Finding the Right Auxiliary Information for Nonresponse Adjustment Models

In Search of Zs with Desirable Properties

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Outline

- What we are (usually) doing wrong
- What we should aim to be doing
- What we can be doing

1. Nonresponse adjustment models are generally bad

Lack of Auxiliary Information in Household Surveys

- Few studies report model fit for nonresponse weight adjustment models
  - Generally poor model fit in general population surveys, relying on aggregate information (e.g., Census Block Group level)
  - Exceptions to this can be undesirable. Variables endogenous to nonresponse are strong “predictors” of nonresponse and can do more harm than good (more on this in a moment)
- Effort to use advanced statistical methods (e.g., machine learning algorithms) to identify complex interactions are limited by the lack of auxiliary information with desirable properties

2. Focus on explaining nonresponse is misplaced

Common Nonresponse Adjustments Model Participation

- Strongest predictors of nonresponse generally do not help with bias reduction
  - Refusal on a prior call/contact attempt, number of calls/contact attempts (Wagner, Valliant, Hubbard, and Jiang, 2014)

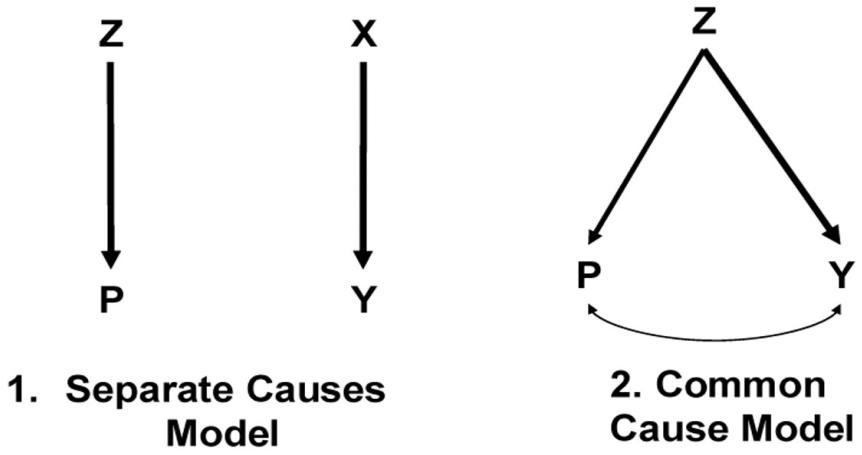
- Associations with nonresponse but not with survey variables of interest unduly increase the variance estimates (Little and Vartivarian, 2005)

	Association with outcome	
Association with nonresponse	Low	High
Low	Bias: --- Var: ---	Bias: --- Var: ↓
High	Bias: --- Var: ↑	Bias: ↓ Var: ↓

3. Commonly used auxiliary information lacks desirable properties

Desirable Properties

- The ideal “Z” variable: an indicator for a common cause of both likelihood to respond and the survey outcome of interest



Note: Partial figure.

Source: Groves, R. M. (2006). Nonresponse rates and nonresponse bias in household surveys. *Public Opinion Quarterly, 70*(5), 646-675.

Challenge in Practice

- The objective is seldom met in practice. Auxiliary variables tend to be associated with EITHER nonresponse OR survey variables

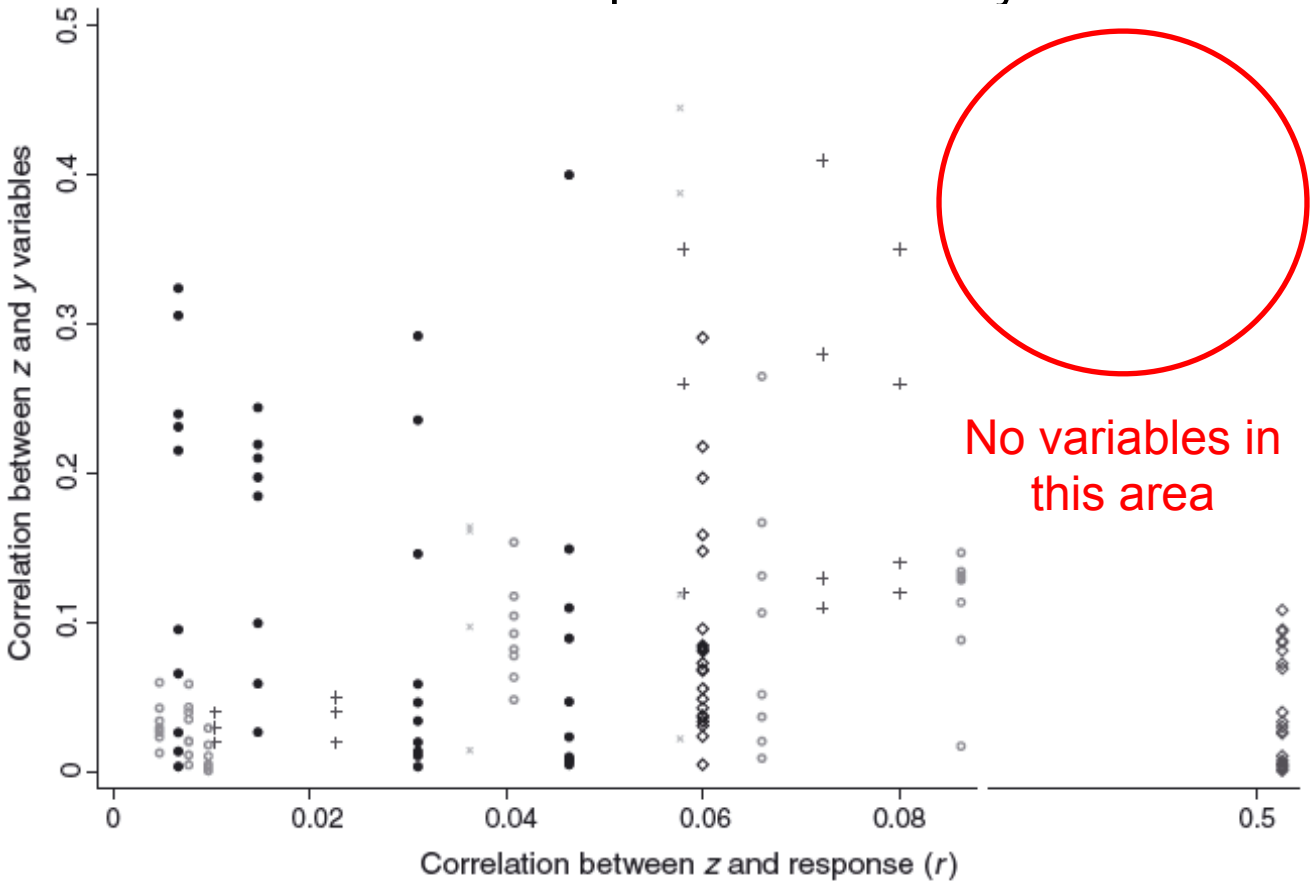


Fig. 1. Relationship between the correlation of z- and y-variables and correlation of z and response in five surveys (all correlations are shown as absolute values): +, UMTRI; ×, MEPS; ○, ESS; ◇, ANES; ●, NSFG

Source: Kreuter, F., Olson, K., Wagner, J., Yan, T., Ezzati-Rice, T. M., Casas-Cordero, C., . . . Raghunathan, T. E. (2010). Using Proxy Measures and Other Correlates of Survey Outcomes to Adjust for Nonresponse: Examples from Multiple Surveys. *Journal of the Royal Statistical Society, Series A (Statistics in Society), 173*(2).

4. Promising avenues for improvement

Potential for Improving Nonresponse Adjustments

- Designed paradata
  - Interviewer observations
  - Proxy reports
- Embed survey content for weight calibration
  - Consider calibration beyond traditional demographic characteristics
- Administrative data
  - E.g., student information
- Statistical methods
  - E.g., tree-based methods (limited utility depending on auxiliary data)
  - Multiple imputation for unit nonresponse, particularly for swiss-cheese pattern of missing auxiliary data and improved efficiency

Designed Paradata

- National Survey of Family Growth's interviewer observations of sexual activity (used in nonresponse weighting adjustments)

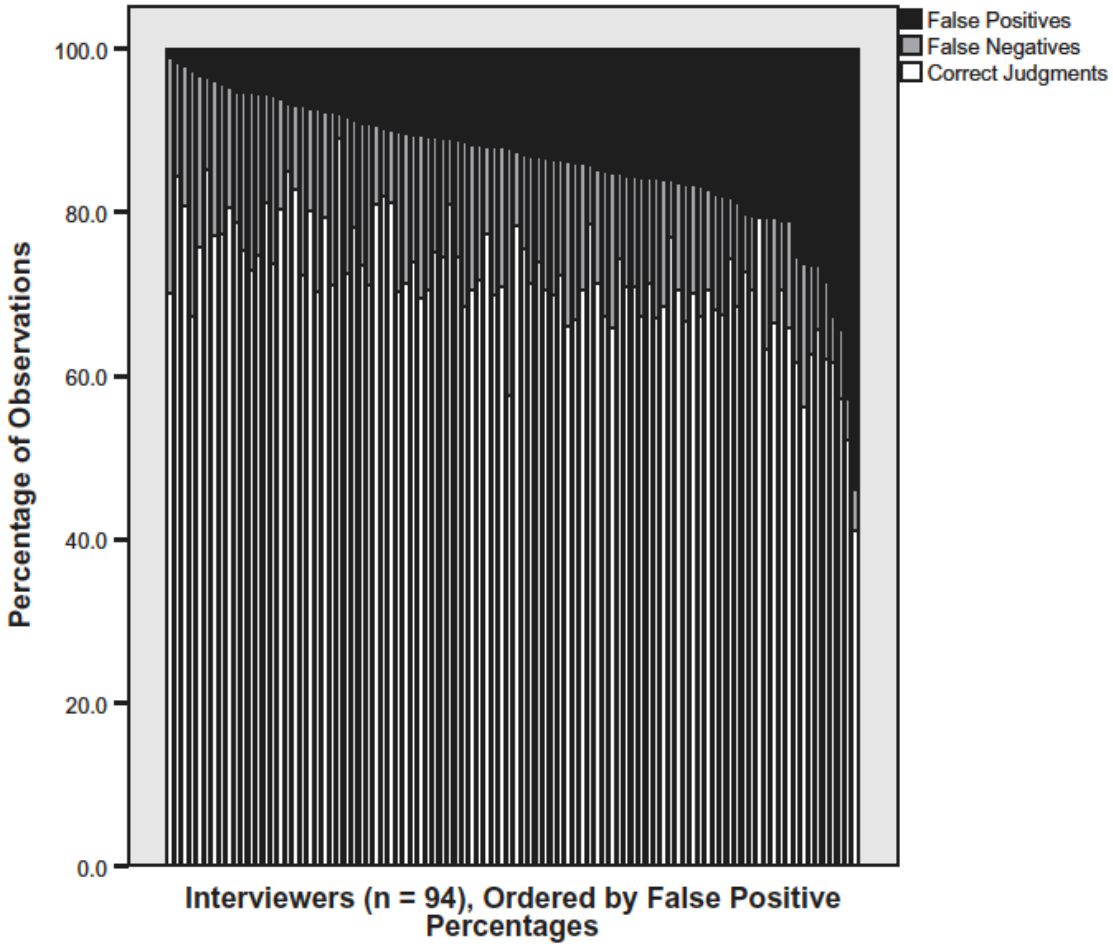
Table 3. Accuracy Rates for the Interviewer Judgments of Current Sexual Activity in the Last Four Quarters of the NSFG (2006–2010).

	Quarter 13	Quarter 14	Quarter 15 (I)	Quarter 16 (I)
Accuracy rate	0.7709	0.7700	0.7809	0.7915
False positive rate	0.5732	0.5989	0.4514	0.5380
False negative rate	0.1328	0.1249	0.1488	0.1124

Source: West, B. T., & Kreuter, F. (2014). A Practical Technique for Improving the Accuracy of Interviewer Observations of Respondent Characteristics. *Field Methods*.

Designed Paradata

- Interviewer variance in interviewer observations



Source: West, B. T., & Kreuter, F. (2013). Factors Affecting the Accuracy of Interviewer Observations: Evidence from the National Survey of Family Growth. *Public Opinion Quarterly, 77*(2), 522-548.

Designed Paradata—Another Cautionary Tale

- 2015 California Health Interview Survey
  - Two-stage design with screener and main interview
  - Ask about health conditions for each selected household member (often a proxy report)
- Found substantial measurement error in the screener reports
- Measurement error was correlated with nonresponse
- Underreporting was correlated with nonresponse

Source: Peytcheva, E., Peytchev, A., Currivan, D. & Jans, M. (2017). Measurement error in proxy measures of key survey variables to estimate, reduce, and adjust for nonresponse bias. Paper presented at the ESRA annual conference, Lisbon.

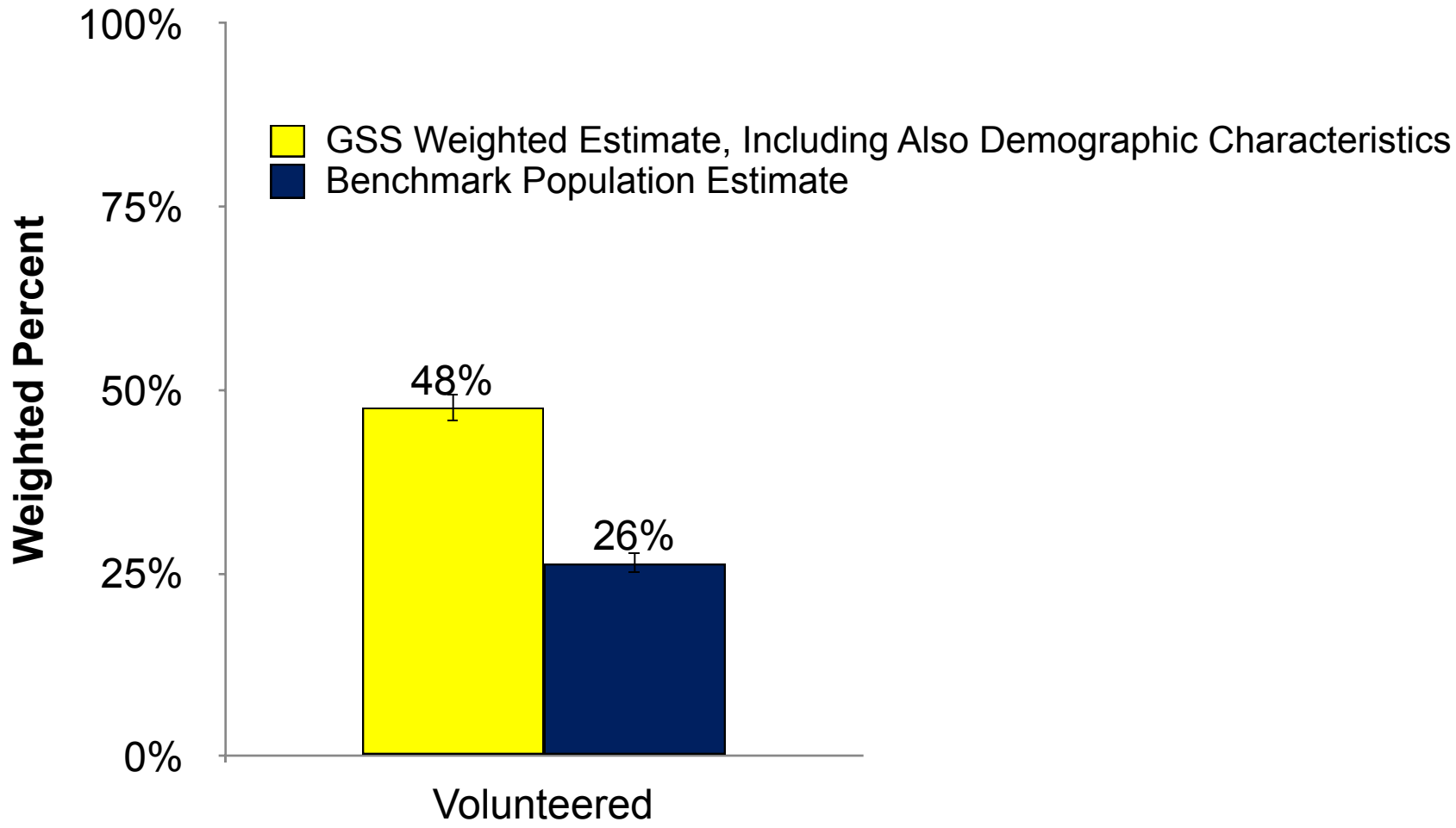
Combining Statistical Properties with Social Science

- What behaviors are related to processes generating nonresponse decisions, and are likely associated with many survey variables?
  - Highly correlated with nonresponse and substantive survey variables

- Two example studies using General Social Survey data (Peytchev, Presser, and Zhang, 2018)
  - Voting
  - Volunteering

- Calibrate survey weights using benchmark estimates from a source that is not subjected to high nonresponse

GSS Weighted Estimates and CPS Population Benchmark Estimates for Volunteering



Note: GSS weights are additionally adjusted to population demographic characteristics. Error bars represent standard errors.

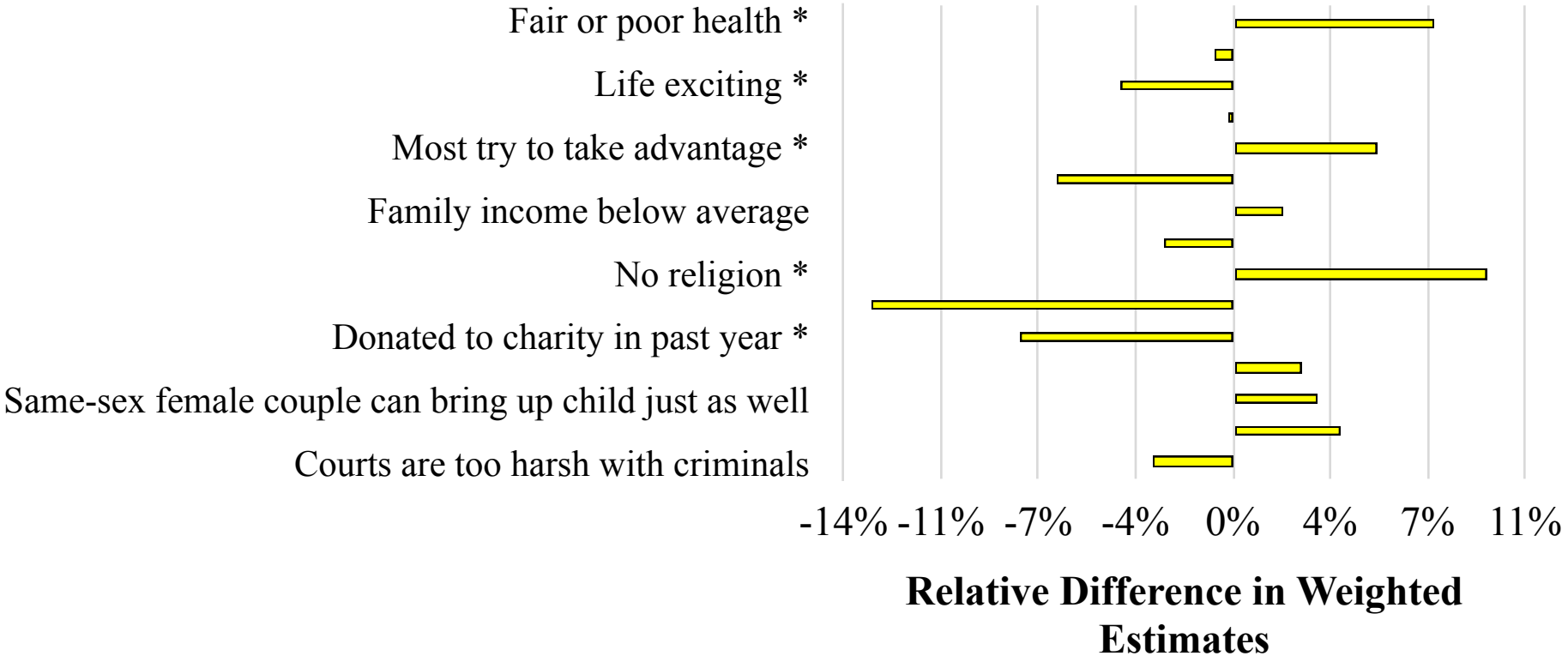
Source: Peytchev, A., Presser, S., & Zhang, M. (2018). Improving Traditional Nonresponse Bias Adjustments: Combining Statistical Properties with Social Theory. *Journal of Survey Statistics and Methodology*, *6*, 491–515.

Selection-Weighted Correlations of Volunteering with 15 GSS Survey Variables

	Volunteered (n=1,299)	
Fair or poor health	-0.12	*
Very or pretty happy	0.07	*
Life exciting	0.11	*
Most people try to be helpful	0.05	
Most try to take advantage	-0.14	*
Most people can be trusted	0.14	*
Family income below average	-0.08	*
Read newspaper every day	0.05	
No religion	-0.07	*
Donated blood in past year	0.15	*
Donated to charity in past year	0.32	*
Support birth control to teens 14 to 16 years old	-0.04	
A same-sex female couple can bring up a child just as well	-0.01	
Oppose capital punishment	-0.04	
Courts are too harsh with criminals	0.01	

Source: Peytchev, A., Presser, S., & Zhang, M. (2018). Improving Traditional Nonresponse Bias Adjustments: Combining Statistical Properties with Social Theory. *Journal of Survey Statistics and Methodology*, *6*, 491–515.

Relative Differences in Weighted Estimates for 15 GSS Variables after Including Volunteering in the Adjustments



Source: Peytchev, A., Presser, S., & Zhang, M. (2018). Improving Traditional Nonresponse Bias Adjustments: Combining Statistical Properties with Social Theory. *Journal of Survey Statistics and Methodology*, *6*, 491–515.

Summary

- The decline in survey participation necessitates greater attention to *effective* and *efficient* nonresponse adjustments
- Devoting more attention to the design and identification of ideal “Z” variables can be highly beneficial
- Attention is also needed to the error properties of the Z-variables, particularly when they are used in nonresponse adjustments as this error can be propagated to the survey estimates

Thank You

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