

Toward automatic scoring and alignment of narrative recall

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Background

Narrative recall

- Part of cognitive and neuropsychological examination protocols.
- Subject listens to brief story, retells the story to the examiner.
- Score: how many items used from a list of target words and phrases.

Examples

- Wechsler Logical Memory*: diagnosis of neurodegenerative disorders, e.g., Alzheimer's related dementia [1].
- NEPSY Narrative Memory*: one of several tasks assessing neuropsychological development in children [2].

Issues

- Examiner must count target phrases in real time: difficult.
- Target list can be quite long: easy to lose track.
- Instructions allow paraphrasing: subjectivity.

Objectives

- Enhance reliability of scoring procedure with automated scoring system.
- Search for both targets and their paraphrases generated from aligned parallel corpora.
- Identify difficulties associated with automatic scoring with and without paraphrasing.

Data Overview

NEPSY

- Series of tests to evaluate neuropsychological development in children.
- Widely used in the clinical community.
- Normed on a stratified sample of 1,000 children and standardized relative to other measures such as the WISC-IV and Children's Memory Scale.

NEPSY Narrative Memory

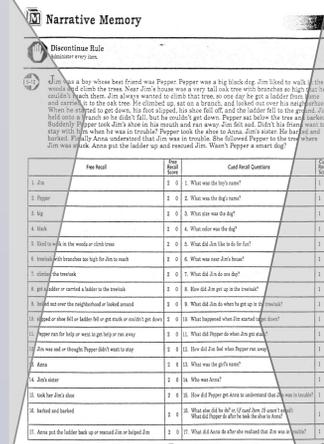
- Subject listens to and retells a brief narrative.
- Examiner notes which NEPSY targets are used by the subject.
- Score: total number of targets used by the subject during the retelling.

Subjects and data collection

- NEPSY administered to 89 children: diagnoses of autism, language impairment, and typical development; 4 to 8 years of age; non-verbal IQ > 70, using WISC-IV PRI [3] and WPPSI PIQ [4].
- NEPSY narrative memory retellings recorded and manually transcribed at the utterance level, then tokenized and downcased.
- Transcribed retellings rescored to identify every item matching a target.

NEPSY narrative

Jim was a boy whose best friend was Pepper. Pepper was a big, black dog. Jim liked to walk in the woods and climb the trees. Near Jim's house was a big oak tree with branches so high that he couldn't reach them. One day Jim decided to climb the tree. He got a ladder from home and carried it to the oak tree. When he got to the top, he looked out over his neighborhood. When Jim started to get down, his foot slipped, his shoe fell off, and the ladder fell to the ground. Pepper sat below the tree and barked. Suddenly, Pepper took Jim's shoe in his mouth and ran off. Jim felt sad. Didn't his friend want to stay with him when he was in trouble? Pepper took the shoe to Anna, Jim's sister. He barked and barked. Finally Anna understood that Jim was in trouble. She took a ladder to the tree and rescued Jim. Wasn't Pepper a smart dog?



Item	Free Recall	Guided Questions	Guided Prompts
1. Jim	1	1	1
2. Pepper	1	1	1
3. big	1	1	1
4. black	1	1	1
5. liked to walk in the woods -or- climb trees	1	1	1
6. tree/oak with branches too high for Jim to reach	1	1	1
7. climbed the tree/oak	1	1	1
8. got a ladder -or- carried a ladder to the tree	1	1	1
9. looked out over the neighborhood -or- looked around	1	1	1
10. slipped -or- shoe fell -or- ladder fell -or- got stuck -or- couldn't get down	1	1	1
11. Pepper ran for help -or- went to get help -or- ran away	1	1	1
12. Jim was sad -or- thought Pepper didn't want to stay	1	1	1
13. Anna	1	1	1
14. Jim's sister	1	1	1
15. took her Jim's shoe	1	1	1
16. barked and barked	1	1	1
17. Anna put the ladder back up -or- rescued Jim -or- helped Jim	1	1	1

Target words and phrases

- Jim
- Pepper
- big
- black
- liked to walk in the woods -or- climb trees
- tree/oak with branches too high for Jim to reach
- climbed the tree/oak
- got a ladder -or- carried a ladder to the tree
- looked out over the neighborhood -or- looked around
- slipped -or- shoe fell -or- ladder fell -or- got stuck -or- couldn't get down
- Pepper ran for help -or- went to get help -or- ran away
- Jim was sad -or- thought Pepper didn't want to stay
- Anna
- Jim's sister
- took her Jim's shoe
- barked and barked
- Anna put the ladder back up -or- rescued Jim -or- helped Jim

Scoring with Exact Match

Results

- Target list expanded to include alternatives with pronouns replacing proper names and with deleted subjects:
Jim was sad => he was sad, was sad
- grep locates 230 of the 397 items identified as matches.
- Fails to find phrases with syntactic variation (31%), lexical variation (51%), anaphora (10%), and embellishment/speech errors (8%).

I remember that Jim was a boy and his best friend was a big black dog Pepper. He liked to go in the forest, and he loved to climb trees. And there 's a tree in his neighborhood. It was a really tall oak tree. And the branches were too high and he couldn't reach them. Until one day he took a ladder, and he put the ladder up there and he climbed it. And he got on the branch. And he looked over his whole neighborhood. And he started to climb back down, and his foot slipped and he lost his shoe. And he was holding on to a branch. And then Pepper the dog sat below the tree barking. And then she grabbed his shoe and he ran away. And Jim was sad and lonely. He didn't know why his best friend didn't want to be with him when he was in trouble. And meanwhile Pepper the dog was at the house barking at his sister Anna. And and it took a long time but finally Anna understood. And she followed Pepper. And Pepper led Anna out to the oak tree. And Anna put back up the ladder, and she saved Jim.

Actual Score: 16/17, Exact Match: 8/17

Lexical variation

Anaphora

Embellishment

Syntactic variation

Scoring with Paraphrases

Monolingual paraphrasing

- Locate target in one English translation of a foreign text, and see how it was translated in another English translation of that text.

a charming young girl	a pretty young maiden
another young girl	another young woman
a young girl was riding by	along rode a damsel

- Monolingual corpus: in-domain, two different English translations of Grimm's and Andersen's fairy tales from Project Gutenberg [5]. 16K sentences, sentences aligned with Moore aligner [6], words aligned with Giza++ [7].

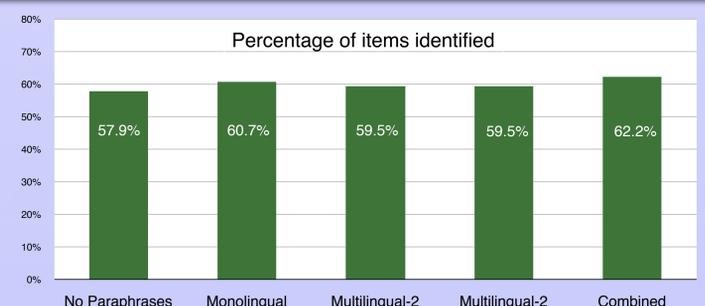
Callison-Burch multilingual paraphrasing

- Locate target on the English side of an aligned parallel corpus; pivot on the foreign translations to find English paraphrases.[8]

a young girl came into the garden	une jeune fille traversa le jardin
a beautiful slender maiden	une jeune fille d'une beauté merveilleuse
a girl walked into the garden	une jeune fille entra dans le jardin

- Multilingual-1: Out-of-domain, Europarl [9], 11 languages, 1 million sentences.
- Multilingual-2: In-domain, handcrafted English-French child-oriented freely available texts [5], 25K sentences, auto-aligned [6,7] + English monolingual parallel corpus.

Target	Monolingual - Fairy Tales	Multilingual - Europarl	Multilingual - Child-oriented Texts
climbed the tree	climbed up the tree	-none-	-none-
looked around	looking around, looked round	looked, sought	looking around, looked round, looked about
slipped	fell, jumped, capered, stripped, flew	worked	fell, jumped, flew, stripped, sprang
his sister	his little sister	her sister, his five-year-old sister	his little sister
(he) ran away	got away, ran out, off he ran, away he ran	-none-	away he ran, ran out, off he ran, escaped
(he) was sad	was grieved, was unhappy	was deplorable, was unfortunate	was sad, was much grieved
helped him	lifted him, helping, offered him	helped, has helped, help him	lifted him



Conclusions

Why such modest gains?

- Multilingual-1 (Europarl): huge corpus, but out-of-domain for this task.
- Monolingual and Multilingual-2: in-domain, but very small, and sentences auto-aligned.
- Majority of target phrases not found in any of the three corpora.

How to improve results?

- Expand in-domain corpora.
- Improve sentence alignment.
- Approximate matching.
- Match partial phrases.
- Match syntactic phrase templates.

Future work

- Use paraphrases to align original narrative to retelling: narrative coherence.
- Especially interesting for our population, which includes children with ASD and LI.

[1] David Wechsler. 1997. Wechsler Memory Scale - Third Edition. The Psychological Corporation, San Antonio, TX.
 [2] Marit Korkman, Ursula Kirk and Sally Kemp. 1998. NEPSY: A developmental neuropsychological assessment. San Antonio: The Psychological Corporation.
 [3] David Wechsler. 2003. Wechsler Intelligence Scales for Children - Fourth Edition (WISC-IV). San Antonio: The Psychological Corporation.
 [4] David Wechsler. 2003. Wechsler Primary and Preschool Scale of Intelligence - Third edition (WPPSI-III). San Antonio: Harcourt Assessment.
 [5] Michael Hart. 1997. Project Gutenberg. <http://www.gutenberg.org>.
 [6] Robert Moore. 2002. Fast and accurate sentence alignment of bilingual corpora. Springer-Verlag.
 [7] Franz Josef Och and Hermann Ney. 2003. A Systematic Comparison of Various Statistical Alignment Models. Computational Linguistics 29:1, 19-51.
 [8] Chris Callison-Burch. 2008. Syntactic constraints on paraphrases extracted from parallel corpora. In Proceedings of EMNLP 2008.
 [9] Phillip Koehn. 2005. Europarl: A Parallel Corpus for Statistical Machine Translation MT Summit 2005.
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