Discourse Compression of Elderly Adults in a Dyadic Context

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Objectives. Elderly adults demonstrate a reduced ability to produce increasingly concise and coherent discourse with repetition when compared with their younger counterparts. We explored whether discourse efficiency and quality would increase with story retelling in a dialogic context.

Method. Participants were 30 elderly adults aged between 65 and 91 years (M = 77.03, SD = 9.214). Fifteen participants were paired with an elderly adult (EE group) and 15 with a young adult (EY group). Within their dyads, participants constructed a story from a series of cartoon frames. Variables analyzed were narrative duration, word count, fluency, and cohesion. Narratives were repeated 3 times.

Results. A compression index was calculated for each variable. For fluency and duration, the compression index for the EY group was significantly higher than for the EE group. While the EY group produced more coherent discourse with repetition, discourse cohesion did not improve with retelling for the EE group.

Discussion. A young conversational partner offers a model of consistently compressed and coherent discourse for their older interlocutor. Producing discourse in tandem with a younger adult may thus support older adults’ use of social platforms (such as SMS or Facebook) that require a highly compressed message.

Key Words: Discourse compression—Dyad—Elderly—Story retelling.

In young adults, it has been reliably demonstrated that story repetition results in the production of progressively more concise narratives without sacrificing narrative content (Field, Saling, & Berkovic, 2000; Goldman-Eisler, 1968; Saling, Laroo, & Saling, 2012). This phenomenon has been termed “discourse compression” (Field et al., 2000) and it manifests behaviorally as the use of fewer words to convey the story, a shorter narrative duration and increased fluency relative to the initial story presentation. The ability to compress discourse can be understood as a marker for efficient discourse processing as it may reflect the capacity to generate an adequate mental representation of the discourse that captures the essential story elements. The discourse representation is then progressively refined with narrative repetition.

In a previous study, we compared the discourse compression abilities of young and elderly adults (Saling et al., 2012). Relative to their younger counterparts, elderly adults were less able to produce increasingly succinct narratives with repetition. Narratives produced by the elderly cohort tended not to reduce in duration (or became longer with story retelling), did not involve fewer words with repetition, and typically did not become more fluent. Initial narratives produced by the elderly participant group were characterized by less informative content than those produced by the younger cohort. Further, while the repeated stories of young adults maintained informative content in the context of an increasingly succinct story presentation, story retelling in older adults was marked by a reduction in informative content in spite of an increase in (or maintenance of) the number of words used to convey the narrative (Saling et al., 2012).

We also compared narrative cohesion of stories produced by young and elderly adults (Saling et al., 2012). In particular, we identified instances where narratives were characterized by a lack of semantic relatedness, contradiction, repetition, and inconsistent referent use (for instance, the use of different referents to denote the same object). The narratives of elderly adults contained significantly more cohesion errors than the stories produced by young adults. Further, while narrative cohesion improved significantly with story retelling for young adults, there was no reduction in cohesion errors associated with narrative repetition in the elderly cohort.

A reduced capacity to compress discourse may result in exclusion from the use of social media (such as SMS and Facebook) as these platforms require the production of a concise, cohesive message. Given the ubiquity of such technology for socialization, exclusion can result in social isolation, which may then have a detrimental impact on psychological and cognitive function. For this reason, it is important to investigate factors that may serve to enhance the ability to compress discourse.

In the present study, we explored the impact of an interlocutor on the ability to produce increasingly concise
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found that a young conversational partner (young or elderly) on the ability of elderly adults to compress discourse with narrative repetition has not previously been investigated. However, discourse production of elderly adults has been investigated in dyadic scenarios. For instance, 

Kemper, Hummert, Kemtes, Shaner, and Se grin (1999) observed the conversations of elderly participants when paired with another elderly individual and conversations between a paired elderly participant and a young interlocutor. Social skills of elderly participants were enhanced when speaking to a young conversational partner as compared to an elderly interlocutor. The authors attributed this effect to facilitation of social ability by the young conversational partner as the elderly individuals were able to draw on topics raised by the younger interlocutor and to ask questions of their interlocutor.

Similarly, Kemper, Vandeputte, Rice, Cheung, and Gubarchuk (1995) found that a young conversational partner enhances social competence and task performance of elderly adults. The young interlocutor appears to scaffold the performance of their elderly partner by introducing ideas and phrases that can then be developed by the elderly individual. This may also play a supportive role where working memory limitations make it difficult for the elderly individual to maintain a coherent conversation. The young interlocutor may offer reminders as to what has occurred thus far in the task/conversation and how it is expected to proceed.

In the present study, we explored whether a conversational partner influences the discourse compression abilities of elderly adults. In pairs, participants and their conversational partners alternately described the story depicted in a cartoon frame. As such, each member of the pair described four of the eight cartoon frames.

We compared the discourse compression abilities of a group of elderly adults who were paired with another elderly adult (EE group) to a group of elderly adults paired with a young adult (EY group). We anticipated that the compression ability of the EY group would be significantly better than that of the EE group. In this context, we expected that the conversational partner would act as a model for the production of compressed, coherent discourse.

Compression was measured by determining the change in discourse variables (word count, duration, and fluency) from Cycle 1 to Cycle 3. We also compared the number of cohesion errors present in the discourse of the two participant groups for Cycles 1 and 3. We expected that the EE group would demonstrate a reduced capacity, relative to the EY group, to produce increasingly coherent discourse with repetition.

METHOD

Participants

Thirty community-dwelling elderly adults aged 65 years and over were recruited. Participants were divided into two groups of 15 participants each. The EE group (paired with an elderly individual aged 84 years) had a mean age of 75.5 (SD = 8.8), while the EY group (paired with a young adult aged 41 years) had a mean age of 78.47 (SD = 9.7). There was no significant difference in the mean age for the two groups. Each group was comprised of 12 females and 3 males.

The same elderly confederate told the story in conjunction with each participant in the EE group while the same young confederate was the communicative partner for each participant in the EY group. A single confederate was selected for each group in order that any between-group differences could be attributed to the age of the confederate rather than the influence of a particular confederate on the discourse produced by a particular participant.

There was no significant difference in educational level of the EY (M = 10.40, SD = 1.50) and the EE (M = 10.36, SD = 0.75) groups. There was also no significant difference in RAVLT performance between the EE (M = 35.21, SD = 10.58) and EY (M = 28.33, SD = 7.37) groups, t(27) = 2.05, p = .06.

Data from one participant from the EE group (male) was excluded from analysis as the value for the duration variable for Cycle 1 was greater than 4 SDs above the mean.

Measures and Procedure

Rey auditory verbal test.—In order to exclude memory differences as an explanation for compression differences observed between the two groups, participants completed the Rey Auditory Verbal Test (RAVLT). The RAVLT is used to measure verbal learning and memory and incorporates a list-learning paradigm whereby a list of 15 words is read to participants and they are asked to recall as many of the words as possible.

Discourse elicitation stimulus.—The “Cowboy Story” (Joanne & Goulet, 1989, see Supplementary Appendix A) was employed to elicit discourse production. This eight-frame cartoon, which depicts a story about a cowboy and his horse, was presented in black and white. All cartoon frames were presented on a single piece of paper. Participants and confederates were instructed to look at the entire sequence of cartoon frames before beginning their narratives. Participants and confederates were asked to tell the story as concisely as possible and to repeat the story three consecutive times. Cartoon frames remained visible to participants and confederates for the duration of the experiment to minimize memory effects.

Within their dyads, participants constructed narratives from the cartoon frames and repeated this story three consecutive times. The members of the pair alternated...
between cartoon frames such that each participant described a single frame followed by a description of the next frame by their conversational partner. Each member of the pair ultimately described four of the eight cartoon frames.

For half of the participants within each group, the participant described the first, third, fifth, and seventh cartoon frame, while the other half of the participants described the second, fourth, sixth, and eighth frame.

Narratives were digitally recorded and later transcribed for analysis. Audacity software (http://audacity.sourceforge.net/) was used to generate graphical representations of the narratives.

**Compression Indices**

Three indices were used to assess changes in discourse production with repetition (Field et al., 2000; Goldman-Eisler, 1968). Variables analyzed were (a) duration (the time [in seconds] taken to relate the narrative); (b) word count (number of words used); and (c) fluency (number of words uttered per second). Duration was calculated using Audacity software. Word count was determined following transcription, while fluency was calculated by dividing the total number of words by duration.

Compression indices were then calculated for each participant for each discourse variable. Of interest was the change in discourse variables between the first and third discourse cycle. Thus, compression indices for word count and duration were calculated by subtracting the scores associated with each participant’s third narrative from those of their first narrative. For fluency, the compression index was calculated by subtracting the scores for each participant’s first narrative from those of their third narrative. In all cases, a higher value for the compression index was taken as evidence of greater compression and hence a greater capacity to produce increasingly concise narratives with repetition.

**Discourse Cohesion**

Discourse cohesion was analyzed by extracting four types of cohesion errors. The four error types are those used by Joanne and Goulet (1989):

1. Repetition errors: These are associated with the semantic relatedness of different parts of the narrative and are marked by, for instance, the inconsistent use of pronouns, or referents for the same object or character.
2. Nonprogression errors: Information that has already been presented is repeated.
3. Contradiction errors: New information contradicts previously presented information.
4. Relation errors: New information is presented that has no relationship to previously presented information.

**Results**

**Compression Indices**

The values for word count, duration, and fluency represent the cumulative totals for a particular discourse cycle. That is, these values are for the four cartoon frames described by a participant. Means and SDs for Cycles 1 and 3 for the three discourse variables (duration, fluency, and word count) for the two participant groups (EE and EY) and for an elderly comparison group are presented in Table 1. Table 1 also depicts the means and SDs of the compression indices for the three discourse variables for the two participant groups.

The mean compression index for EY participants for duration was significantly higher than that for EE participants, *t*(27) = −3.30, *p* = .003. Similarly, for fluency, the EY participants demonstrated a significantly higher mean compression index than the EE group, *t*(27) = −2.87, *p* = .008. No significant difference in the mean compression indices of the two groups was found for word count.

**Comparisons With Elderly Participant Group**

Compression indices for the EY and EE groups were also compared to those of an elderly group (mean age = 73.57, *SD* = 9.73, Saling et al., 2012, see Table 1) who produced narratives in a monologic context using all eight frames of the Cowboy cartoon used in the present study. Although the comparison group described all eight frames of the Cowboy story, while the EE and EY participants described only four frames, the findings of the two studies can be compared. This is because we compared the change in the discourse variables from Cycle 1 to Cycle 3, rather than the values of the discourse variables for any particular cycle.

<table>
<thead>
<tr>
<th>Variable</th>
<th>EE</th>
<th>EY</th>
<th>Elderly group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word count</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle 1</td>
<td>94.43 (40.22)</td>
<td>69.14 (22.81)</td>
<td>100.14 (39.23)</td>
</tr>
<tr>
<td>Cycle 3</td>
<td>96.92 (39.28)</td>
<td>64.79 (20.05)</td>
<td>99.07 (34.36)</td>
</tr>
<tr>
<td>Compression index</td>
<td>−2.50 (18.87)</td>
<td>4.80 (10.38)</td>
<td>1.07 (24.73)</td>
</tr>
<tr>
<td>Duration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle 1</td>
<td>50.29 (23.06)</td>
<td>34.36 (9.42)</td>
<td>40.65 (12.77)</td>
</tr>
<tr>
<td>Cycle 3</td>
<td>49.79 (23.74)</td>
<td>24.50 (7.46)</td>
<td>37.49 (13.61)</td>
</tr>
<tr>
<td>Compression index</td>
<td>0.50 (8.78)</td>
<td>9.47 (5.60)</td>
<td>3.17 (8.58)</td>
</tr>
<tr>
<td>Fluency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle 1</td>
<td>1.94 (0.49)</td>
<td>2.17 (0.74)</td>
<td>2.45 (0.51)</td>
</tr>
<tr>
<td>Cycle 3</td>
<td>2.03 (0.50)</td>
<td>2.77 (0.77)</td>
<td>2.69 (0.48)</td>
</tr>
<tr>
<td>Compression index</td>
<td>0.10 (0.32)</td>
<td>0.60 (0.58)</td>
<td>0.24 (0.35)</td>
</tr>
</tbody>
</table>

Notes: EE = elderly adult; EY = young adult.

*The values of the discourse variables for each cycle for the elderly group are based on a story told in a monologic context describing all eight cartoon frames. The values for the EE and EY groups are derived from a story told in a dyadic context, thus involving only four cartoon frames.*
For duration, the mean compression index of the EY group was significantly higher than that of the elderly group, $t(42) = -2.57$, $p = .014$. For fluency, the mean compression index of the EY group was also significantly higher than that of the elderly group, $t(42) = -2.59$, $p = .013$. For word count, no significant difference was found. Although the mean compression indices of the EE group were lower than those of the elderly comparison group for all discourse variables (see Table 1), these differences did not reach statistical significance.

**Discourse Cohesion**

In keeping with the procedure of Joanette and Goulet (1989), the total number of errors was calculated (for Cycles 1 and 3) by adding together the four types of cohesive errors: repetition errors, nonprogression errors, relation errors, and contradiction errors. An error rate for the two participant groups was calculated by dividing the total number of errors by word count. Means and SDs of error rate for the two participant groups (EE and EY) are presented in Table 2.

Two raters identified errors in the discourse of the EE and EY groups for Cycles 1 and 3. Interrater reliability was found to be $k = 0.964$, $p = .0001$. A representative example of a repetition error in the current study was the use of pronouns in a way that did not reliably indicate the character referred to. For instance in the phrase, “the toy horse is there,” he’s still hanging onto it,” it is unclear whether the cowboy is referred to as “he” or whether “he” refers to the little boy. Nonprogression errors were characterized by repetition of information such as “boy frightens the horse,” and yeah frightens the horse” and “the cowboys knocked the stool over … and he has knocked the stool over.” Other instances of nonprogression errors were a failure to provide new information as opposed to straightforward repetition (“but the poor old feller is still sleeping, we’ll say he’s old, but I mean it doesn’t matter anyway”). Relation errors were signaled by the presentation of disconnected information. “Somewhere to tie the horse and the trough for water” was considered to be an example of a relation error. Other relation errors were instances where no causal connection was provided, “Reins in cowboy’s hand and horse runs away” (i.e., no indication of how horse was able to run away in spite of cowboy holding reins). Another example is “man is asleep with something in his hand.” No description is provided regarding how the object (reins of little boy’s toy horse) came to be in the cowboy’s hand (i.e., placed there by the little boy).

While for Cycle 1, there was no significant difference found between the error rate associated with the discourse of the two participant groups, for Cycle 3, the narratives of the EE group were characterized by a significantly higher error rate than those of the EY group, $t(27) = 3.67$, $p = .001$. For the EY group, there was a significant reduction in the mean error rate from Cycle 1 to Cycle 3, $t(13) = 5.141$, $p = .0001$, while, for the EE group, no significant change in error rate from Cycle 1 to Cycle 3 was observed.

The mean error rate of the discourse produced by the EE and EY groups in Cycles 1 and 3 were also compared to the elderly comparison group. Although the narratives of the EE group had the lowest mean error rate for Cycle 3 (when compared to the EE and Elderly groups, see Table 3), no group differences reached statistical significance.

**Confederate Data**

**Discourse variables: word count, duration, and fluency.**—Means and SDs for the three discourse variables are presented in Table 3. Discourse produced by the young confederate was characterized by a significantly lower word count for cycle 1, $t(27) = 9.06$, $p = .0001$, and Cycle 3 $t(27) = 7.34$, $p = .0001$ and duration for cycle 1, $t(27) = 8.94$, $p = .0001$ and cycle 3, $t(27) = 11.37$, $p = .0001$ than that produced by the elderly confederate. Fluency was significantly greater for the young confederate than for the elderly confederate for Cycle 1, $t(27) = -3.994$, $p = .0001$ and Cycle 3 $t(27) = -4.630$, $p = .0001$. As depicted in Table 3, there was greater variability in word count and duration of the discourse produced by the elderly confederate than for the discourse produced by the young confederate.

**Discourse cohesion.**—The discourse of the elderly confederate was characterized by a lack of cohesion as provided.

### Table 2. Means and SDs (in brackets) of error rate for the EE and EY participant groups and an elderly comparison group (Saling et al., 2012)

<table>
<thead>
<tr>
<th>Variable</th>
<th>EE</th>
<th>EY</th>
<th>Elderly group$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Errors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle 1</td>
<td>0.029 (0.018)</td>
<td>0.035 (0.027)</td>
<td>0.036 (0.049)</td>
</tr>
<tr>
<td>Cycle 3</td>
<td>0.032 (0.015)</td>
<td>0.011 (0.015)</td>
<td>0.021 (0.026)</td>
</tr>
</tbody>
</table>

*Notes.* EE = elderly adult; EY = young adult.

$^a$The values of the discourse variables for each cycle for the elderly group are based on a story told in a monologic context describing all eight cartoon frames. The values for the EE and EY groups are derived from a story told in a dyadic context, thus involving only four cartoon frames.
measured by cohesion errors (repetition errors, relation errors, and nonprogression errors were identified in the transcripts of the confederate data), while the young confederate produced only a single (nonprogression) error. An error rate was calculated for the older confederate by dividing the number of errors by word count. For Cycle 1, the mean error rate was 0.012, while for Cycle 3, the mean error rate was 0.013. The error rate for the elderly confederate for Cycles 1 and 3 for each participant is depicted in Table 4.

For the elderly confederate, a typical example of a nonprogression error was repetition of previously presented information. For instance “He’s tied the horse up…. Tied the horse up.” A representative example of a repetition error was the use of pronouns in a way that did not reliably indicate the character referred to. For example, in the same sentence, the term “he” is used to refer to the horse and to the little boy. A relation error was characterized by an indication of an effect with no antecedent cause, such as “While he’s sleeping there the horse looks a bit puzzled, the little boy comes up with a toy horse on a rein.” In this instance, there is no indication as to why the horse is puzzled.

Discussion

We compared the discourse compression abilities of elderly adults in a dyadic context when paired with another elderly adult (EE group) or with a young adult (EY group). As expected, the EY group demonstrated better compression abilities than the EE group.

Discourse Compression

The ability to compress discourse with story retelling is marked by reduced narrative duration, fewer words used to convey the narrative and an increase in fluency. We calculated a compression index to quantify changes in discourse for each discourse variable for the two participant groups.

Table 4. Error Rate for the Elderly Confederate for Cycles 1 and 3 for Each Participant

<table>
<thead>
<tr>
<th>Participant</th>
<th>Cycle 1</th>
<th>Cycle 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0.012</td>
</tr>
<tr>
<td>2</td>
<td>0.032</td>
<td>0.012</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0.026</td>
</tr>
<tr>
<td>4</td>
<td>0.012</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0.013</td>
<td>0.012</td>
</tr>
<tr>
<td>6</td>
<td>0.001</td>
<td>0.019</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0.013</td>
</tr>
<tr>
<td>8</td>
<td>0.021</td>
<td>0.013</td>
</tr>
<tr>
<td>9</td>
<td>0.012</td>
<td>0.011</td>
</tr>
<tr>
<td>10</td>
<td>0.024</td>
<td>0.013</td>
</tr>
<tr>
<td>11</td>
<td>0.013</td>
<td>0.031</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>0.013</td>
</tr>
<tr>
<td>13</td>
<td>0.021</td>
<td>0.011</td>
</tr>
<tr>
<td>14</td>
<td>0.011</td>
<td>0</td>
</tr>
</tbody>
</table>

A higher value associated with the compression index indicates greater compression.

We have previously demonstrated that elderly adults have a reduced ability, relative to their younger counterparts, to compress discourse with repetition (Saling et al., 2012). In the present study, we explored whether the presence of a conversational partner would influence the compression abilities of elderly adults with narrative retelling.

We found that the compression index for the EY group was significantly higher than for the EE group for duration and fluency but not for word count. We also compared the compression indices for the EY group with a group of elderly adults who produced narratives in a monologic context using the same discourse elicitation stimulus (Cowboy story) as was used here. For both duration and fluency, the EY group demonstrated significantly greater compression than the elderly group. When paired with an elderly partner or when producing discourse alone, elderly adults are not as good at achieving discourse compression as when discourse is produced collaboratively with a young conversational partner.

Discourse Cohesion

Discourse cohesion was assessed by determining the number of cohesion errors produced by the two participant groups for Cycles 1 and 3. An error rate was calculated by dividing the number of errors by word count.

While the discourse of the EY group became more cohesive with story repetition, discourse cohesion did not increase for the EE group with story retelling. When we compared the Cycle 3 mean error rates of the three groups (Elderly, EE, and EY), the mean error rate of the EY group was lowest, while that of the EE group was highest. Although there were no statistically significant mean differences, this trend provides further evidence for the role played by the young conversational partner in supporting conversational abilities of their elderly counterparts.

Confederate Discourse

The discourse produced by the younger confederate was characterized by a significantly lower word count and duration and significantly greater fluency than the discourse produced by the older confederate for both Cycles 1 and 3. A higher SD was associated with the compression indices for word count and duration for the older confederate, suggesting inconsistent discourse compression, when compared to the younger confederate.

While the younger confederate produced only one error in all cycles analyzed, the older confederate produced errors in the majority of cycles analyzed. The elderly participants who were paired with the younger confederate were therefore exposed to consistently compressed, connected discourse while the model provided by the older confederate was one of prolixity and a lack of cohesion.
The present findings have implications for the use of social media by elderly adults. For instance, text messages, Twitter, and Facebook involve a highly compressed format whereby a message is presented using very few words. This format may not be appropriate for older adults. An inability to engage effectively in a technological environment may result in a loss of dignity for elderly adults in the face of cognitive decline. The support of a young adult could serve to facilitate the elderly adult’s communicative competence where the production of highly compressed messages is required.

CONCLUSION
Elderly adults display a greater ability to produce succinct, connected discourse when they retell a story in conjunction with a younger conversational partner compared to when their interlocutor is another elderly adult or when they retell a story alone. By providing a consistent model of a compressed message, the young member of the dyad supported the narrative production abilities of their elderly partner.

The ability to compress discourse is thought to be underpinned by the formation of an adequate discourse representation that retains key concepts of the story (macrolinguistic features) without maintaining specific lexical or syntactic items (microlinguistic aspects). Through story repetition, the discourse representation is refined such that connections between microlinguistic and macrolinguistic features progressively diminish (Lillywhite et al., 2010). As such, with repetition, the same story can be told in a shorter time, using fewer words and with greater fluency.

A reduced ability to compress discourse with repetition, demonstrated by elderly adults as well as adults with temporal lobe epilepsy (Field et al., 2000), may therefore reflect an ineffective mental representation of the narrative. For elderly adults, producing discourse collaboratively with a younger interlocutor may facilitate the generation of an efficient discourse representation.

SUPPLEMENTARY MATERIAL
Supplementary material can be found at: http://psychsocgerontology.oxfordjournals.org/

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REFERENCES