

Reply to Egloff et al.: On the relationship between positive and negative reciprocity

The letter by Egloff, Richter, and Schmukle (1) regarding our article (2) provides excellent evidence for the implication in our study that positive and negative forms of reciprocity are independent of one another. Although we restrained our claim to a more limited conclusion that the rejection of unfair offers in the ultimatum game (*rUG*) may not be used as evidence of strong reciprocity, we also suggested the possibility of a more general conclusion proposed by the authors of the letter. I commend the authors on providing stronger evidence for the independence of the two forms of reciprocity. Their study and conclusion will certainly encourage further work to examine the neuropsychological mechanisms underlying the two forms of reciprocity.

The authors of the letter noted two possible methodological problems with our study, and I wish to use this opportunity to discuss these problems. First, we agree that the small sample size prevented us from drawing firmer conclusions. We are currently conducting a larger scaled study to provide further evidence, but it will require a few more years to complete because we incorporate long time intervals between the

economic games. The second problem was the measurement error in the economic games. This error is always a potential problem that should concern all experimental researchers. In our study, however, the correlations between the games reported in Table S1 provided evidence that the games reported in the article (2) were successful in maintaining relatively small measurement errors. If the absence of correlations between the *rUG* and other game behaviors was because of large measurement errors, they would have also prevented the formation of correlations between the other games. We expended great care to avoid generating artificial correlations between the games because of carryover effects by incorporating long time intervals between the games; therefore, we believe that the correlations between the other games are substantial. The lack of correlations between the *rUG* and other game behaviors should be interpreted within the context of the substantial correlations observed between the other games.

With the data provided by the authors of the letter, I am more strongly convinced that positive and negative forms of reciprocity are not derived from an identical

neuropsychological mechanism. Furthermore, the negative form of reciprocity itself may also be generated by mechanisms that are relatively independent of one another, such as envy, vengeance, assertiveness, righteousness, and other such emotions. Each of the mechanisms may produce identical behaviors, but the occurrence of identical behavior is not a good reason to attribute the behavior to a single mechanism of negative reciprocity. Such an attribute is similar to calling pneumonia and malaria identical “high-fever diseases.”

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1 Egloff B, Richter D, Schmukle SC (2013) Need for conclusive evidence that positive and negative reciprocity are unrelated. *Proc Natl Acad Sci USA* 110:E786.

2 Yamagishi T, et al. (2012) Rejection of unfair offers in the ultimatum game is no evidence of strong reciprocity. *Proc Natl Acad Sci USA* 109(50):20364–20368.

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The author declares no conflict of interest.

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