



Outline

- Reinforcement arrangements for children with ASD
 - "Conventional" preference and reinforcer assessment
 - What are we good at?
 - What remains to be understood?

> Behavioral economics: Tools for gauging stimulus value

- Demand curves
 - Demand elasticity
 - Substitutable reinforcers
 - Interaction with interventions in ASD
- Delay Discounting

Some determinants of stimulus value

- Contiguity: Reinforcer delay
- Continuity: Reinforcer accumulation
- Contingency: Historical effort and subsequent stimulus value







What's Left to Do?

- Have we nailed it?
 - Developed methods
 - Examined stability
 - Effects of motivational operations
 - Matching methods to purpose & circumstance



What's Left to Do?

- Have We Nailed It?
 - Developed methods
 - Examined stability and its determinants
 - Effects of motivational operations
 - Matching methods to purpose & circumstance
- Getting Close?
 - Do we really need a hierarchy?
 - Verbal and pictorial preference assessments
 - Preference assessments that match real work requirements or reinforcement parameters
 - Overjustification



Roscoe, Iwata, & Kahng, 1999, Journal of Applied Behavior Analysis

Verbal and Pictorial Preference Assessments

- Verbal assessments (e.g., Cohen-Almeida, Graff, & Ahearn, 2000; Northup, 2000).
 - Depends on language abilities
- Pictorial assessments (e.g., Clevenger & Graff, 2005; Conyers et al., 2002; Graff & Gibson, 2003; Graff, Gibson, & Galiatsatos, 2006)
 - Depends on picture-to-object matching abilities

11















Overjustification Effects in IDD

Q: Do extrinsic rewards decrease intrinsic motivation in persons with IDD??

- Analysis of published reinforcer assessments
 - Participants with an intellectual disability
 - ABA design with a clear reinforcement effect
 - Some responding during the initial no-reinforcement phase with at least three data points
- 65 qualifying data sets from 27 studies











Responding to Overjustification Concerns

- Reinforcement systems depend on task completion, performance quality, or both
 - These are reward procedures *not reliably* found to reduce intrinsic task interest.
 - Quality-dependent <u>verbal</u> rewards actually have a positive effect on intrinsic interest.
- Little evidence of systematic OJE in IDD
 - Effect sizes were just as likely to be negative or positive

Responding to Overjustification Concerns

- We generally do not program reinforcement for behaviors already occurring at high rates.
- Some effects may be best attributed to satiation

 Esp. when reward does increases engagement, and
 Effects are measured immediately afterwards
- Even if OJE occur, programmed contingencies:
 - Establish repertories that place the individual in contact with more frequent SR+
 - Lay groundwork for adaptive functioning

What's Left to Do?

- Have We Nailed It?
 - Developed methods
 - Examined stability and its determinants
 - Effects of motivational operations
 - Matching methods to purpose & circumstance
- Getting Close?
 - Do we really need a hierarchy?
 - Verbal and pictorial preference assessments
 - Preference assessments that match real work requirements or reinforcement parameters
 - Overjustification
- Where are the data?
 - But...does it enhance learning?
 - Ecological fitness?
 - Establishing reinforcers and transferring control
 - Determinants of reinforcer effectiveness







Does it Enhance Learning?

- Does varying reinforcers matter?
- Does choice matter?
- Does immediacy matter?
- Does schedule matter?
- Does quality matter?
- Does magnitude matter?
- Can we determine through pre-instructional assessments which child would or would not benefit from these variations.

Category of Item Used	Percentage of All Responses	Percentage of Responses: BCBA/BCaBA	Percentage of Responses: Non-BCBA/BCaBA
Social praise/attention (tickles, high-fives, etc.)	91.5	94.4	90.0
Tokens/Points	65.6	81.3	57.6
Breaks from work	65.0	77.6	58.6
Edibles	50.2	69.2	40.5
Toys	49.0	71.0	37.6
independent free play	49.0	59.8	43.3
Access to physical activities (e.g., running, sports, slayground)	37.5	42.1	35.6
Sensory items (e.g., theraband, theraputty, muscle massager, fatt)	33.8	43.0	29.0
Community-based activities	19.2	21.5	18.1









Determinants of Stimulus Value

- Behavioral Economics
 - Psychological concepts applied towards understanding human decision-making
 - Human irrationality; cognitive biases, suboptimal choice
- Behavioral Economics in Behavior Analysis
 - "...concepts from microeconomic theory are extended to the study of consumption by a range of species in the laboratory and the concepts of operant conditioning are extended to an understanding of demand for economic commodities."

Hursh, Madden, Spiga, DeLeon, & Francisco (2013)

- Choice and consumption under conditions of constraint; determinants of stimulus value

Behavioral Economics

- Why microeconomic theory in BA?
 - Many points of convergence
 - Understanding determinants of the value of goods
 - Interest in the process of choice
 - Once parallels are drawn, suggests relations heretofore only considered by economists
 - New phenomena previously ignored
 - · New functional relations previously unnamed

Behavioral Economics

- Commodities
 - Econ: Goods and services
 - B. Econ: Reinforcers

• Unit Price:

- Econ: \$\$\$ paid per unit of commodity (2.25 per gallon)
- B. Econ: Number of responses "paid" per unit of reinforcer

• Consumption:

- *Econ: Total quantity of a commodity consumed, typically at the group or population level*
- B. Econ: Total amount of a reinforcer obtained per unit time, typically at the individual level



















What Influences Elasticity of Demand?

- Constraints on income re: "luxury goods" vs. "necessary goods"
 - Demand for luxury goods is more elastic
- Open vs. closed economies
 - *The extent to you can access the commodity outside the conditions of constraint*
 - Demand is more elastic under open economies
- Availability and price of substitutable commodities
 - Demand is more elastic when substitutes are available
 - E.g. Demand for gasoline at is relatively inelastic; demand for Coca-Cola is not



















Translation: Substitution and Stimulus Value

• If problem behavior continues to be reinforced, (extinction is impracticable), and

- The schedule for appropriate behavior is thinned

- Arranges a situation analogous to:
 - Holding the cost of the reinforcer for problem behavior constant, while...
 - Increasing the cost of the reinforcer for the alternative behavior
 - In essence...a demand curve

• Applying economic analysis lets us consider ways to enhance interventions based on what influences demand curves























Yankelevitz, Bullock, & Hackenberg (2008), Journal of the Experimental Analysis of Behavior















Mean rates of responding								
Condition	Evan	Alice	Jillian	Sam				
Baseline	0.04	0.00	1.49	N/A				
Distributed	0.84	0.73	1.37	N/A				
Accumulated	1 27	1 56	1.83	N/A				

- "Handling Costs"?

DeLeon, Chase, Frank-Crawford et al. (2014), Journal of Applied Behavior Analysis

Continuity & Stimulus Value: Preference

Q: Does the delay inherent in accumulated reinforcement render it less preferred than distributed reinforcement? Does the kind of reinforcer matter?

Concurrent-chain reinforcer assessment

- Initial link choose accumulated or distributed
- Terminal link complete 10 tasks under chosen arrangement
- 5 choice trials per session

Measure

- Cumulative choices
- Food and non-food conditions







Continuity & Value Interim Summary

- Accumulated reinforcement seems preferred by learners with IDD <u>despite the inherent delay</u>
- Accumulated reinforcement mediated by tokens supports higher rates of free-operant responding <u>despite the inherent delay</u>
- *But*...
 - *Is response rate really the most relevant measure?*
 - What about the <u>amount</u> of behavior supported by the stimulus?

Continuity & Stimulus Value: Amount of work

Q: Is demand for delayed, accumulated access more or less elastic as an equal amount of immediate, but distributed access?

2 Concurrent-schedule demand curves

First series:

- Test stimulus: Increasing FR across Phases (FR1, FR2, FR5, FR10, FR20, etc.)
- Second stimulus, constant FR1

Second series:

- Token later exchangeable for test stimulus: Increasing FR across Phases (FR1, FR2, FR5, FR10, FR20, etc.)
- Second stimulus, constant FR1









Effort and Subsequent Value

- Tokens, later exchanged for accumulated activity reinforcers
 - Have the same desirable qualities as edibles
 - Lack the "undesirable qualities"
 - Appear to be just as "durable" in the face of schedule thinning
- *How does schedule thinning (unit price increases) impact the value (effectiveness) of the reinforcer?*
- The relation between historical effort and subsequent value
 - The Law of Least Effort all else being equal, organisms prefer options associated with less cost
 - But what happens later to those stimuli historically associated with greater effort?

Contingency: Effort and Subsequent Value

- Possibility 1
 - Stimuli historically associated with greater effort, by virtue of being paired with an aversive event (i.e. greater effort), lose value over time and experience
 - A negative relation between "how much one has to work" for a reinforcer and how it is subsequently valued
- Possibility 2
 - Stimuli historically associated with greater effort, once current effort is equated, are "on sale."
 - A positive relation between "how much one has to work" for a reinforcer and how it is subsequently valued

Contingency: Effort and Subsequent Value

"..such are the Tempers and dispossissions of Seamen in general that whatever you give them out of the common way, altho it be ever so much for their good yet it will not go down with them and you will hear nothing but murmurrings gainest the man that first invented it; but the Moment they see their superiors set a Value upon it, it becomes the finest stuff in the World and the inventor an honest fellow."



Captain James Cook, April, 1769



"The harder the conflict, the more glorious the triumph. What we obtain too cheap, we esteem too lightly."

Thomas Paine, The Crisis, 1776























Do you due PALE 3 or more times in the 162 M to, passes "U" Do you see PALE best han 3 times in the 1642 M to, passes "U" You have 20 seconds from the time the array appeared								
	(ERC)I	ik:te	TEPY	THEF	TLEY	PULL.	EHIC	
	0.1740 E			SYPE	FELC	1.87.612	1.000	
	11.000	11.112	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	COLUMN T	Peter-	11120	ALC: NO	
	mrev						LATE	
	111210						ALLEL, ID	
	2.1.6.5						1.12418	
	RATG				HJ. 110		POTL	
	1012.2						- ELIT	
	11.441		PTTE		The Pres		1 111.11	
	10.55	Distant P					10000	
	THE R						120 14	
	1100.9				1919		T HITSE	
	192.0				LUST		EUV2.	
	LULC				ECHY		REFERENCE	
	10122						THEFT	
	INVER:						1.111(1)	
	2121						CHIPPET	
	A.C.640						ic till 1	

Do you see P7LE less than 3 times in the list? If so, press $\Psi^{\rm I}$								
	HTTP	CIIII.	CYUT	EEVI.	UNCY	HETY	LCHT	
	PLIER			THE	IVER	PTLE	EF.IV.	
	BEIC						128087-12	
	CIDI				CLYR		ALC F	
	WILLS.	COLLE					ALC: NO.	i .
	L C WY						DOCUMPED.	i .
	401201.						PTLE	i .
	V123 B						ETT.	i .
	OT YES						- P.M. 112	i .
	PENT						T WHAT	i .
							6.311 E	i .
	STOLET.			U SO			DOT N	i .
	11.07				PTLE		CELR	i .
	WP CH-				DOLLD:		NUMBER OF T	i .
	1.1.11						1 YCE	
	$1, Y \in \Pi$			LILE			121.012	i .
	31Y			PTLE			1111	

	Rolax and w	atch your tok	ens get to 2	0. Then you	r game will	stard	
			10000		CONT. OF	-	
BC	OY IMXE	TUVI	WO ACT	CNIJ	COLLARS	DI MD	
11	HA ZOUC	FIELD	5.80.0	MODUL	CHURCH IN	JURT	
	ON EVOP	LBAT	VTEN	DEVM	Inde	LEFE	
20	HS LIVE	HINCH	CPCD	BYDT	OBJE	AABA	
CH CH	BO CHER	TVVU	ASOI.	ATDO	UBHO	PXAD	
30	A0 SHJT	BGYP	HULIC	UBJE	EYCL	HYDE	
530	K1 GEKX	EATEX	PUYR	HNOU	UIBE	SOUDY	
A1	TK LESS	OTYK.	RIGI	VIEW	C0.70	DCHV	
FD	#8 ALCS	- WOLD	TODE	HRPD		FYKK	
AT I	HV PPBV	UIBI	BPAM	TCSI	10040	VLWF	
VT.	LVI BOOWN	VARV	OCAA.	BCSX.	U.TYW	DADHID .	
EH	OF LSOY	LEHT	HISH	LETT	MIAM	LOXP	
TV.	BK TOUH	AMR.R	NAIA	CHIVY	ocruo.	0.008	
CS	EC TWYN	UO1.R	ALPD	HEOR	C028	VIRQ	
GC	RU EBUS	DICE	TOXH	XFXO	WXA.A.	JIEX	
NI I	¥3 1.¥UI	RABI	TOTAL	2123M.K.	FTPH:	0.1.00	
142	CH ITERO	OLFB	OWEQ	DELC	AEOW	ETUU	
YI	VO VRLU	HIVO	DAME D	HIGHN	CR	R.I.VN	
	THAN MADE	1.6110	W0205	HAVE	WEED	MILKO.	











Grand conclusions

- Economic analyses tell us:
 - Despite initial appearances, not all reinforcers "perform" equally
 - "Value" (reinforcer effectiveness) is not an inherent or static property of the stimulus; it depends critically on context
 - What else is available?
 - How is the opportunity to consume arranged?
 - How has it been used historically?
 - These relations can have meaningful implications, on the individual level, in applied contexts

Review References

Hursh, S.R., Madden, G.J., Spiga, R., DeLeon, I.G., & Francisco, M. T. (2013). The translational utility of behavioral economics: The experimental analysis of consumption and choice. In G. Madden, W.V. Dube, G. Hanley, T. Hackenberg, and K.A. Lattal (Eds.) *American Psychological Association Handbook of Behavior Analysis*. Washington, DC: American Psychological Association.

- Reed, D.D, Nileksela, C.R., & Kaplan, B.A. (2013). Behavioral economics: A tutorial for behavior analysts in practice. *Behavior Analysis in Practice*, 6, 34-54
- Francisco, M. T., Madden, G.J., Borrero, J.B. (2009) Behavioral economics: Principles, procedures, and utility for applied behavior analysis. *The Behavior Analyst Today*, *10*, 277-294.

deleon@ufl.edu