Sentence processing strategies of ancient scribes: Evidence from the Qumran Scrolls

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Background. Local ambiguities as in (1) have received much attention in sentence processing research. Many studies have found that the ambiguous phrase (underlined) is initially attached as the object of the first verb, and reanalysis is required upon encountering the second verb [1-3]. One prominent explanation for the initial attachment preference was offered by Frazier (1987), who proposed that at points of structural ambiguity, the parser attempts to build a minimal structure (Minimal Attachment, MA), and to incorporate the input into the phrase currently being built (Late Closure, LC) [4].

    (1) After the guests drank the wine spilled on the carpet.

Evidence for the operation of MA and LC has come from experiments measuring reading time [1-3] or targeting (mis)interpretation [5-7]. Here, **we present evidence that these principles were operative during the copying of ancient Hebrew texts, almost 2000 years ago**.

Method. Our corpus is the Great Isaiah Scroll (1QIsa[a]) found in Qumran, dated to the 2nd century BCE. The scroll is a version of the Masoretic Text (MT), i.e. the canonical, biblical version of Isaiah we know today. Presumably, an early, **unpunctuated version** of the MT was the source text for the scroll [8]. According to a recent view, the scroll was copied by two different scribes [9]. Interestingly, the scroll exhibits over 2,000 variants from the MT version, including omissions, additions and substitutions of letters and words, and word order variants. Here we focus on one type of variant, namely **additions of the conjunctive *waw* ('and').** 242 additions of this type are found in the scroll. For each of them, we coded three variables:

(i) Whether the addition of 'and' appears in the context of a (locally or globally) ambiguous verse, namely a verse where a phrase has two attachment options. Such ambiguous verses are prevalent in the source text, for two main reasons: (a) the source text lacked punctuation; (b) Biblical Hebrew presented a very flexible word order, where, among other variations, subjects could either precede or follow their verb phrase, and adverbials could appear clause initially or clause finally. For example, (2) below is globally ambiguous, since the adverb 'together' can either modify the verb in the first clause ('feed') or in the second clause ('lie down'). Verse (3) below is locally ambiguous, since the phrase 'wine' can be attached either as the object of 'will drink', or as the subject of 'will be bitter'. In the final analysis of the verse, 'wine' is the object of 'will drink'; the subject of 'will be bitter' appears post-verbally. In the context of an ambiguous verse, the added *waw* disambiguates the verse towards one reading.

(ii) Whether the addition of 'and' complies with the Masoretic reading tradition, evident from the system of cantillation marks in the MT. The cantillation system was superimposed upon the biblical text around the 8th century CE, but was arguably consolidated before 70 CE [10]. The accents have a musical function, but also syntactic significance, similarly to punctuation marks [11]. In (2) below, the accents in the MT indicate that 'together' is part of the second clause. In (3), they indicate that 'wine' is part of the first clause.

(iii) Whether the addition of 'and' complies with known sentence processing strategies, specifically MA and LC. For example, in both (2) and (3) below, the addition of the *waw* disambiguates the verse in line with MA and LC: the ambiguous element is attached to the phrase currently built, with no additional structure assumed.

Results (see Table 1). Out of the 242 additions of the conjunctive, 89 were in ambiguous verses. Out of these, 76 additions complied with MA and LC (as in 2,3 below). In 29 of these, the addition was in line with the Masoretic tradition (as in 3). Most importantly, in the other 47 examples, MA and LC overrode the Masoretic reading tradition (as in 2). Interestingly, in some cases, the compliance with MA and LC even led to anomaly or unintended meaning, which was not corrected (4). 13 additions did not comply with MA and LC. Importantly, in only 4 of those cases, the addition was also not consistent with the Masoretic reading tradition (other constraints – semantic or pragmatic – may be at work here).

Discussion. The results show that MA and LC are powerful factors in the copying of an unpunctuated text, able to override an oral tradition associated with the text. The data provide the earliest evidence, as far as we know, of the operation of these processing strategies.

(2) **Is. 11:7:** וּפָרָ֨ה וָדֹב֙ תִּרְעֶ֔ינָה יַחְדָּ֖ו יִרְבְּצ֣וּ יַלְדֵיהֶ֑ן
1QIsaª: ופרה ודב תרעינה יחדו **ו**רבצו ילדיהן

Original text: And-a-cow and-a-bear feed <u>together</u> lie down their-children
1QIsaª: And-a-cow and-a-bear feed together **AND** lie down their children
        'And the cow and the bear shall feed together; **AND** their young ones lied down'
MT: 'And the cow and the bear shall feed; their young ones shall lie down together'

Ambiguous verse: yes
Addition complies with MT reading tradition: no
Addition complies with MA and LC: yes

(3) **Is. 24:9:** בַּשִּׁ֖יר לֹ֣א יִשְׁתּוּ־יָ֑יִן יֵמַ֥ר שֵׁכָ֖ר לְשֹׁתָֽיו
1QIsaª: בשיר לוא ישתו יין **ו**ימר שכר לשותיו

Original text: In the song they will not drink <u>wine</u> will be bitter liquor to its drinkers
1QIsaª: In the song they will no drink wine **AND** will be bitter liquor to its drinkers
        'They shall not drink wine with a song; **AND** strong drink shall be bitter to them that drink it'
MT: 'They shall not drink wine with a song; strong drink shall be bitter to them that drink it'

Ambiguous verse: yes
Addition complies with MT reading tradition: yes
Addition complies with MA and LC: yes

(4) **Is. 45:5:** אֲנִ֤י יְהוָה֙ וְאֵ֣ין ע֔וֹד זוּלָתִ֖י אֵ֣ין אֱלֹהִ֑ים
1QIsaª: אני יהוה ואין עוד זולתי **ו**אין אלוהים

Original text: I am the Lord and none other <u>beside-me</u> there is no God
1QIsaª: I am the Lord and none other beside me **AND** there is no God
        'I am the Lord, and there is none else beside me; **AND** there is no God'
MT: 'I am the Lord, and there is none else; beside me there is no God'

Table 1: Summary of findings

Addition complies with MA and LC	Addition complies with MT	29 cases
	Addition does not comply with MT	47 cases
Addition does not comply with MA and LC	Addition complies with MT	9 cases
	Addition does not comply with MT	4 cases

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