This paper describes a task we have designed and been using for some time now to compare outcomes of different treatment approaches. Since we have found the task useful, we wanted to share the details of its development. The task is based on a familiar real-life communicative context–ordering items from a catalog–that requires functional receptive and expressive abilities. The catalog-ordering task can be performed in either oral/aural modalities or visual/written modalities, thus providing a comparison of content across modalities. It is administered in quiet and concurrent task conditions, thus assessing performance in distracting conditions that might present more demanding cognitive challenges.

The concurrent task component of the catalog-ordering task has theoretical and clinical motivations. Attention and cognitive resources are often allocated differently when individuals are asked to perform a task in a challenging multi-task situation, and this observation extends to the performance of adults with aphasia (e.g., McNeil, Doyle, Hula & Rubinsky, 2004; Murray, 1999). Practice and the development of automaticity in any given task should free up cognitive resources and lead to improved performance of a target task under concurrent task conditions.

Clinically, then, improvement in a communication task should lead to improved performance with a concurrent task. Such a goal is also clinically desirable since most tasks are realistically performed in disrupting conditions. The ICF Checklist (WHO, 2003) acknowledges the importance of assessing whether impairment affects one's ability to perform a single task or multiple tasks concurrently. The catalog-ordering task addresses these theoretical and clinical goals.

Development of the Task

We audiorecorded an order from three major catalog ordering companies, in compliance with state laws. The event sequences and subroutines in each of the sampled catalog ordering calls were analyzed to create a prototype script (see Table 1).

Analysis of these real calls generated a list of six content categories for vocabulary (Table 2). Results of Type-Token Ratio across the three sampled ordering scripts showed that there is a limited vocabulary across naturally-occurring catalog ordering routines. Analysis of average morphemes per sentence suggested that two of the catalog ordering examples used longer forms (8 morphemes per sentence) and one used shorter forms (5 morphemes per sentence). Grammatical forms included simple declarative, compound, active and passive forms in present and future tenses. Questions were primarily modals and ellipticals.

Two phone (oral/aural) catalog-ordering scripts were developed based on these data, one using longer (14 morphemes per sentence) forms and the other using shorter (6 morphemes per sentence) forms. The scripts reflected naturally-occurring content and grammatical categories. Morpheme lengths were chosen to moderately tax skills relative to the real world to be sure that the instrument would capture relevant individual differences and changes due to different interventions. A written version of the task was also created mirroring typical mail order forms that included similar content categories (see Appendices).

A tone-detection task using a foot pedal was developed so that individuals would be able to use their hands while completing the task, yet need to execute a very different action in response to being interrupted to pursue a very different goal, as often happens in the real world.

Validity

Because the task was intended to be used with adults with aphasia, three adults with aphasia were first recruited to complete the prototype task as well as to actually make catalog orders on the phone (see description in Table 3). Error frequency and types between the actual calls and performance on the task were analyzed and results are shown in Table 4. The pattern

of errors was very similar between the actual calls and performance on the role-play task. The primary difference was that during actual calls some error types were fatal and resulted in the inability to complete the order. In the catalog-ordering task fatal errors were ignored.

Once we believed that the task could reasonably be completed by adults with aphasia and that performance on the task mirrored actual catalog-ordering performance, we finalized the script. The final task included three versions (phone version with long grammatical forms, phone version with short forms, and written/mail order version) and two conditions (single-task and concurrent-task), yielding six trials. Clothing was chosen as a common ordering category for the task overall based on its familiarity. One of six potential clothing items (pants, shirt, etc.) was randomly assigned to each trial. Additionally, "credit cards" were developed for use during the role-play. Six "credit cards" were developed that were also randomly assigned, and each "credit card" included a ten digit number that incorporated all possible digits so that all single digit names were sampled at each trial.

We then administered all six trials (three versions in two conditions) to seven adults without aphasia aged 34-59 years. All of the responses of the adults without aphasia were accurate, although there were rare self-corrections primarily on the production of the first one or two digits of the credit card number in the concurrent task condition. There was also one phonemic error ("gray leather" for "gray heather") that was self-corrected. Consequently, self-corrections were included in the highest scoring category as a result of these performances. Reaction times and total task durations were also collected.

Performance data from these adults without aphasia were used to develop the scoring system, and it is presented in Table 5.

Seven additional adults with aphasia aged 52 to 70 years then completed all six trials (see Table 6). Performance accuracy ranged from 11% to 94%. These seven adults with aphasia were also administered an additional functional communication assessment, the *CADL-2* (Holland, Frattali, & Fromm, 1999). Their performance on the *CADL-2* was relatively high overall (M = 86%, range = 78% to 98%) so it was difficult to interpret any potential relationship between performance on the catalog-ordering task and the external functional communication measure, the *CADL-2* (see Table 6). In the *CADL-2*, most items can be responded to in a fully communicative way in any modality, and that is not true for each version of the catalog-ordering. Since the real world often restricts the response modalities that are acceptable, the catalog-ordering task benefits from a certain kind of ecological validity in this regard.

In addition to differences in accuracy performance between the adults with and without aphasia, reaction times on the tone detection task also differed (see Table 7). Trial duration also was significantly different between the adults with and without aphasia (see Table 8). Performance differences between the single-task and concurrent task conditions for the adults with aphasia were inconsistent.

Reliability

Scoring reliability was assessed by having independent, trained scorers re-score half of all of the trials, randomly selected. They also re-measured total task duration and re-calculated mean reaction times for each trial. Point-to-point agreement for scoring accuracy was 92%.

Test-retest reliability was assessed by asking a different group of 15 adults without aphasia to complete the task once and repeat it six to eight weeks later. Point-to-point agreement within subjects was high (98%).

Conclusion

The catalog-ordering task holds promise as a functional assessment measure in aphasia that reveals strengths and weaknesses across modalities in a naturalistic context. It may detect changes in dual-task performance that are potentially important clinical outcomes.

Acknowledgements

References

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Table 1. Subroutines gathered from sampled catalog-ordering calls and used in the prototype script development for the catalog-ordering task.

Invariant Sequences: These subroutines appeared in the same position in each of the three sampled calls.

Opening: Introduction +"May I help you?"

Closing: Total amount to be billed, shipping time, thank you for calling)

Variant Sequences. These subroutines appeared in different positions in each of the three sampled calls, but all six subroutines appeared in each sampled call. The positions of each subroutine in each of the three calls were analyzed and the order of these subroutines in the prototype role-play script was based on the most common position.

1. Catalog number ("What is the number above the name on the back of the catalog?")
2. Phone number
3. Name (last name, first name)
4. Address (zip code, city/state, street address)
5. Credit card (card number, expiration date)
6. Order item (item number, quantity, color, size)

Table 2. Content categories and vocabulary used in actual catalog-ordering calls that served as a basis for prototype script development.

Content Categories	Vocabulary Items (Receptive and Expressive)
Personal information	Name, phone number, area code, address, city, zip code
Object names	Catalog, item, clothing item names such as 'pants' and 'shirt', credit card, expiration date, total, order.
Adjectives	First, last, color names such as 'red' and 'blue'
Category names	Color, size, quantity
Number names	Number names used in prices, number of days until item is shipped, credit card number, street address
Actions	Help, spell, deliver, start, include, bill, ship, arrive

Table 3. Participant description for the three adults with aphasia placing actual catalog-ordering calls and completing the prototype catalog-ordering task.

Participant	Age (years)	Aphasia type (*BDAE* Classification)	Aphasia severity (*BDAE* Severity Rating)
1	52	Broca's	3/5
2	23	Broca's	3/5
3	13	Anomic	4/5

Table 4. Error frequency and types between actual catalog-ordering calls and performance on the catalog-ordering task by three adults with aphasia. (Failures = Did not respond or fatal errors; Related errors = response related to preceding item but incomplete or inaccurate; Unrelated errors = responses unrelated to preceding item in script)

| Participant | Actual Call | | | | Catalog Ordering Task | | | |
| | Overall Accuracy | Error Types | | | Overall Accuracy | Error Types | | |
		Failures	Related	Unrelated		Failures	Related	Unrelated
1	17%	3	2	0	71%	2	3	0
2	95%	2	0	0	89%	0	2	0
3	100%	0	0	0	100%	0	0	0

Table 5. Scoring system for use in the catalog-ordering task. The accuracy scoring system was modeled on the 0, 1, 2 scoring system on a standardized functional communication task, the *CADL-2* (Holland, Frattali, & Fromm, 1999).

Score	Characteristics	Examples
0	No Response (NR) "I don't know" (IDK) Unintelligible response Completely unrelated to task Completely inappropriate Related to task, but not to item	answers "blue" when asked for size
1	Related to item, but incorrect Partially correct Incomplete Correct information provided in inappropriate modality	Says 'red' for 'blue' Misses one digit on credit card number Gives credit card number but not expiration date Says 'mastercard' but doesn't circle in on written version
2	Communicates information completely Appropriate to question/item Judged to be effective in real ordering situation	

Table 6. Participant description for seven adults with aphasia participating in the validity study for the catalog-ordering task.

Participant	AGE (YEARS)	GENDER	TPO (MONTHS)	SES[1]	TYPE OF STROKE[2]	LESION LOCUS[3]	APHASIA TYPE[4]	APHASIA SEVERITY RATING[5]	CADL-2 (%)
4	52	M	55	2	H	Frontal	Broca's	2	78
5	59	F	42	2	O	Fronto-pareital	Broca's	3	87
6	70	F	82	1	O	Fronto-pareital	Broca's	3	89
7	64	F	48	2	O	Fronto-pareital	Broca's	3	98
8	64	F	5	2	O	Pareital-occipital	Conduction	3	86
9	53	M	21	1	O	Temporo-pareital	Broca's	2	89
10	62	M	3	2	O	Temporo-pareital	Wernicke's	3	85

[1] SES = Socioeconomic status determined by the Four Factor Index (Hollingshead, 1975), and based on weighted contributions of educational level and occupation. 1 = Major business owners and professionals; 2 = Medium business owners, minor professionals; 3 = Skilled craftsmen, clerical, sales; 4 = machine operators, semiskilled workers; 5 = unskilled laborers.

[2] H = Hemmorhagic; O = Occlusive

[3] Based on CT and/or MRI reports.

[4] Determined by administration of the Boston Diagnostic Aphasia Examination (BDAE) or the Western Aphasia Battery.

[5] Based on the BDAE Severity Rating. 0 = No usable speech or comprehension; 1 = Communication through fragmentary expression; 2 = Conversation about familiar subjects is possible with help; 3 = Patient can discuss almost all everyday problems with little or no assistance; 4 = Some loss of fluency in speech or comprehension; 5 = Minimal discernible speech handicaps – difficulties may not be apparent to the listener.

Table 7. Mean reaction times (and ranges) on the tone detection task for each trial of the catalog-ordering task for seven adults without aphasia and seven adults with aphasia participating in the validity study.

	Participants with aphasia	Participants without aphasia
Baseline (Tone detection task alone)	486 (225-633)	355 (189-467)
Tone detection during phone version - short	625 (412-848)	458 (364-668)
Tone detection during phone version - long	649 (386-780)	481 (356-668)
Tone detection during written version	789 (370-1188)	607 (302-1117)

Table 8. Mean trial duration times (and ranges) in minutes for each trial of the catalog-ordering task for seven adults without aphasia and seven adults with aphasia participating in the validity study.

	Participants with aphasia	Participants without aphasia
Phone version – short		
Single task	4.44 (2.34-8.58)	2.36 (1.75-2.92)
Concurrent task	3.76 (2.04-5.25)	2.18 (1.50-2.46)
Phone version – long		
Single task	4.65 (2.4-7.08)	2.75 (1.92-5.00)
Concurrent task	4.92 (3.29-7.3)	2.63 (2.22-3.16)
Written version		
Single task	7.35 (3.16-10.45)	2.60 (1.75-5.00)
Concurrent task	6.88 (3.05-8.3)	3.03 (1.85-5.25)

Appendix 1. Script for the phone version (with longer grammatical forms) of the catalog-ordering task.

Examiner Item	Subject Response	Elapsed Time	Accuracy Score
1. Thank you for calling. May I help you?			
2. What is the number above the name on the back of the catalog?			
3. What is your home phone number starting with the area code?			
4. What is your last name and the spelling, please?			
5. What is your first name and the spelling?			
6. What is the zip code of your billing address?			
7. What is the city and state of your billing address, please?			
8. What is the number and street of your billing address including any apartment number?			
9. What credit card will you be using, mastercard or visa?			
10. What is your credit card number and the expiration date, please?			
11. (Repeat credit card number and expiration date back to subject)			
12. What is your first item number and the quantity?			
13. OK, that's a (incorrect item).			
14. I'm sorry - that's the (correct item). What color do you think you would like?			
15. What size would you like that in?			
16. What is your next item and the quantity?			
17. Your order total comes to (incorrect amount).			
18. I'm sorry - your order totals (correct amount), plus shipping and handling. Your package will arrive in 10 days and your credit card will be billed when the order is shipped. Thank you for calling.			

Appendix 2. Form for the written version of the catalog-ordering task.

SPECIAL CLOTHING COMPANY
1-555-5252
East Lansing, Michigan

Ship to: _____

    Last name   *First name*

_____

    Address

_____

    Apartment number

_____

    City   *State*   *Zip code*

Daytime Phone Number: (_____) _____

                      Area code

Item Number	Size	Quantity	Color	Description	Price	Total

Subtotal   _____

Shipping/Handling   _____

Total   _____

Payment By: Check   AMEX
                        Visa   Mastercard

Card Number: _____

Expiration Date: _____

Signature: _____

Your merchandise will be shipped within 24 hours of receipt of your order, and should be received within 10 days. If you are in a hurry, please contact us for rush delivery charges.