucial score was achieved through a blatant violation of a rule, as Argentinian player Maradona pushed the ball into the net with his hand. The referee did not see the infraction and validated the score. Thus, even though Argentina cheated, and hence did not *deserve to win* the match, it was nonetheless the *winner*, since the competent authority so declared.

With this in mind, ask yourself again: was (2) true when uttered in Context A? Needless to say, Armstrong did not deserve to win the Tour de France in 2000. Therefore, (2) would be false in Context A if it ascribed the property *being a person who deserves to win the Tour de France in 2000* to Armstrong. However, (2) does not ascribe this property to Armstrong, but rather ascribes the property *being the winner of the Tour de France in 2000* to him. Since on 23 July 2000 a competent authority had declared Armstrong the winner, and this declaration was still valid on Christmas 2002, it follows that (2) is true in Context A.

(ii) P(Armstrong wins the Tour de France & it is 2000)

Formula (ii) is true in a context c if and only if 'Armstrong wins the Tour de France & it is 2000' is true relative to c_w and a time $t < c_t$ (where c_w and c_t are, respectively, the world and the time of c). This entails that (ii) is true in c if and only if 'Armstrong wins the Tour de France' is true relative to c_w and a time $t < c_t$ such that $t=2000$. Thus, since (ii) is true in Context A, 'Armstrong wins the Tour de France' is true relative to @ and a time $t < 25$ th December 2002 such that $t=2000$; and since (ii) is false in Context B, it is not the case that 'Armstrong wins the Tour de France' is true relative to @ and a time $t < 25$ th December 2012 such that $t=2000$. But this means that there is a time in the past of @, namely the year 2000, in which Armstrong both wins and doesn't win the Tour de France.

The second variant of the objection has it that (2) is *still true* after the revocation of Armstrong's titles – hence, still true in Context B. One can try to support this intuition by exploiting the platitude that sincere speakers only assert what they take to be true sentences, and then pointing to cases in which sincere and informed speakers seem to assert (2), or sentences entailing (2), after the revocation of Armstrong's titles. For example, one might consider discourses like the following ones:

(4) Armstrong won the Tour de France seven times from 1999 to 2005. He was later stripped of those titles for doping.
(*USA Today*, 28 June 2013)⁷

(5) The American won seven times straight, before being disqualified for systematic doping.
(*The Australian*, 13 July 2013)⁸

(4) seems to entail (2) because discourses in which two sentences S_1 , S_2 are concatenated are usually interpreted as entailing the logical conjunction [S_1 & S_2] (Asher and Lascarides 2003), hence as entailing S_1 . Therefore, given that the conjunct S_1 in (4), namely, 'Armstrong won the Tour de France seven times from 1999 to 2005', entails (2), one might conclude that (4) entails (2). On the other hand, complex sentences of the form [S_1 before S_2] are usually understood as entailing their component sentence S_1 (Beaver and Condoravdi, 2003). Thus, since S_1 in (5), i.e., 'The American won seven times straight', contextually entails (2), it might appear safe to conclude that (5) contextually entails (2). These conclusions, however, are flawed. If (4) really entailed its S_1 -component, the addition of sentence (6) to (4) would result in a contradiction, since (6) and the S_1 -component of (4) are logically incompatible:

(6) Armstrong never won any Tour de France in the end.

But the following discourse is perfectly consistent:

(7) Armstrong won the Tour de France seven times from 1999 to 2005. He was later stripped of those titles for doping. *So, Armstrong never won any Tour de France in the end.*

Therefore, (4) does not entail its S_1 -component. Hence, given that (4) could entail (2) only in virtue of entailing its S_1 -component, it follows that (4) does not entail (2) either. The same considerations apply, *mutatis mutandis*, to (5).

7 <http://www.usatoday.com/story/sports/cycling/2013/06/28/lance-armstrong-impossible-win-tour-de-france-doping/2471413/>

8 <http://www.theaustralian.com.au/sport/opinion/chris-froome-looking-just-too-good-in-yellow-jersey-at-tour-de-france/story-e6frg7t6-1226678708461#mm-premium>

Accordingly, the alleged evidence in support of the intuition that (2) is true in Context B does not stand up scrutiny.

It turns out that there are in fact plenty of assertions made by sincere and informed speakers that entail that (2) is false if uttered after the titles' withdrawal. Here are just a few of them:

(8) Who won the Tour de France 1999-2005? No one.
(*Law, Economics & Cycling*, 22 October 2012)⁹

(9) Lance Armstrong has no longer won any Tour de France titles.¹⁰

(10) Lance Armstrong is no longer the winner of the Tour de France from 1999 to 2005.
(Christian Prudhomme, Director of the Tour de France, from *CBSNews*, 22 October 2012)¹¹

Thus, the strategy of considering assertions made by informed and sincere speakers, rather than supporting the intuition that (2) is true in Context B, provides evidence in favour of the intuition that (2) is false in that context.

4. A second way in which one might try to block the conclusion that the past has changed is arguing that the proposition that is false in Context B is not the same as the proposition that is true in Context A. There are two plausible ways to articulate this objection:

Contextualism

The verb phrase 'win the Tour de France in 2000' is a context-sensitive monadic predicate whose content at a context depends on which declaration is relevant in that context.¹²

Relationalism

The verb phrase 'win the Tour de France in 2000' is an implicitly relational predicate (Condoravdi and Gawron 1996) which, at a certain

9 <http://cyclingprof.blogspot.fr/2012/10/congratulations-to-no-one.html>

10 <http://twitter.com/TheCodyG/statuses/238835618472423424>

11 http://www.cbsnews.com/8301-400_162-57537025/lance-armstrong-stripped-of-tour-de-france-medals/

12 More precisely, the content of 'win the Tour de France in 2000' at a context c would be a function from worlds w to sets of individuals i such that i wins the Tour de France in 2000 in w according to the declaration that is relevant in context c .

context, relates a person and a declaration that is relevant in that context.¹³

On these accounts, (2) is predicted to express proposition (11) at Context A and proposition (12) at Context B:¹⁴

(11) *that Lance Armstrong won the Tour de France in 2000 according to UCI declaration of the 23rd of July 2000* (hereafter ‘declaration α ’);

(12) *that Lance Armstrong won the Tour de France in 2000 according to UCI declaration of the 22nd of October 2012* (hereafter ‘declaration β ’).

Contextualism and Relationalism, however, face a major problem. Suppose that, having come to know that Armstrong’s titles have been revoked by declaration β , Ms. Blue utters sentence (13) at Context B:

(13) It is no longer the case that Lance Armstrong won the Tour de France in 2000.

There is a clear intuition that (13) is true in Context B, but one cannot account for this if one assumes that the verb phrase ‘win the Tour de France in 2000’ is a context-sensitive monadic predicate or an implicitly relational predicate. On both accounts, since the declaration that is relevant in Context B is declaration β , (13) is predicted to express proposition (14) at that context:

(14) *that it is no longer the case that Lance Armstrong won the Tour de France in 2000 according to declaration β .*

According to Contextualism, declaration β enters proposition (14) in virtue of being a part of the content (at Context B) of ‘win the Tour de France in 2000’. According to Relationalism, declaration β enters proposition (14) in virtue of being an argument of the implicitly relational predicate ‘win the

13 Relationalism naturally follows from the view that the property *being the winner of the Tour de France in 2000* is a relational property holding (at a context c) between a person and a declaration (which is valid in c) by a competent authority.

14 Strictly speaking, the two accounts ascribe different logical forms to sentence (2):

(iii) *Contextualism:*

[_{TP} PAST [_T [_{DP} Lance Armstrong]_[VP win the Tour de France in 2000]]]

(iv) *Relationalism:*

[_{TP} PAST [_T [_{DP} Lance Armstrong]_[VP win the Tour de France in 2000 according to d]]]

This difference, however, has no bearing on the point we are making here, since (iii) and (iv) specify the same proposition in any given context – relative to a context c , they specify the proposition that Lance Armstrong won the Tour de France in 2000 according to the declaration by UCI that is relevant in c .

Tour de France in 2000'. Either way, the propositional constituent *according to declaration β* obligatorily takes narrow scope with respect to the propositional constituent *it is no longer the case that*. Thus, (14) has to be kept distinct from (14'):

(14') *that according to declaration β , it is no longer the case that Lance Armstrong won the Tour de France in 2000.*

Rather, (14) must be read as presupposing that it was true in the past that Armstrong won-the-Tour-de-France-in-2000-according-to-declaration- β . But this presupposition is false in Context B: since declaration β established the revocation of Armstrong's titles, it has never been the case that, relative to the past of Context B, Armstrong won the Tour de France in 2000 *according to β* . Therefore, sentence (13) cannot be true in Context B in virtue of expressing proposition (14) at that context, thus 'win the Tour de France in 2000' is neither a context-sensitive monadic predicate, nor an implicitly relational predicate. Since sentence (2) does not contain any other element which may be plausibly regarded as context-sensitive, it follows that (2) expresses the same proposition at both Context A and Context B.

5. Conclusion

Without any doubt, there is something puzzling in the conclusion that the past has changed. This conclusion, however, has been shown to follow from a platitude and a true story. One should then stop asking *whether* the past can change and start to inquire on *how* to make sense of this. We leave this task to a future paper – unless the future changes.¹⁵

*University of Sheffield, UK
l.barlassina@sheffield.ac.uk*

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CNRS & University of Toulouse II, France
fabio.del-prete@univ-tlse2.fr

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Mind the metaphor! A systematic fallacy in analogical reasoning

EUGEN FISCHER

Conceptual metaphors facilitate both productive and pernicious analogical reasoning. Their conscious and explicit use in analogical reasoning has been demonstrably helpful and productive in disciplines ranging from physics (Hesse 2000) and biology (Keller 1995) to psychology (Gentner and Grudin 1985) – despite limitations (Boudry and Pigliucci 2011). Recent experimental studies have demonstrated their largely productive use in