RECENT ADVANCEMENTS IN FUNCTIONAL ASSESSMENT

METHODS AND APPLICATIONS

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Functional Assessment

- "A process by which the variables influencing problem behavior are identified"
- Why conducted functional assessments?
 - We acknowledge that if a behavior is occurring, it is being reinforced
 - Functional assessments enables the client to "tell us" why they are engaging in the behavior
 - Function based treatment are more effective and rely less on punishment

Types of Functional Assessments

- Indirect assessments*
 - No direct observation of the client
 - Ratings scales (FAST, QABF), questionnaires, and interviews

• Descriptive assessments

- Direct observation of the client
- No manipulation of the environmental conditions
- ABC recording, scatterplots, etc.
- Functional analyses*
 - aka: experimental analyses
 - Direct observation of the client
 - Manipulation of antecedents and (usually) consequences

Today's Objectives

- Indirect assessments
 - Overview research on the FAST and QABF
 - Practice analyzing QABF results and designing FA test conditions
- Functional analyses
 - Overview research addressing limitations of "standard" FAs
 - Ways to decrease time required
 - How to assess dangerous behavior
 - Practice conducting functional analyses based on:
 - Latency measures
 - Precursor behavior

Indirect Functional Assessments

- Rating scales that focus on identifying common functions
 - FAST Functional Analysis Screening Tool (Iwata & DeLeon, 1996)
 - QABF Questions About Behavior Function (Matson & Vollmer, 1995)
- Reliability
 - The extent to which multiple people completing the same scale produce the same answers (item by item, function specific, etc.)
- Validity
 - The extent to which results of rating scales match those of an experimental functional analysis

Iwata & DeLeon, 1996

- Overview
 - 16 questions
 - Assesses potential functions:
 - Social positive reinforcement (attention and preferred items)
 - Social negative reinforcement (escape from demands, etc.)
 - Automatic positive reinforcement (sensory stimulation)
 - Automatic negative reinforcement (pain attenuation)
- Example questions
 - Is the client usually well behaved when he/she is not required to do anything?
 - Does the problem behavior appear to provide some sort of sensory stimulation?

Iwata & DeLeon, 1996

- Response format
 - Yes/No or N/A
- Scoring summary

Circle the number of each question that was answered "Yes" and enter the number of items that were circled in the "Total" column.

Item	<u>is Cir</u>	cled "	Yes"	<u>Total</u>	Potential Source of Reinforcement
1	2	3	4		Social (attention/preferred items)
5	6	7	8		Social (escape from tasks/activities)
9	10	11	12		Automatic (sensory stimulation)
13	14	15	16		Automatic (pain attenuation)

Iwata & DeLeon, 1996/Iwata et al., 2013

Administration procedure

- Subjects: 151 individuals diagnosed with ID or autism, ages 5-53 years
- Informants: parents, relatives, teachers, direct care staff
- One target behavior per survey
- Two informants independently completed each FAST (no more than 3 days apart)
- Part 1: Assessing Reliability
- Part 2: Assessing Validity

Iwata & DeLeon, 1996/Iwata et al., 2013

- Item by item agreement for each FAST
 - Reliability for each subject/target behavior

• Method

- Overall agreement score for each FAST
- Agreement: both saying "yes", or both saying "no"
- Calculation: agreements/(agreements+disagreements) * 100

• Results

- 71.5% (range, 28.6% to 100%)
- Moderately reliable

Iwata & DeLeon, 1996/Iwata et al., 2013

• FAST outcomes

• Function identified for each subject/target behavior

• Method:

- Function identified: the one with the most "yes" answers
- Agreement: both respondents identified the same function
- Calculation: number of agreements/total number of pairs of FASTs * 100

• Results:

- Single function: 67.1% agreement
- Multiple functions: 63.3% agreement

Iwata & DeLeon, 1996/Iwata et al., 2013

Functional analyses

- Similar to Iwata et al., 1982/1994
- Conditions: alone (or no interaction), attention, play, and demand
- Multilement design, 10 min sessions
- Subjects
 - 59 individuals, including 69 FAs (one for each target behavior)
- Data interpretation
 - Team of 5 behavior analysts, blind to the FAST outcomes
 - Reach a consensus about the function of problem behavior

Iwata & DeLeon, 1996/Iwata et al., 2013

• Comparing FA to FAST

- Complete agreement if FA matched both FASTS (score = 1)
- Partial agreement if FA matched only one FAST (score = .5)
- No agreement if FA matched neither FAST (score = 0)

FA outcome	Cases	Cases Matches to FAST	
Comparison based on all pairs of FASTs	10		
Social-positive reinforcement	18	14	77.8
Social-negative reinforcement	25	14	56
Automatic-positive reinforcement	26	16	61.5
Total	69	44	63.8
Comparison based on FASTs for which there y	was agreement on function		
Social-positive reinforcement	7	7	100
Social-negative reinforcement	11	6	54.6
Automatic-positive reinforcement	6	4	66.7
Total	24	17	70.8

Questions about Behavioral Function (QABF)

Matson & Vollmer, 1995

- Overview
 - 25 questions
 - Assesses potential functions:
 - Positive reinforcement (attention)
 - Positive reinforcement (tangibles)
 - Negative reinforcement (escape, not just from demands)
 - Automatic reinforcement (non-social)
 - Automatic reinforcement (physical)
- Example questions
 - Engages in the behavior to get attention
 - Engages in the behavior to try to get people to leave them alone

Questions about Behavioral Function (QABF)

Matson & Vollmer, 1995

- Response format
 - 4-pt Likert scale
 - X = does not apply
 - 0 = never, 1 = rarely, 2 = sometimes, 3 = often

Scoring summary

- Total score on one of 5 sets of questions
- Endorsement score (at least "rarely") on each set as well

Attention	Escape	Non-social	Physical	Tangible
1. attention	2. escape	3. self stim	4. in pain	5. access to items
6. reprimand	7. do something	8. thinks alone	9. when ill	10. take away
11. draws	12. not do	13. nothing to do	14. physical prob	15. you have
16. reaction	17. alone	18. repetitive	19. uncomfortable	20. peers has
21. "come see"	22. "leave alone"	23. enjoy by self	24.not feel well	25. "give me that"

Questions about Behavioral Function (QABF) Matson & Vollmer, 1995/Smith et al., 2012

- Reliability results have been mixed, though often in the fair to good range (e.g., Paclawskyj et al, 2001; Shogren et al., 2003)
- Validity (agreement with FAs) was 69% (Shogren et al., 2003)
- Smith et al., 2012
 - Evaluated agreement across 5 respondents on the QABF (and MAS)
 - Evaluated agreement with FA for a sample of participants
 - Participants and setting
 - 27 individuals, ages 27 to 66 years, all diagnosed with intellectual disabilities
 - Large, state-sponsored residential facility
 - Variety of target behaviors: aggression, self-injury, vocal disruption, stereotypy...
 - Respondents
 - Staff members of the facility, employed there for at least 6 months

Questions about Behavioral Function (QABF) Smith et al., 2012

- Assessing reliability
 - Agreement scored if 4 out of 5 (or 5/5) respondents agreed about the maintaining variable (highest point value)
- Reliability results
 - Agreement for 57% (24 out of 42) target behaviors
 - Perfect agreement (5/5) occurred for 17% of the behaviors

Questions about Behavioral Function (QABF) Smith et al., 2012

- Assessing validity
 - 8 participants whose QABF results showed agreement between 4/5 or 5/5 respondents
 - Target behaviors included SIB, pica, aggression, vocal disruption
 - FAs: similar to Iwata et al., 1982
 - Standard conditions + tangible for 6 individuals
 - 10 minutes
- Validity results
 - Agreement between the QABF occurred for 87% (6/7 participants)
 - One functional analysis produced undifferentiated/unclear results

Rating Scales - Best Practice

- Use rating scales to inform and supplement functional analyses
 - There is not enough evidence to suggest any one rating scale will produce valid results in most cases
- Which and how to use?
 - The QABF and FAST are the most commonly used assessments
 - The QABF has the most evidence in favor of it's use
 - Assess one target behavior at a time
 - Respondents should have at least a 6 month history with the client
 - Interview multiple respondents, independently and in a distraction free environment

Rating Scales - Best Practice

• Assess reliability

- Compare the results of multiple respondents
- Agreement is scored if the functions match (highest score)

• Red flag

• If agreement is low, you can't trust the results!

Caution flag

- If agreement is high, there is a higher probability that the results could be valid, but it is not a guarantee
- Evaluate your intervention!

- Split up into 4 teams
- Grab a packet with a hypothetical case
 - Packet will contain 5 completed QABFs

		QABF		
	Questio	ons About Behavioral 1	Function	
2	Timothy 1	R Vollmer & Johnny	L. Matson	
Student: (ase)			Staff: CG	
Target Behavior:			Date:	
	**	One behavior per form	n**	
Rat	te each question on	the following scale. S	coring on second page.	
X	0	1	2	3
Does not apply	Never	Rarely	Sometimes	Often

- 3 1. Engages in the behavior to get attention.
- O 2. Engages in the behavior to escape work or learning situations.
- () 3. Engages in the behavior as a form of "self-stimulation".
- 1. 4. Engages in the behavior because he/she is in pain.
- 0 5. Engages in the behavior to get access to items such as preferred toys, food or beverages.
- 2 6. Engages in the behavior because he/she likes to be reprimanded.
- O 7. Engages in the behavior when asked to do something (brush teeth, work, etc.)
- 0 8. Engages in the behavior even if he/she thinks no one is in the room.
- 10 9 Engages in the behavior more frequently when he/she is ill.

- Summarize and graphs the scores of each individual QABF
 - Total scores for each function

Case # Example WABF Target Behavior:

	CG 1	CG 2	CG 3	CG 4	CG 5
Attention	(4)	(\hat{D})	(1)	(2)	()
1. attention	0	0	0	0	1
6. reprimand	1	1	0	1	0
11. draws	Z	0	0	0	0
16. reaction	1	0	1	1	6
21. "come see"	0	0	0	D	0
	CG 1	CG 2	CG 3	CG 4	CG 5
Escape		(II)	9	(D)	(ii)
2. escape	3	3	3	3	2
7. do something	2	3	Z	2	3
12. not do	3	2	1	Z	3
17. alone	1	0	1	0	ð
22. "leave alone"	2	3	2	3	3
	CG 1	CG 2	CG 3	CG 4	CG 5
Non-social	0	0	0	0	0
3. self stim	6	0	0	0	0
8. thinks alone	0	0	0	0	6
13. nothing to do	0	0	0	0	0
18. repetitive	0	0	0	0	0
23. enjoy by self	0	0	0	0	D
	CG 1	CG 2	CG 3	CG 4	CG 5
Physical	0	0	0	0	0
4. in pain	0	0	0	0	0
9. when ill	0	0	0	0	0
14. physical prob	0	0	0	0	0
19. uncomfortable	0	0	0	0	0
24.not feel well	0	0	0	0	0
	CG 1	CG 2	CG 3	CG 4	CG 5
Tangible	(2)	()	(2)	()	$\langle \rangle$
5. access to items	0	0	1	0	0
10. take away	1	0	0	0	0
15. you have	0	1	0	0	0
20. peers has	0	0	1	0	1
25. "give me that"	1	0	0	1	0

- Summarize and graphs the scores of each individual QABF
 - Graph on the template provided



Summary/Hypothesized Function:

- Report to the group
 - What was the agreement?
 - If agreement was sufficiently high, what was the function(s) of the behavior?
 - Which functions should you test for in an experimental FA (based on these results?)

Functional Analysis Methodology

- Iwata et al. (1982/1994) model
 - Tested for social negative (escape), social positive (attention), and automatic
 - Included test conditions and 1 control condition, multielement design
 - Sessions were 15 minutes
 - Each social test condition consisted of:
 - An establishing operation (e.g., deprivation of attention)
 - A discriminative stimulus (e.g., different rooms, different therapists)
 - Putative reinforcer delivered contingent on the target behavior
 - Test for automatic reinforcement (alone or no interaction)
 - Establishing operation: austere environment
 - No social consequences for the target behavior
 - Control condition
 - Abolishing operation (opposite of the EOs in the test condition)
 - No social consequences for the target behavior

Commonly Mentioned Limitations of FAs

- Time Constraints
 - Session length
 - Within-session analyses
 - Limiting test conditions to only hypothesized function
 - Single-function test
 - Screening for automatic reinforcement
- Limited external validity (novel setting and therapists)
 - Trial based functional analyses in classrooms
 - Caregivers as therapist
- Risk
 - Latency measures (also saves time)
 - Functional analysis of precursor behavior

Session Length

Wallace et al., 1999

- Participants and setting
 - 46 individuals living in a state residential facility
 - All diagnosed with severe or profound mental retradation
 - Target behaivors: SIB or aggression
- FAs
 - Iwata et al., 1982
 - Demand, alone, and play conditions (plus tangible for 4)
 - Multielement design, 15 minute sessions
- Graphs prepared 3 for each FA
 - Full 15 minutes
 - 10 minutes (last 5 min deleted)
 - 5 minute (last 10 min deleted)

Session Length

Wallace et al., 1999

• Example



• Results

- Total agreement between 15min and 10 min session
- 3 disagreements between 5 min and 10/15 min sessions

Vollmer et al., 1995

- Progression from brief to extended functional analyses
- Participants and setting
 - 20 children and adolescents
 - Diagnosed with sever/profound MR, autism, cerebral palsy, Down syndrom
 - Target behaviors included SIB, aggression, hand mouthing, disruption
 - Session conducted in empty rooms at the child's school
- Functional analysis conditions
 - Based on Iwata et al.., 1982
 - Attention, tangible, escape from tasks, no interaction/no consequence, play

Vollmer et al., 1995

- Phase 1 Brief assessments
 - 8 to 10, 10-min sessions
 - Data graphed minute by minute, in a reversal design



• Identified functions in 30% of the participants



Vollmer et al., 1995

- Phase 2 Multielement FA
 - Included sessions from Phase 1, plus additional, in a multielment design



• Identified functions in additional 20% (50% total)

Vollmer et al., 1995

Phase 3 – Extended no interactions

• Series of session to test if behavior persisted in the absence of social reinforcement (i.e., was automatically reinforced)



• Identified additional 25% (75% total)

Vollmer et al., 1995



Vollmer et al., 1995

- Phase 4 Reversal design
 - If behavior extinguished in the extended no interaction sessions
 - Same FA conditions, but in a reversal design to control for interaction effects from the multielement (or perhaps lack of discrimination)



Single Function Test

Iwata et al., 2008

- Evaluate one test condition versus a control condition
 - Multielement design may be faster
 - Make sure there are salient stimuli associated with each condition type to facilitate faster discrimination



Multiple Function Tests

Iwata et al., 2008

• Evaluate multiple test conditions, but in a pairwise design



Testing for Automatic Reinforcement

Querim et al., 2013/Roscoe et al., 2013

- Observations and caregiver reports may indicate a likely automatic function for behavior
 - Occurs when the client is alone, and persists despite a lack of social reinforcement
 - Occurs across a variety of situations and seems unaltered by social contingencies
- Some types of aberrant behavior may be more likely maintained by automatic reinforcement
 - **Hand-mouthing**: automatically reinforced in 83% (Goh et al., 1995) and 98% of cases evaluated (Roscoe et al., 2013)
 - Stereotypy: automatically reinforced in 72% of cases (Beavers et al., 2013)

- Alone or no-interaction condition
 - Automatic reinforcement is evident if behavior persists in the absence social reinforcement
- Participants
 - 26 individuals, some with multiple topographies assessed (total 30 cases)
 - All diagnosed with autism spectrum disorder, intellectual disabilities, or other impairments
- Target behaviors
 - Stereotypy (70%), aggression, SIB, property destruction

- Screening
 - Series of 5-min alone or no-interaction sessions
 - Brief 2-min break in-between (walks or trips to bathroom)
 - At least 3 sessions
- Full functional analysis
 - Iwata et al., 1982 conditions
 - Alone or no-interaction, attention, play, and demand
- Data interpretation
 - Automatic function if:
 - Behavior persisted in 3 or more screening sessions
 - Behavior was highest in alone or no-interaction of full FA
 - Behavior was high in all conditions of the full FA

- Screening correctly predicted full FA results in 28 of 30 cases
 - Matched automatic functions in 21/30 cases (70%)



- Screening correctly predicted full FA results in 28 of 30 cases
 - Matched indicative of social function in 7/30 cases (23%)



- 1 miss
 - Screening indicated social
 - FA indicated automatic

- 1 false alarm
 - Screening indicated automatic
 - FA indicated attention



Querim et al., 2013

• Results

- Prevalence of automatic reinforcement function
 - Stereotypy: 89% of cases (16/18)
 - SIB: 83% of cases (5/4)
 - Less for property destruction and aggression
- Still not safe to presume stereotypy, hand mouthing, or SIB will be automatically reinforced
- Screening may save time in that a full FA may not be needed
 - If behavior persists in screening automatic reinforcement verified
 - If behavior is not occurring (or decreasing) in screening subsequent test for social functions may not need to include additional alone sessions

Time Constrains - Summary

- Decide on which conditions to evaluate
 - Consider screening for automatic reinforcement
 - If a single social function is hypothesized: test/control pairwise for that one
 - Include tangible if preliminary assessments suggest it may be a function
- Session length
 - Consider 5-min or 10-min sessions
- Design
 - Consider within-session analyses more data per session!
 - Consider reversal or pairwise if discrimination of conditions is a problem, or interaction effects are evident

Risk and Dangerous Behavior

- Consider the extent to which behavior is already occurring
- Determine if conducting a FA would increase (temporarily) the behavior
 - Kangh et al, 2015
 - Compared frequency and severity of injury during FA and on the inpatient unit
 - During the FA: .8 per participant (range, 0 to 8)
 - Outside the FA: 1.9 per participant (range, 0 to 6)
 - Severity was low in both settings, and no greater in the FA
- Consider the risk of not conducting an FA and exposing individuals to ineffective treatments

Risk and Dangerous Behavior

- Medical oversight may be necessary
 - Examination by physician/nurse before/after sessions
 - Come up with a criterion for terminating sessions (degree of injury or number of responses)
- Functional analyses variations
 - Latency based measures
 - FA of precursor behavior

Thomason-Sassi et al., 2011

- Typically, multiple instances of behavior may occur during a functional analysis
 - Rate or duration or percentage of intervals is the measure
- An alternative is latency to the first response
- Thomason-Sassi et al. compared latency based FA to full FA
- Participants and setting
 - 10 individuals diagnosed with developmental disabilities
 - Sessions conducted in therapy rooms at the school, residential program, or vocational training program
 - Target behaviors included SIB, aggression, property destruction

Thomason-Sassi et al., 2011

- Latency FA conducted first
 - Conditions similar to Iwata et al., 1982; multielement design
 - Session began when the establishing operation was in place in the test conditions
 - Attention was removed, demand was given, client left alone, or in play, when the first praise statement was given
 - Sessions terminated after first response in attention and demand, and 1 minute after a response in attention and play (so no inadvertent social reinforcement)
 - Session duration was 5-min max, 5-min break was given in-between
- Standard FA
 - 10-min sessions, similar conditions, also multielement design

Thomason-Sassi et al., 2011

• Correspondence was found in 9/10 cases



Thomason-Sassi et al., 2011

• Much fewer responses observed in the latency FA

	Late	ncy	Standard		
Subject	Function	No. of responses	Function	No. of responses	
Kate	escape	8	escape	33	
Rachel	attention	6	attention	108	
Gary	escape	3	escape	28	
Eric	automatic	29ª	automatic	398°	
Wayne	escape and attention	21	escape and attention	304	
Isaac	escape	2	escape	28	
Shane	escape	18	escape	77	
Jay	escape	3	escape	106	
Ralph	automatic	11 ^a	automatic	779 ^a	
Bart	escape and attention	7	escape	70	

* Indicates number of intervals in which responding occurred.

Practicing FA - Latency

- Split up into 5 teams
- Discuss the target behavior and note the operational definition and hypothesized function
- Design two conditions
 - 1 Test condition (establishing operation, and consequence)
 - 1 Control condition

Practicing FA - Latency

- Conditions
 - <u>Social positive</u>: begin once attention/tangibles are removed record the latency to the first response. Deliver reinforcement for 10 s.
 - <u>Social negative</u>: begin once the task/social interaction is presented record the latency to the first response. Remove the task/interaction for 10 s. <u>Automatic</u>: begin once the person is left "alone" – continue for 1 min max
 - <u>Control (play)</u>: begin once the person has access to materials and (maybe) attention, demands removed continue for 1 min max
- Conduct at least 3 sessions of each type
 - Record the latency to the first response, then move on to the next session*
- Graph your results on the data sheet
 - Note: in clinical practice, at least 5 min should elapse in-between sessions; control and alone conditions would also be longer

Practicing FA - Latency



Fritz et al., 2013, based on Smith et al., 2002

- Some serious problem behavior may be predictably precede by less severe behavior
- Functional analyses of these precursor behavior often yield the same results as the FA of the target behavior
- Interventions that change contingencies for precursor behavior have been found to decrease the more risky behavior as well
- Fritz et al. (2013) developed a method for identifying precursors
 - Then conducted FAs of both precursor and target behaviors

Fritz et al., 2013

- Participants and setting
 - 16 individuals, ages 6 to 54
 - Diagnoses: intellectual disabilities, down syndrome, autism, etc.
 - Target behaviors: property destruction, SIB, aggression
 - Sessions conducted in an observation room at a day program, or an area of the classroom at a special education school

Precursor evaluation

- Discrete trials in which antecedent conditions that might serve as establishing operations were presented (attention/demand/tangible)
- Reinforcer provided contingent on target behavior, then trial ended
- Evaluation complete after 10 instances of the target behavior
- All trial videotaped for subsequent data collection

Fritz et al., 2013

- Precursor identification
 - Observations of the video tapes
 - First to identify topographies of behavior, to form topographical definitions
 - Then to score the frequency of precursor behavior and target behavior
- Probability analyses
 - Selected precursors that often preceded the target behavior, and that did not occur when the target behavior did not occur
 - All participants engaged in one or more precursor behavior
- Precursors include:
 - Vocalizations, facial expressions, postures, repetitive movements, etc.
- Precursor evaluations took 10-min to 150-min

Fritz et al., 2013

- Functional analyses conducted for 8 individuals
 - Similar to Iwata et al., 1982
 - Conditions included: attention, demand, alone, play, and tangible
 - Sessions 10-min, evaluated in multielement design
- Conducted for precursor behavior first, then target behavior

Fritz et al., 2013

• Precursor and target behavior FAs matched in 7/8 participants



• For the remaining participant, the precursor FA identified only positive reinforcement, whereas the target behavior identified both positive and negative reinforcement functions

Fritz et al., 2013

- Treatment validity evaluation
 - Conducted a precursor evaluation
 - Then conducted a functional analysis of the precursors
 - Finally, conducted an intervention consisting of continuous noncontingent reinforcement with the reinforcer identified in the FA, then NCR thinning, then differential reinforcement of an alternative response
- Participants
 - Two from the precursor evaluation study, who did not take part in the FA comparison study
 - Both engaged in socially maintained problem behavior
 - Interventions were effective, though they had to add blocking or other procedures to break the chain of precursor-appropriate behavior.

Decreasing Risk Summary

- Evaluate the current level of behavior in the natural environment
 - Insure a functional analysis would not dramatically increase the behavior
 - Measure and document injuries, and get medical consults when needed
- Consider latency to the first response
- Consider implementing contingencies for precursor behaviors
 - Precursor analyses also evoke problem behavior
- If no instances of the behavior can be allowed
 - Consider determining precursors via caregiver interviews
 - Consider a functional analysis of appropriate responses (with the typical consequences evaluated in an FA)
 - Both can give inaccurate results however, so...
- Evaluate your intervention!

• Identify precursors

- Your "client" will identify and demonstrate both the target behavior and the precursor behaviors. Come up with operational definitions.
- Your packet includes a hypothesis on which you can design your test condition and control condition
 - Test: conduct 10 trials that include the establishing operation and consequence
 - Control: conduct a session of similar length with the abolishing operation
 - Alone/: conduct until 10 instances of target behavior or 3 minutes
- Record each instance of the precursors and the target behaviors

Precursors are behaviors that are frequently followed by the target, and don't occur frequently in the absence of the target

• Summarize the data

- a. # of trials with the target bx
- b. # of trials without the target bx
- c. # of trials with the precursor behavior
- d. # of trials without the precursor behavior
- e. # of trials with precursor that also contained target
- **f**. *#* of trials without the precursor that contained target
- **g**. *#* of trials with the target that also contained the precursor
- h. # of trials without the target that contained the precursor

- Calculating Probabilities
 - A: Conditional probability of the target, given the precursor: e/c
 # of trials with the precursor that also contained the target
 # of trials with the precursor
 - B: Conditional probability of the target, given no precursor: f/d <u># of trials without the precursor that contained the target</u> <u># of trials without the precursor</u>
 - C: Conditional probability of the precursor, given the target: g/a
 # of trials with the target that also contained the precursor
 # of trials with the target
 - D: Conditional probability of the precursor, given no target: h/b
 <u># of trials without the target that contained the precursor</u>
 # of trials without the target

Precursor Data

Case: P1: P2:

Target: Seream

Trial	P1	P2	Target
1	V	~	1
2		V	
3	~		1
4	1	~	V
5		1	
6	2	~	V
7		2	
8	~	~	~
9	V		V
10	1	1	1

Control Condition:						
Interval	P1	P2	Targe			
0-19		~				
20-39						
40-59		V				
1:00-1:19	_	V				
1:20-1:39	V		V			
1:40-1:59		V				
2:00-2:19		1				
2:20-2:39						
2:40-2:59		V				
3:00-3:19	1	V				

Interval	P1	P2	Target
0-19			
20-39			
40-59			
1:00-1:19			
1:20-1:39			
1:40-1:59			
2:00-2:19			
2:20-2:39			
2:40-2:59			
3:00-3:19			

20-s intervals

20-s intervals

✓ if the behavior occurred.

P1	P2		
8	8	a. # of trials with the target bx	
12	12	b. # of trials without the target bx	
8	15	c. # of trials with the precursor behavior	
12	5	d. # of trials without the precursor behavior	
8	5	e. # of trials with the precursor that also contained target	
0	3	f. # of trials without the precursor that contained target	
8	5	g. # of trials with the target that also contained precursor	
0	10	h. # of trials without the target that contained the precursor	

P1	P2	
1.0	, 33	A: Conditional probability of the target, given the precursor: e/c
0	,60	B: Conditional probability of the target, given no precursor: f/d
1.0	.63	C: Conditional probability of the precursor, given the target: g/a
0	. 83	D: Conditional probability of the precursor, given no target: h/b

- Determining if there is a reliable precursor
 - The probability of the target given the precursor (A) has to be higher than the probability of the target given the absence of the precursor (B)
 - The probability of the precursor given the target (C) has to be higher than the probability of the precursor given the absence of the target (D)

• If we have time, we'll also practice a functional analysis of the precursor behavior...

Example Case: Target Behavior: Denne Sellan 1 0.8 Probability 0.6 0.4 0.2 в D B С D A 0 Precursor 2 Precursor 1 Moan table Slap A: Conditional probability of the target, given the precursor B: Conditional probability of the target, given no precursor C: Conditional probability of the precursor, given the target D: Conditional probability of the precursor, given no target Precursor 1: is A > B and C>D? <u>yes/yes - likely strong preusor</u> Precursor 2: is A>B and C>D? <u>no/no not a petusor</u>