

My goal is to teach about the framework of psychological game theory. To prepare, first read

Battigalli, Pierpaolo & Martin Dufwenberg (B&D) (2022), “Belief-Dependent Motivations & Psychological Game Theory,” *Journal of Economic Literature* 60, 833-82.

Start with Section 1, then read, in turn, Sections 6, 2-5, 7-10 (where “bonus” Section 10 is available via my homepage). As you go, read also, and compare with, the following three articles:

Geanakoplos, John, David Pearce & Ennio Stacchetti. 1989. “Psychological Games and Sequential Rationality,” *Games and Economic Behavior* 1, 60-80.

B&D (2009), “Dynamic Psychological Games,” *Journal of Economic Theory* 144, 1-35.

Battigalli, P., Roberto Corrao & M. Dufwenberg (2019), “Modeling Belief-Dependent Motivation in Games,” *Journal of Economic Behavior & Organization* 67, 228-34.

Had I lectured I would first use guilt aversion as my leading topic. I’d touch on Dufwenberg’s (2002, *JEBO*) example of psychological forward induction, Dufwenberg & Gneezy’s (D&G) (2000, *GEB*) early experimental test, Charness & Dufwenberg’s (C&D) (2006, *Econometrica*; 2010, *Econ. Lett.*; 2011, *AER*) considerations of communication, B&D’s (2007, *AER P&P*) general model, Attanasi, Battigalli & Manzoni’s (2016, *Management Science*) extension to incomplete information, Dufwenberg, Gächter & Hennig-Schmidt’s (2011, *GEB*) (DG&HS) work on framing, Battigalli, Charness & Dufwenberg (2013, *JEBO*) account of how the model can shed light on Uri Gneezy’s (2006, *AER*) deception data, Chang, Smith, Dufwenberg & Sanfey’s (2011, *Neuron*) neuroeconomics turn, Dufwenberg & Nordblom’s (2022, *JPET*) application to tax evasion, and other papers, including many in the special issue on psychological game theory that Amrish Patel and I handled as guest editors for *JEBO* (2019); most are cited in B&D (2022). I’d also discuss the industry of experimental studies that follow up and debate the work by D&G and C&D, starting with Vanberg (2008, *Econometrica*) and Ellingsen, Johannesson, Tjøtta & Torsvik (2010, *GEB*), and other studies including many that I coauthored with (subsets of) Italian friends Di Bartolomeo, Papa, Passarelli, and Razzolini. All papers (mentioned above & below) where I was a co-author are downloadable on my homepage:

<http://www.u.arizona.edu/~martind1/>

Two exercises: Refer to B&D’s (2022, *JEL*) article: 1. Consider G_9 , modified as described in footnote 71. Define that game form using the formalism of Section 6. 2. Now assume that all players are selfish except Penny who is affected by guilt as described in Section 3.1 and on p. 863. How will Penny plan to choose if her belief system satisfies rational planning as described on p. 863?

Next, read up on perceived cheating aversion, the topic I’d cover next in my would-have-been lectures:

Fischbacher, U., and F. Föllmi-Heusi (2013). “Lies in Disguise – An Experimental Study on Cheating,” *Journal of the European Economic Association* 11, 525-47.

Dufwenberg, M. & M.A. Dufwenberg (D&D) (2018), “Lies in Disguise – A Theoretical Analysis of Cheating,” *Journal of Economic Theory* 175, 248-64.

Solve three related exercises: 3. Prove that if $n > 1$ then $s \in S$ defined by $s(x)(x+1)=1$ for all $x < n$ and $s(n)(n)=1$ is not a SE for any θ . 4. Prove that $s \in S$ defined by $s(x)=n$ for all x is not a SE for any high enough θ . 5. An erroneous claim is made on p257 – find it!

Gneezy, Kajackaite & Sobel (2018, *AER*) offer a related theory. Have a look, compare assumptions, appreciate differences (see D&D’s section 6; Abeler, Nosenzo & Raymond 2019, *Econometrica*).

Next: Learn, test, and apply reciprocity theory! Start with Dufwenberg & Kirchsteiger (D&K) (2004, *GEB*) – work through all examples carefully! Note and understand how D&K’s (2004) article relates to earlier work by Rabin (1993, *AER*) and to Falk & Fischbacher (2006, *GEB*). Look up also D&K (2000, *EER*), DG&HS, Dufwenberg, Smith & Van Essen (2013, *EI*) (DS&VE), van Damme et al (2014, *JEBO*; section 6), Dufwenberg & Rietzke (2016, mimeo), Dufwenberg & Patel (2017, *GEB*), Jang, Patel & Dufwenberg (2018, *GEB*), Dufwenberg, Johansson-Stenman, Kirchler, Lindner & Schwaiger (2022, *JPubE*). For more discussion/references, see D&K (2019, *JEBO*) and B&D’s (2022) section 2.

Then, study...

- anger & frustration: read Battigalli, Dufwenberg & Smith (2019, *GEB*) (BD&S),
- social image concerns: read Dufwenberg & Lundholm (2001, *EJ*), Bernheim (1994, *JPE*), and the related discussion + further related references in B&D (2022, Section 4) and D&D,
- B&D (2022) again, focusing on additional topics (including disappointment, belief-dependent loss aversion, regret, anticipatory emotions, self-esteem, norms, ...).

Finally, solve even more exercises:

6. Consider the Abi-&-Ben example on p5 in B&D (2009) but allow that Abi’s utility is $w-m-\theta_A \cdot \max\{\mu-m, 0\}$, where $\theta_A \geq 0$ is Abi’s guilt sensitivity. (μ is the same as B&D’s μ with an upper-bar; I just can’t make upper-bar in Word). B&D consider the case where $\theta_A=2$. What would Abi choose if (i) $\theta_A=3$, $w=100$, and $\mu=5$? (ii) $\theta_A=3$, $w=5$, and $\mu=100$? (iii) $\theta_A=3$, $w=100$, and Abi assigns probability $\frac{1}{2}$ to Ben expecting nothing and 5? (iv) $\theta_A=0$, $w=100$, and $\mu=5$? (v) $\theta_A=0$, $w=5$, and $\mu=100$?

7. Consider the game form in Figure 1 of C&D. Apply B&D’s (2007) theory of simple guilt. For which values of θ_B is *(In, Roll)* an SE?

8. Now apply B&D’s (2007) theory of guilt-from-blame. (a) For which values of θ_B is *(In, Roll)* an SE? (b) If $\sigma=(\sigma_A, \sigma_B)$ is an SE, describe $\sigma_B(\text{Roll})$ as a function of θ_B .

9. Consider the following game under D&K’s reciprocity theory:

	C	D
C	3, 3	0, 4
D	4, 0	1, 1

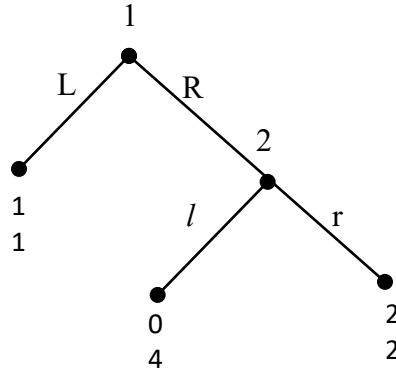
Let $Y=Y_{12}=Y_{21} \geq 0$. (i) For which values of Y is *(C, C)* an SRE? (ii) What about *(D, D)*? (iii) *(D, C)*?

10. Consider instead the following game:

	<i>A</i>	<i>B</i>
<i>A</i>	2, 1	0, 0
<i>B</i>	0, 0	1, 2

Again $Y=Y_{12}=Y_{21} \geq 0$. (i) For which Y -values are (A,A) an SRE? (ii) (B,B) ? (iii) (B,A) ? (iv) (A,B) ?

11. Solve the following game for all its SREs for all values of Y_{12} and Y_{21} :

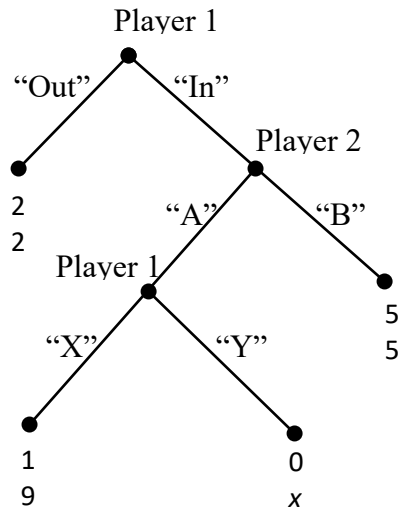


12. Find all Nash equilibria in DG&HS' let's-get-7 and let's-get-9 games (page 460). Then consider the public goods game subsequently explored and explain why, under guilt aversion as well as reciprocity theory, if, for all i , γ_i and Y_i are high enough, everyone choosing 0 as well as everyone choosing 20 is consistent with equilibrium play as defined by B&D and by D&K.

13. Consider the definition of vengeance equilibrium in DS&VE section IV.B. Note that “neither SRE nor VE is a refinement of the other concept,” and convince yourself that you understand why by studying DS&VE's example in their Figure 2. Then move instead to another paper, namely van Damme et al (2014) (available on my homepage) and its section 6. Study the two observations there, and then explain why or why not those propositions would change if one applied the VE concept instead of the SRE concept to the ultimatum game.

14. DS&VE discuss a “miserable VE,” by which they mean that behavior in some subgame is characterized by the players being unkind to each other despite that there is a different VE where they would be kind. Similar issues arise with SRE; see van Damme et al (2014, section 6, Observation 2(b)). Construct another example based on some other game, as simple as possible, which exhibits miserable play in SRE.

15. Consider the following game:



(i) Find all subgame perfect equilibria assuming selfishness. Does x “matter”? Why/why not? (ii) For which values of x can $((In,Y),B)$ be supported as a vengeance equilibrium (VE), and for what θ_{ij} -values? (iii) Suppose the game were instead just the subgame where 1 chooses between X and Y; for which values of $x \geq 0$ can Y be supported as a VE?

16. Check out BD&S. (i) Study example 1, in particular the last three lines where some formalism is illustrated. Suppose that the game form in Figure E had been substituted for that in Figure A. How would the stuff in the last three lines of Example 1 have looked instead? (ii) Study Example 10, based on the hammering-1’s-thumb game of Figure C. Consider the set $(1/(2(1-\epsilon)), 1/(2(1-2\epsilon)))$ mentioned towards the end. Suppose that the game form in Figure C had had payoffs of (1,1) substituted for where it now says (1,2). What set would subsequently have appeared instead of $(1/(2(1-\epsilon)), 1/(2(1-2\epsilon)))$, towards the end of the accordingly modified Ex 10?

17. Consider the ultimatum minigame in Figure A of BD&S. (i) According to D&K’s theory, for which values of Y_{ab} and Y_{ba} is (f,n) an SRE? (ii) What about (g,y) ? (iii) What about (g,n) ? Now consider instead BD&S theory of simple anger. (iv) For which values of θ_b is (f,n) an sequential equilibrium (SE)? (v) What about (g,y) ? (vi) What about (g,n) ? (vii) How do the answers to (iv)-(vi) change if anger-from-blame is considered instead of simple anger?

18. Consider Example 2 of BD&S. Explain why the last sentence must be true. Then consider Example 6 and explain how the value of $\alpha_a(N|B) = 1/(2\epsilon\theta_a) - (1-2\epsilon)/\epsilon$ was obtained.