Analysis of Gambling Behavior

Volume 10

Article 1

2016

Annotated Bibliography of Behavior Analytic Scholarship Outside of *Analysis of Gambling Behavior*: 2013-2015

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Recommended Citation

Costello, Mack S.; Whiting, Seth W.; Hirsh, Jamie L.; Deochand, Neil; and Spencer, Taylor (2016) "Annotated Bibliography of Behavior Analytic Scholarship Outside of *Analysis of Gambling Behavior*: 2013-2015," *Analysis of Gambling Behavior*: Vol. 10, Article 1. Available at: https://repository.stcloudstate.edu/agb/vol10/iss1/1

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Analysis of Gambling Behavior; 2016, 10, 1-10

Annotated Bibliography of Behavior Analytic Scholarship Outside of *Analysis of Gambling Behavior*: 2013-2015

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Previous scholarly reviews have summarized behavior analytic gambling literature up to 2012 and have identified *Analysis of Gambling Behavior* as the primary journal for such scholarship. This article includes an annotated bibliography of behavioral literature centered on gambling and related issues published outside of *Analysis of Gambling Behavior* from 2013 to 2015.

Analysis of Gambling Behavior has been the primary outlet for behavior analytic research on the topic of gambling since the journal began publication in 2007 (see Dixon, Whiting, Gunnarsson, Daar, & Rowsey, 2015; Witts, 2013). Scientific research on gambling is of interest to clinical and research professionals from many disciplines (Dixon et al., 2015), so a proportion of scholarship in this area is published across several other journals. Considering the spread of scholarship published across journals, annotated bibliographies on gambling research may hold particular utility to readers of Analysis of Gambling Behavior. An annotated bibliography can be a resource for researchers, and acts as a hub of relevant literature that goes beyond the often singular content of meta-analyses and other literature reviews (Carr, Nosik, Lechago, & Phillips, 2015). There has been additional precedent for annotated bibliographies to be published on several topics in behavior analysis (e.g., Carr et al., 2015; Rapp, Carstensen, & Prue, 1983).

An annotated bibliography of behavior analytic gambling literature published outside of Analysis of Gambling Behavior between 2013 and 2015 is presented herein. Previous reviews have summarized behavioral gambling literature until 2012 (Dixon et al., 2015; Witts, 2013). Two procedures were used to identify articles for this annotated bibliography. First, the authors reviewed article titles in behavioral journals likely to publish work on gambling behavior (adapted from Carr & Briggs, 2010). The journals selected were those used in previous reviews of behavior analytic gambling literature through 2012 (i.e., Dixon et al., 2015; Witts, 2013), with three additions. Similar to Dixon et al. (2015), the present search included Journal of Applied Behavior Analysis, Journal of the Experimental Analysis of Behavior, The Analysis of Verbal Behavior, The Behavior Analyst, and The Psychological Record. Behavior Modification and Behavior Research Methods were also included in a former review by Witts (2013) and were, thus, incorporated into the present search. These lists were further expanded to include Behavior Analysis in Practice, Behaviour Research and Therapy, and Behavior Analysis: Research and Practice (and its previous title The Behavior Analyst Today). Within these outlets, authors searched for the following keywords indicative of gambling content: gambl(ing), slot machine, poker, roulette, blackjack, bet(ting), and wager.

Second, because gambling is a phenomenon of interest across several scientific perspectives (Fantino, 2008), common authors of behavior analytic gambling work were searched in Google Scholar to find articles in publications outside the searched behavior analysis journals. Authors identified as accounting for a large proportion of scholarship in the Dixon et al. (2015) review were searched. These were M. R. Dixon and J. N. Weatherly. In the case of J. N. Weatherly, a Google Scholar profile was utilized to search articles published between 2013-2015. In the case of M. R. Dixon, Google Scholar was used for a search and was checked against a curriculum vitae requested and obtained by one of the authors.

The searches described above produced a list of articles for potential inclusion in the bibliography. The authors then used a consensus approach to determine the relevance of each article for inclusion in the final bibliography. Several articles utilized correlational and other non-experimental methods, and two articles reported on neurological responses. These articles were included because of the behavior analytic (or functional contextual) theory implicated. In sum, the article identification process resulted in 22 journal articles for inclusion. In the future, these and other methods can be used to generate other criteria for inclusion, such as additional author searches, or examining articles that cite behavior analytic work in and outside of *Analysis of Gambling Behavior*. The annotated bibliography appears below on behavior analytic gambling literature outside of *Analysis of Gambling Behavior* for 2013-2015.

ANNOTATED BIBLIOGRAPHY

Bordieri, J., Dixon, M. R., Loukus, A. K., & Bordieri, M. (2013). The effect of financial contingencies on golf performance. *Journal of Applied Sport Psychology*, 25, 92-105. doi: 10.1080/10413200.2012.684833

In this study, the authors examined the effects of monetary contingencies on golf performance for four participants by comparing contingencies for earning or losing money based on performance (analogous to the practice of betting on golf). The authors found that for the three novice participants, monetary contingencies were detrimental to performance. For the one professional golfer, the contingencies did not affect performance. The authors discussed how financial contingencies affect performance.

Cookman, M. L., & Weatherly, J. N. (2015). Investigating possible effects of ethnicity and age on gambling as an escape. *Journal of Gambling Studies* (in press). doi: 10.1007/s10899-015-9555-9

In this study, the authors examined potential risk factors (i.e., ethnicity and age) for disordered gambling by comparing those factors and measures of gambling in a sample of 315 adults. The authors found an interaction between age and ethnicity, in which, for the 36-55 year age group, non-Caucasian participants generally had higher scores for disordered gambling on one of the measures. Additionally, for all participants, gambling for escape significantly predicted disordered gambling. The authors discussed the identification of risk factors and interactions among them for treatment professionals.

Dixon, M. R., Whiting, S. W., Gunnarsson, K. F., Daar, J. H., & Rowsey, K. E. (2015). Trends in behavior-analytic gambling research and treatment. *The Behavior Analyst.* doi: 10.1007/s40614-015-0027-4

The authors compiled gambling-related articles printed in behavior-analytic journals between 1992 and 2012, and reviewed and reported on observed trends in the publications. Of the 108 articles that met the inclusion criteria, the authors reported that the vast majority of articles were empirical rather than conceptual. Approximately half of the research included compensation contingent on gambling outcomes. Despite an increasing rate of published gambling literature, the authors noted a paucity of treatment research. The authors discussed the state of the field and suggested directions for future research and treatment efforts.

Dixon, M. R., Wilson, A., & Habib, R. (2014). Neurological correlates of slot machine win size in pathological gamblers. *Behavioural Processes*, 104, 108-113. doi: 10.1016/j.beproc.2014.02.007

In this study, the authors examined the fMRI scans of 22 participants while the participants watched outcomes on a simulated slot machine. The authors found that large wins on the simulation produced more neural activation in the dopaminergic pathway for participants identified as pathological gamblers compared to participants identified as non-pathological gamblers. The authors discussed the observed dosage effect in relation to those in chemical addictions, and potential behavioral mechanisms underlying the different neurobiological effects.

Dymond, S., Lawrence, N. S., Dunkley, B. T., Yuen, K. S. L., Hinton, E. C., Dixon, M. R., . . . Singh, K. D. (2014). Almost winning: Induced MEG theta power in insula and orbitofrontal cortex increases during gambling near-misses and is associated with BOLD signal and gambling severity. *NeuroImage*, 91, 210-219. doi: 10.1016/j.neuroimage.2014.01.019

In this study, the authors examined the BOLD-fMRI brain scans and magnetoencephalography (MEG) of participants while those participants interacted with a slot machine task. The authors hypothesized that, consistent with previous research, overlap in the BOLD and MEG response measures would be found for both wins and near-misses for participants categorized as pathological gamblers. The authors found that, consistent with their hypothesis, across both wins and near-misses, reward circuitry (also implicated in reinforcement) was active, and increased activity for near-misses was associated with pathological gambling.

Rachlin, H., Safin, V., Arfer, K. B., & Yen, M. (2015). The attraction of gambling. *Journal of the Experimental Analysis of Behavior*, *103*, 260-266. doi:10.1002/jeab.113

The authors presented a behavioral model of gambling related to delay discounting. They conceptualized gambling as strings of losses followed by wins, which necessarily include delays to winning. The authors posited that objectively negative-valued games can be subjectively positive as longer strings of losses with greater delays to wins are discounted in value. Per this model, the steeper delay discounting curves are, the greater the subjective value of gambling is to the gambler.

Schmidt, B., & Hewig, J. (2015). Paying out one or all trials: A behavioral economic evaluation of payment methods in a prototypical risky decision study. *The Psychological Record*, 65, 245-250. doi: 10.1007/s40732-014-0112-1

In this study, participants selected among two options with equal expected value, but several differing levels of risk (A: win 11 cents or 0 cents vs. B: win 7 cents or 4 cents, etc.). Participants' choices were compared in a within-subjects design; in one condition, the outcome of each trial was paid out, and in a second condition, the total payment was based on the outcome of one randomly-selected trial. The authors found risky choices were more likely in the former condition, and these results corresponded with choices on a questionnaire with hypothetical risks. The authors discussed the results and implications in a behavioral economic framework.

Smith, D. P., Battersby, M. W., Harvey, P. W., Pols, R. G., & Ladouceur, R. (2015). Cognitive versus exposure therapy for problem gambling: Randomised controlled trial. *Behaviour Research and Therapy*, 69, 100-110. doi: 10.1016/j.brat.2015.04.008

In this study, the experimenters examined the effects of therapies by comparing cognitive therapy and behavior therapy conditions in a randomized trial with 87 participants. A self-report outcome measure was used at baseline, treatment-end, and follow ups. The experimenters found that both therapies were comparably effective. The authors discussed the conceptual and applied implications of these findings and noted that large-scale trials are needed to compare the therapies.

Speelman, R.C., Whiting, S. W., & Dixon, M. R. (2015). Using behavioral skills training and video rehearsal to teach blackjack skills. *Journal of Applied Behavior Analysis*, 48, 632-642. doi:10.1002/jaba.225

In this study, four individuals attempted to win hypothetical credits playing blackjack in a simulated casino, and then learned a technique for counting cards and adjusting bet sizes via a behavioral skills training procedure. Employing the techniques from the training, three participants then won significantly more hypothetical credits in the second simulation. The study utilized a multiple baseline across participants. The authors discussed implications for recreational, non-problem gamblers.

Thomas, K. B., Derenne, A., & Weatherly, J. N. (2015). Delay and probability discounting in the context of gambling function and expectancies. *Journal of Gambling Issues, 30*, 35-56. doi: 10.4309/jgi.2015.30.6

In this study, the authors examined the relationship between delay and probability discounting and the Gambling Functional Assessment-Revised (GFA-R; Weatherly, Miller, & Terrell, 2011) and Gambling Expectancies Questionnaire. Two hundred seventy-two participants completed questionnaires. The authors found that gambling for positive reinforcement on the GFA-R was the best predictor of discounting.

Weatherly, J. N., Aoyama, K., Terrell, H. K., & Berry, J. C. (2014). Comparing the Japanese

version of the Gambling Functional Assessment-Revised to an American sample. *Journal of Gambling Issues*, 29, 1-20. doi: 10.4309/jgi.2014.29.4

In this study, the authors examined the validity of the GFA-R by comparing endorsements from a sample of 126 Japanese university students to 133 USA university students. The authors employed a confirmatory factor analysis and found that the structure of the GFA-R fit the Japanese student data well. Problem gambling measures correlated with the escape subscale in the GFA-R for the Japanese sample, but the difference between subscales was small. The authors discussed the potential utility of the GFA-R for use in Japan.

Weatherly, J. N., & Bogenreif, D. (2013). Measuring the contingencies maintaining gambling behavior in a sample of non, light, and heavy smokers. *Journal of Addictive Behaviors, Therapy, and Rehabilitation, 2*, 4pp. doi: 10.4172/2324-9005.1000108

In this study, the authors examined the relationship between self-reported smoking magnitude and endorsement of gambling for positive reinforcement or escape with the GFA-R. The participants were grouped as non(n=45), light(n=49), and heavy smokers(n=29). The authors found that endorsement of gambling for escape varied as a function of smoking magnitude, suggesting that smoking more and gambling for escape were related.

*This article's first author sent the article to the authors of the annotated bibliography. The article is indexed in Google Scholar, but the website repository was no longer available at the time of this manuscript.

Weatherly, J. N., & Cookman, M. L. (2014). Investigating several factors potentially related to endorsing gambling as an escape. *Current Psychology*, *33*, 422-433. doi: 10.1007/s12144-014-9220-y

In this study, the authors examined several factors related to disordered gambling and their relation to endorsing gambling as escape with the GFA-R. Three hundred eleven participants completed several different gambling questionnaires. The authors found that endorsing escape on the GFA-R was strongly associated with reporting gambling problems. The authors discussed that escape may be a factor that links disordered gambling and substance abuse, and that escape may be related to affect.

Weatherly, J. N., Dymond, S., Samuels, L., Austin, J. L., & Terrell, H. K. (2014). Validating the Gambling Functional Assessment-Revised in a United Kingdom sample. *Journal of Gambling Studies*, 30, 335-347. doi: 10.1007/s10899-012-9354-5

In this study, the authors examined the validity of the GFA-R by comparing endorsements from a sample of 274 UK university students to 201 USA university students. The authors employed a confirmatory factor analysis and found that the structure of the GFA-R fit the UK student data well. Problem gambling measures correlated with the escape subscale in the GFA-R for the UK sample. The authors discussed that the GFA-R is a valid measure for use in the UK.

Weatherly, J. N., & Miller, K. B. (2013). Exploring the factors related to endorsing gambling as

an escape. International Gambling Studies, 13, 52-64. doi: 10.1080/14459795.2012.703214

In this study, the authors explored factors related to endorsing gambling as an escape across two studies. In the first study, 149 participants completed an executive function questionnaire and the GFA-R. The authors found that escape was predicted by affect. In the second study, 269 participants completed the GFA-R and measures related to affect. The authors found that impulse control related to negative emotions predicted gambling as an escape, suggesting the possibility of endorsement of gambling as an escape being related to emotion regulation.

Weatherly, J. N., Terrell, H. K., & Bogenreif, D. (2013). Testing the internal consistency and construct validity of the Gambling Functional Assessment-Revised in a general population sample. *Modern Behavioral Science*, 1(1), 37-48.

In this study, the authors examined the psychometrics of the GFA-R in a general population sample. Two hundred ninety-two participants were recruited to complete the GFA-R and problem gambling measures. The authors found that, consistent with other research, the GFA-R was a god fit for the data and the GFA-R escape subscale predicted problem gambling data. The authors discussed the GFA-R and the association between gambling and escape.

Whiting, S. W., & Dixon, M. R. (2013). Effects of mental imagery on gambling behavior. *Journal of Gambling Studies*, 29, 525-534. doi: 10.1007/s10899-012-9314-0

In this study, the authors examined whether engaging in mental imagery of gambling would satiate gambling-related reinforcers. Thirty-one participants completed one of two mental imagery tasks; these tasks involved either repeated trials playing a slot machine or putting coins into a laundry machine. Following those tasks, participants had an opportunity to play an actual slot machine until they opted to stop. The group who engaged in mental imagery of slot machines gambled significantly fewer trials. The authors discussed the relationship between imagery, motivating operations, and related treatment components.

Whiting, S. W., & Dixon, M. R. (2015). Examining contextual control in roulette gambling. *Journal of Applied Behavior Analysis, 48*, 204-208. doi: 10.1002/jaba.182

The authors replicated previous research that demonstrated biased betting patterns following a greater-than/less-than relational training procedure, but with roulette gambling rather than slot machine gambling. Twelve participants made a series of red/black bets, then completed a relational training procedure which established the color they bet on fewer times as a contextual cue for more-than and vice versa. During the roulette post-test, a vast majority of participants increased betting on the color that shared color properties with the more-than contextual cue. The authors discussed the importance of verbal behavior in gambling research.

Wilson, A. N., & Dixon, M. R. (2015). Derived rule tacting and subsequent following by slot machine players. *The Psychological Record*, 65, 13-21. doi: 10.1007/s40732-014-0070-7

In this study, the experimenters examined how self-rules affect slot machine play choices. Participants wagered red or silver coins on a slot machine displaying three arbitrary symbols above the play area. After completing a conditional discrimination training procedure that established equivalence of the arbitrary symbols and the words "play red (or silver) coins," all correctly identified this rule and five of six engaged in betting patterns that indicated following the rule. The authors discussed the conceptual and applied implications of these findings in terms of verbal behavior and rule governance.

Wilson, A. N., & Grant, T. (2015). Implications of derived rule following of roulette gambling for clinical practice. *Behavior Analysis in Practice*, *8*, 52-56. doi: 10.1007/s40617-014-0029-9

In this study, the experimenters examined the effects of self-rules on roulette gambling choices and the subsequent maintenance of those effects. Six participants placed bets on red or black in a simulated roulette game, above which three arbitrary symbols were posted. Following a conditional discrimination training procedure that established equivalence between the arbitrary symbols and the words "bet on black (or red)," five of six participants correctly stated this rule and all participants bet more on the color corresponding to the rule in the roulette post-test and in a one week follow-up session. The authors discussed working with potentially harmful self-rules in treatment.

Witts, B. N., Ghezzi, P. M., & Manson, M. (2015). Simultaneously observing concurrentlyavailable schedules as a means to study the near miss event in simulated slot machine gambling. *The Psychological Record*, 65, 115-129. doi: 10.1007/s40732-014-0095-y

In this study, the authors examined conditioned reinforcement of contextual background colors for slot machine tasks. Concurrently-available tasks with different win schedules were compared for 29 participants in a procedure termed "simultaneous observing." In this procedure, participants had to first demonstrate that they had discriminated the tasks with the relevant background colors, then could engage in a button-pushing response to bring the hidden background colors into vision, and therefore know which schedule each task was associated with. Two experiments were employed to examine potential reinforcement effects of background color with wins and near misses. The authors found that conditioned reinforcement effects appeared for background color associated with higher win frequency, but did not find a reliable effect for the higher near-miss frequency. The authors discussed limitations and conditioned reinforcement effects in near-misses.

Zentall, T. R., Laude, J. R., Stagner, J. P., & Smith, A. P. (2015). Suboptimal choice by pigeons: Evidence that the value of the conditioned reinforcer rather than its frequency determines choice. *The Psychological Record*, *65*, 223-229. doi: 10.1007/s40732-015-0119-2

In this study, the experimenters examined whether pigeons chose, in an analogue to gambling, stimuli that had been previously associated with the greatest reinforcement probability, independent of the frequency of the reinforcement, or "win", in the current context. A between-

groups design was employed in which the suboptimal choice resulted in a probability of the stimuli always presented with reinforcement and the optimal choice always resulted in presentation of a stimulus associated with 75% reinforcement. The experimenters found that for both groups, pigeons chose sub-optimally. The authors discussed the conceptual processes that account for the effect and extensions to human gambling behavior.

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