Grammatical and pragmatic cues guide temporal comprehension in discourse

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The discourses in (a) and (b) are ambiguous—the event in the first sentences (S1) could be interpreted as preceding that in the second (S2), or vice versa. However, (a) is usually interpreted as **progression** (S1 before S2) and (b) as **backshift** (S1 after S2).

   (a) Maxine fell. Joanna helped her up.   (b) Maxine fell. Joanna pushed her.

There is a large body of formal linguistic work on these intersentential temporal relations [1-5], but little work has investigated (i) what factors modulate on-line temporal comprehension, or (ii) how strongly each factor is leveraged [6,7]. [7] argues that backshift is more costly than progression because progression is the default in discourse. This work provides self-paced reading evidence which suggests that (i) backshift may not be inherently more costly, (ii) pragmatic factors can modulate on-line temporal comprehension fairly strongly, and (iii) overt aspect marking may not be a strong modulator, despite being a highly valid cue for backshift.

Three phrase-by-phrase self-paced reading studies were run on Mechanical Turk and analyzed with linear mixed-effects models fit to residualized reading times (residualization by region length and position). Item sets were constructed so that each S1 had an S2 normed for High (H) Plausibility of backshift and one for Non-high (N) Plausibility (Plausibility = Plaus).

Expt. 1 (N=36) crossed AdvP position (Initial, Final) with Temporal Disambiguation (=TD) (Backshift (=Back), Progression (=Prog)), for 32 experimental items with N Plaus (Table 1). The design is comparable to [7], but [7] found that Backs were read slower than Progs at Spillover 1 (fig.A) for Initial and Final. This study found no difference between Initial conditions, and only a trend towards Final Backs being slower at Spillover 1 (t=1.87). This suggests that backshift is not inherently more costly, or at least that its cost is not especially large or robust.

Expt. 2 (N=43) crossed Plausibility of backshift interpretation (H, N) with TD (Back, Prog), for 32 experimental items (Table 2). All AdvPs were Final, to isolate any early effects of Plaus from effects of TD. At V+1, N-Backs were read slower than H-Backs (t=2.95). At AdvP, N-Backs and H-Progs were slower than H-Backs (t=3.23 & t=2.06). At Spillover 2, H-Progs were slower than H-Backs (t=2.34). The items in Expt. 1 and [7] had N Plaus; manipulating Plaus shows that pragmatic cues modulate temporal relation comprehension. Since H-Backs were faster than H-Progs, and since N-Backs were not slower than N-Progs, backshift is not necessarily costlier than progression. Given a sufficiently valid backshift cue, comprehenders may commit to a backshift interpretation before AdvP, resulting in a slowdown if they encounter a Prog AdvP. Plaus seems to be such a cue, though it does not unequivocally disambiguate.

Expt. 3 (N=48) crossed Aspect (Perfect had, Simple) with TD (Back, Prog), for 35 experimental items (Table 3). The had-Prog condition was omitted because it is ungrammatical. All items had Final AdvPs and N Plaus. At SubVerb, had-Backs were read faster than Simple Backs and Progs (t=3.3 & t=3.91). This may be due to the residualization overcompensating for the greater length of had-Backs at this region. At V+1, had-Backs were slower than Simple Backs (t=2.29). At Spillover 1, had-Backs were slower than Progs (t=2.04). Though had was a highly valid backshift cue in these items, its effects do not clearly suggest that it led to an early commitment to a backshift interpretation. Again, Simple Backs and Progs were not different from each other.

All three experiments suggest that backshift may not have an inherently higher comprehension cost than progression, or at least that the cost difference is not very large or robust. There seems to be a difference in how strongly pragmatic cues and grammatical cues are leveraged. Expt. 2 suggests that pragmatic cues can be leveraged fairly quickly and strongly, though they are not completely unambiguous. Expt. 3 does not clearly suggest that had is leveraged strongly, or at all, even though it is an unambiguous backshift cue in these items.

Materials. ('|' indicates phrase boundaries. Critical regions—i.e., TD regions—bolded.)
Note: All experiments had 72 fillers.

Fig. A: Region label schema

SubVerb	V+1	AdvP	Spillover 1	Spillover 2	Spillover 3
He fell asleep	in biology class	a moment earlier,	in his seat	near the back	of the lecture hall.

Table 1: Sample item from Experiment 1—AdvP Position x Temporal Disambiguation

S1:	Lianne poked Eric.	
S2:	Initial, Backshift	**A moment earlier,** | in his seat | near the back | of the lecture hall, | he pinched | her on the arm.
	Initial, Progression	**A moment later,** | in his seat | near the back | of the lecture hall, | he pinched | her on the arm.
	Final, Backshift	He pinched | her on the arm | **a moment earlier,** | in his seat | near the back | of the lecture hall.
	Final, Progression	He pinched | her on the arm | **a moment later,** | in his seat | near the back | of the lecture hall.

Table 2: Sample item from Experiment 2—Plausibility x Temporal Disambiguation

S1:	Lianne poked Eric.	
S2:	High, Backshift	He fell asleep | in biology class | **a moment earlier,** | in his seat | near the back | of the lecture hall.
	High, Progression	He fell asleep | in biology class | **a moment later,** | in his seat | near the back | of the lecture hall.
	Non-high, Backshift	He pinched | her on the arm | **a moment earlier,** | in his seat | near the back | of the lecture hall.
	Non-high, Progression	He pinched | her on the arm | **a moment later,** | in his seat | near the back | of the lecture hall.

Table 3: Sample item from Experiment 3—Aspect x Temporal Disambiguation

S1:	Lianne poked Eric.	
S2:	Simple, Backshift	He pinched | her on the arm | **a moment earlier,** | in his seat | near the back | of the lecture hall.
	Perfect had, Backshift	He had pinched | her on the arm | **a moment earlier,** | in his seat | near the back | of the lecture hall.
	Simple, Progression	He pinched | her on the arm | **a moment later,** | in his seat | near the back | of the lecture hall.

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