

Graphics Code for  
The Politics of the First World War:  
A Course in Game Theory and International Security

Scott Wolford  
University of Texas  
[swolford@austin.utexas.edu](mailto:swolford@austin.utexas.edu)

Updated May 27, 2021

# Contents

<b>Timeline of Key Events</b>	<b>v</b>
<b>1 Introduction: The Great War</b>	<b>1</b>
<b>2 The Theory of War I: Commitment Problems</b>	<b>2</b>
<b>3 Armed Continent: The Anglo-German Naval Race</b>	<b>5</b>
<b>4 Leaping Into the Dark: Europe Goes to War</b>	<b>7</b>
<b>5 The Theory of War II: Information Problems</b>	<b>9</b>
<b>6 A Scrap of Paper: Belgium, France, and British Entry</b>	<b>12</b>
<b>7 Troubled Partnerships: Coalitions at War</b>	<b>14</b>
<b>8 The Best Laid Plans: Attrition's Static Horror</b>	<b>16</b>
<b>9 Choosing Sides: Building Military Coalitions</b>	<b>18</b>
<b>10 Coordinating Caution: Naval War in The North Sea</b>	<b>20</b>
<b>11 The Theory of War III: Commitment and War Termination</b>	<b>22</b>
<b>12 The Theory of War IV: Information and War Termination</b>	<b>26</b>

*CONTENTS*

ii

<b>13 Too Proud to Fight?: U-boats and American Neutrality</b>	<b>29</b>
<b>14 The End of the Beginning: Victory, Defeat, and Peace</b>	<b>31</b>
<b>15 Conclusion: History and the Present</b>	<b>33</b>

# List of Figures

2.1	Players, Actions, and Outcomes . . . . .	2
2.2	Players, Actions, Outcomes, and Payoffs . . . . .	3
2.3	An Example of a Nash Equilibrium . . . . .	3
2.4	The Inefficiency of War . . . . .	3
2.5	Commitment Problems and War . . . . .	4
3.1	From <i>Dreadnought</i> to Naval Race, 1905-1912 . . . . .	5
3.2	The Anglo-German naval race . . . . .	6
3.3	The Anglo-German naval race . . . . .	6
4.1	The Path to War, 1905-1914 . . . . .	7
4.2	The Austro-Serb Crisis . . . . .	8
4.3	Russia and the July Crisis . . . . .	8
4.4	Germany and Russia in the July Crisis . . . . .	8
5.1	A Game With Unknown Preferences . . . . .	9
5.2	Uncertainty and Subjective Probabilities . . . . .	10
5.3	An Example of a Bayesian Game . . . . .	10
5.4	Information Problems and War . . . . .	10
5.5	Unique and Overlapping Equilibria . . . . .	11
5.6	The Principal-Agent Problem in Military Strategy . . . . .	11
5.7	Solving the Principal-Agent Problem in Military Strategy . . . . .	11
6.1	The Violation and Defense of Belgium, August 1914 . . . . .	12
6.2	German Goals and Britain's Strategic Problem . . . . .	13
6.3	German Strategy and Belgian Neutrality . . . . .	13
6.4	Germany's Aims and British Intervention . . . . .	13
7.1	Coalition Warfare, 1914 . . . . .	14
7.2	Coalition War Efforts as a Collective Goods Problem . . . . .	15
7.3	Private Benefits for Cooperation on the Western Front . . . . .	15
7.4	Germany Shoulders the Burden on the Eastern Front . . . . .	15
8.1	The Path to Attrition, 1914-1916 . . . . .	16
8.2	Military Strategies on the Western Front . . . . .	17
8.3	The Grim Logic of Attrition on the Western Front . . . . .	17

8.4	Arming to Change and Defend the Status Quo . . . . .	17
9.1	Other Powers Fall in Line, 1914-1917 . . . . .	18
9.2	Italy Chooses Between Rival Coalitions . . . . .	19
10.1	The War in the North Sea, 1914-1916 . . . . .	20
10.2	Naval Strategy in the North Sea . . . . .	21
10.3	The Sidewalk Problem . . . . .	21
10.4	The Coordination Problem in Bargaining . . . . .	21
11.1	Extorting a dollar with a hand grenade . . . . .	23
11.2	Extorting a dollar with a hand grenade (in the extensive form) . . . . .	23
11.3	Backward induction in the dollar-grenade game . . . . .	23
11.4	Incredible commitments and preventive war . . . . .	24
11.5	Crisis bargaining and shifting power at $t = 1$ . . . . .	24
11.6	Crisis bargaining at $t = 2$ after shifted and preserved power . . . . .	24
11.7	Commitment and War in the Extensive Form . . . . .	25
11.8	Trade and the Opportunity Costs of War . . . . .	25
12.1	Ambushing a professor who just wants to get to happy hour . . . . .	26
12.2	Information problems and war ( $t = 1$ and $t = 2$ if no prior battle) . . . . .	27
12.3	Information problems and war ( $t = 2$ following a battle at $t = 1$ ) . . . . .	27
12.4	Threats and Crisis Communication . . . . .	28
13.1	The End of American Neutrality, 1917 . . . . .	29
13.2	German Strategy and American Intervention . . . . .	30
13.3	Entente Borrowing, German Strategy, and American Intervention . . . . .	30
14.1	Endgame, 1918 . . . . .	31
14.2	German Political Institutions and War Termination . . . . .	32

# Timeline of Key Events

1905		Russo-Japanese War Ends (Ch. 12)
1906	Anglo-German naval race begins (Ch. 3)	First Moroccan Crisis (Ch. 4)
1911	Second Moroccan Crisis (Ch. 4)	
1912		Anglo-German naval race ends (Ch. 3)
		First Balkan War begins (Ch. 4)
	First Balkan War ends (Ch. 4)	
1913	Second Balkan War (Ch. 4)	
	Liman von Sanders crisis (Ch. 4)	Sarajevo assassinations (Ch. 4)
	General army expansions (Ch. 4)	July Crisis (Ch. 4)
		British entry (Ch. 6)
		Battle of the Frontiers (Ch. 7)
1914		Battle of Heligoland Bight (Ch. 10)
		First Battle of the Marne (Ch. 8)
	Battle of Dogger Bank (Ch. 10)	Ottomans join Central Powers (Ch. 9)
	Gorlice-Tarnów offensive (Ch. 8)	Japan declares war on Germany (Ch. 9)
1915	Italy joins Entente (Ch. 9)	First Battle of Ypres (Ch. 8)
	German <i>Sussex</i> Pledge (Ch. 13)	
	Japan issues "21 Demands" (Ch. 9)	Battle of Verdun (Ch. 8)
1916		Battle of Jutland-Skaggerak (Ch. 10)
	"Peace Without Victory" speech (Ch. 13)	Battle of the Somme (Ch. 8)
	Germany unleashes U-boats (Ch. 13)	Brusilov Offensive (Ch. 8)
1917	U.S. declares war on Germany (Ch. 13)	
	China declares war on Germany (Ch. 9)	Treaty of Brest-Litovsk (Ch. 13)
1918		German Spring Offensive (Ch. 14)
	Treaty of Versailles (Ch. 14)	Bulgaria requests armistice (Ch. 14)
1919	U.S. fails to ratify Versailles (Ch. 14)	Germany requests armistice (Ch. 14)

# **Chapter 1**

## **Introduction: The Great War**

No graphics.

# Chapter 2

## The Theory of War I: Commitment Problems

**Figure 2.1:** Players, Actions, and Outcomes

		B	
		half	all
A	half	split	split
	all	war	A wins



**Figure 2.2:** Players, Actions, Outcomes, and Payoffs

		B	
		half	all
A	half	2, 4	2, 4
	all	1, 3	4, 1

**Figure 2.3:** An Example of a Nash Equilibrium

		B	
		half	all
A	half	2, 4	2, 4
	all	1, 3	4, 1

**Figure 2.4:** The Inefficiency of War

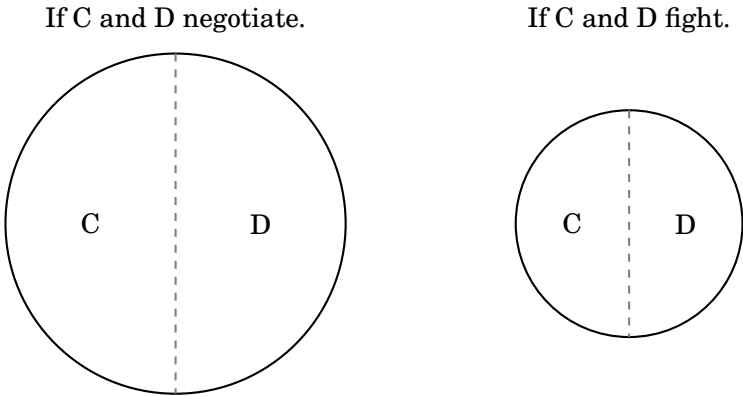


Figure 2.5: Commitment Problems and War

		B	
		honor	renege
A	pass	4, 3	1, 4
	attack	2, 2	3, 2

# Chapter 3

## Armed Continent: The Anglo-German Naval Race

**Figure 3.1:** From *Dreadnought* to Naval Race, 1905-1912

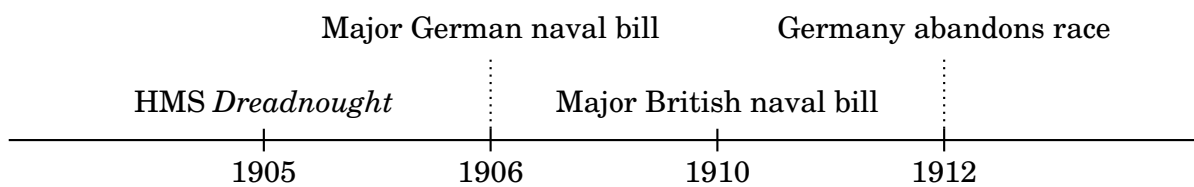


Figure 3.2: The Anglo-German naval race

		Germany	
		¬build	build
UK	¬build	3, 3	1, 4
	build	4, 1	2, 2

Figure 3.3: The Anglo-German naval race

		Germany	
		¬build	build
UK	¬build	3, 3	1, 4
	build	4, 1	2, 2

# Chapter 4

## Leaping Into the Dark: Europe Goes to War

**Figure 4.1:** The Path to War, 1905-1914

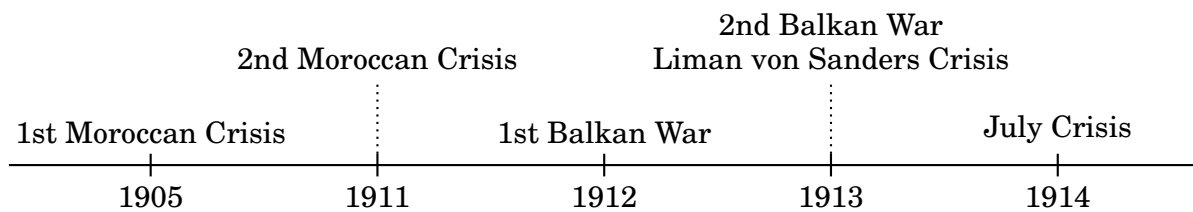


Figure 4.2: The Austro-Serb Crisis

		S	
		honor	refuse
A	pass	4, 1	1, 4
	attack	2, 2	3, 3

Figure 4.3: Russia and the July Crisis

		A	
		pass	attack S
R	pass	4, 1	1, 4
	attack	2, 2	3, 3

Figure 4.4: Germany and Russia in the July Crisis

		R	
		abandon	support
G	abandon	3, 1	1, 4
	support	4, 1	2, 3

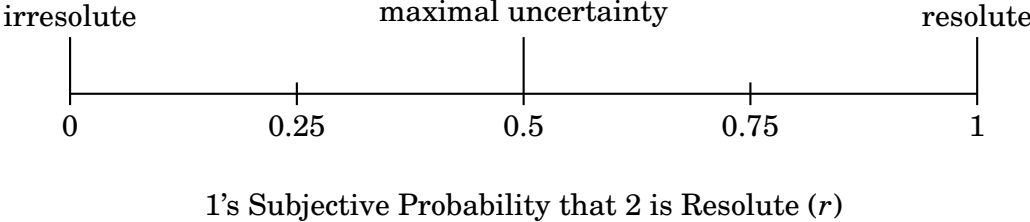
# Chapter 5

## The Theory of War II: Information Problems

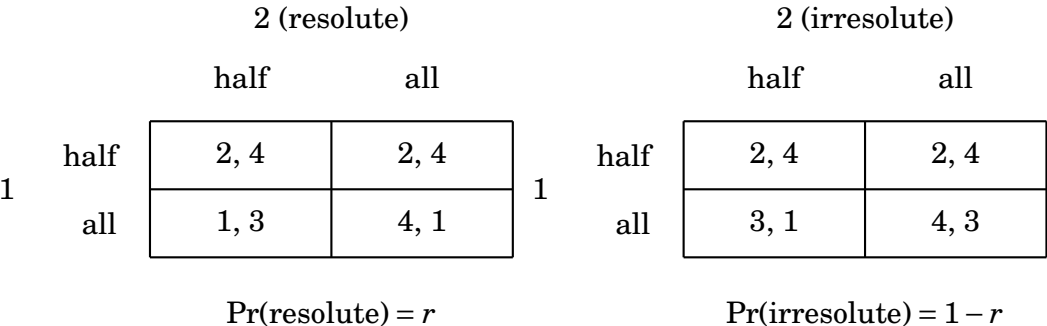
**Figure 5.1:** A Game With Unknown Preferences

		B	
		half	all
A	half	2, 4	2, 4
	all	3, ?	4, ?

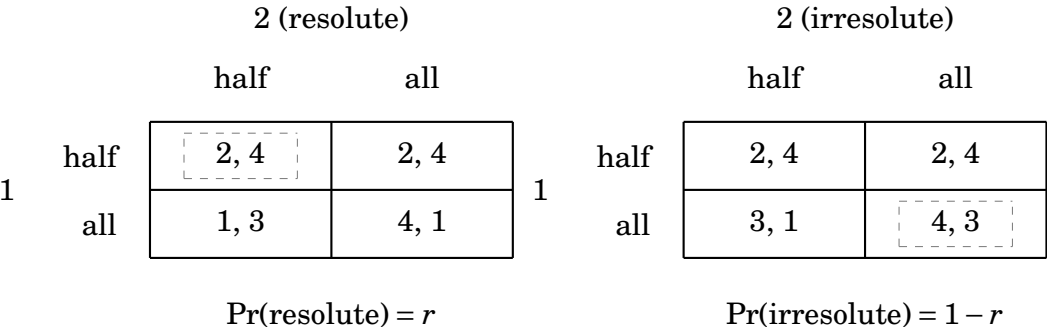
**Figure 5.2:** Uncertainty and Subjective Probabilities



**Figure 5.3:** An Example of a Bayesian Game

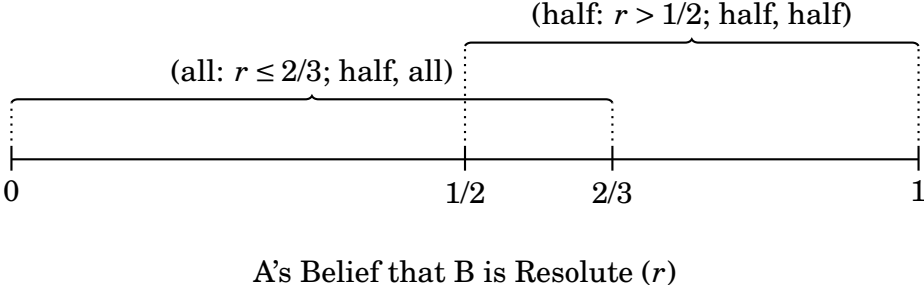


**Figure 5.4:** Information Problems and War





**Figure 5.5:** Unique and Overlapping Equilibria



**Figure 5.6:** The Principal-Agent Problem in Military Strategy

		G (defensive)		G (expansionist)		
		wait	now	wait	now	
P	either	4, 3	5, 4	P	3, 3	2, 4
	neither	1, 1	1, 1		3, 1	3, 1

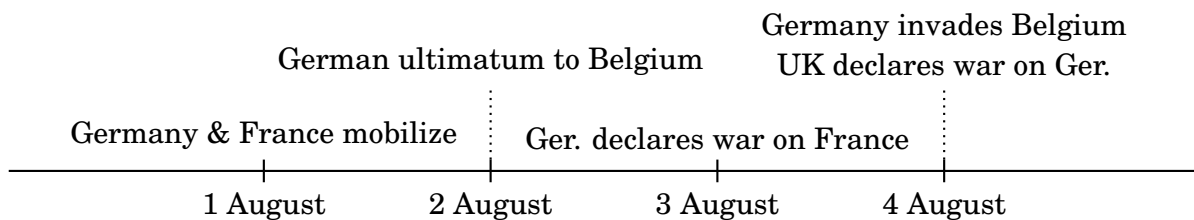
**Figure 5.7:** Solving the Principal-Agent Problem in Military Strategy

		G (defensive)		G (expansionist)		
		wait	now	wait	now	
P	either	4, 3	5, 4	P	3, 3	2, 4
	wait	4, 3	1, 1		3, 3	3, 1
	neither	1, 1	1, 1		3, 1	3, 1

# Chapter 6

## A Scrap of Paper: Belgium, France, and British Entry

**Figure 6.1:** The Violation and Defense of Belgium, August 1914



**Figure 6.2:** German Goals and Britain’s Strategic Problem

		G (unlimited)		G (limited)	
		offense	defense	offense	defense
UK	fight	3, 3	3, 1	2, 1	1, 3
	¬fight	1, 4	1, 2	1, 2	4, 4

**Figure 6.3:** German Strategy and Belgian Neutrality

		G (unlimited)		G (limited)	
		violate	honor	violate	honor
B	resist	3, 3	4, 1	3, 1	4, 3
	acq	1, 4	4, 1	1, 2	4, 3

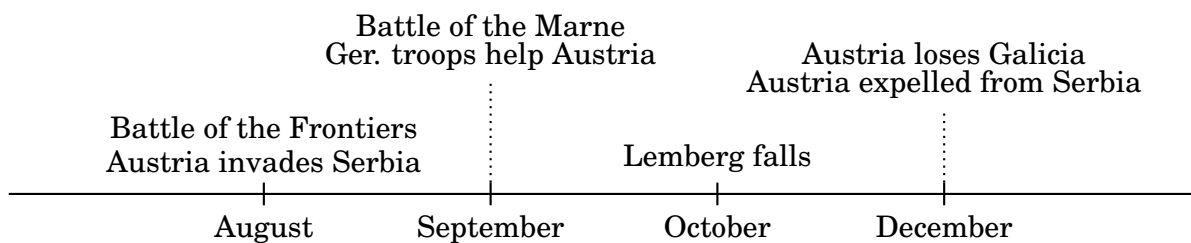
**Figure 6.4:** Germany’s Aims and British Intervention

		G (unlimited)		G (limited)	
		offense	defense	offense	defense
UK	fight	3, 3	3, 1	2, 1	1, 3
	¬fight	1, 4	1, 2	1, 2	4, 4

# Chapter 7

## Troubled Partnerships: Coalitions at War

**Figure 7.1:** Coalition Warfare, 1914



**Figure 7.2:** Coalition War Efforts as a Collective Goods Problem

		B	
		high	low
A	high	3, 3	1, 4
	low	4, 1	2, 2

**Figure 7.3:** Private Benefits for Cooperation on the Western Front

		F	
		high	low
UK	high	4, 4	3, 2
	low	2, 3	1, 1

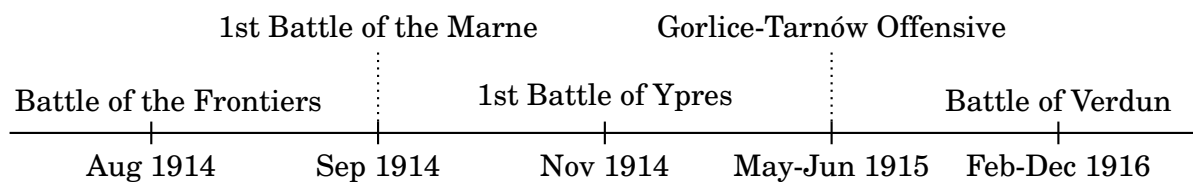
**Figure 7.4:** Germany Shoulders the Burden on the Eastern Front

		G	
		high	low
A-H	high	3, 4	1, 2
	low	4, 3	2, 1

# Chapter 8

## The Best Laid Plans: Attrition's Static Horror

**Figure 8.1:** The Path to Attrition, 1914-1916



**Figure 8.2:** Military Strategies on the Western Front

		G	
		left	right
F	left	1, 0	0, 1
	right	0, 1	1, 0

**Figure 8.3:** The Grim Logic of Attrition on the Western Front

		Central	
		static	mobile
Entente	static	3, 3	4, 1
	mobile	1, 4	2, 2

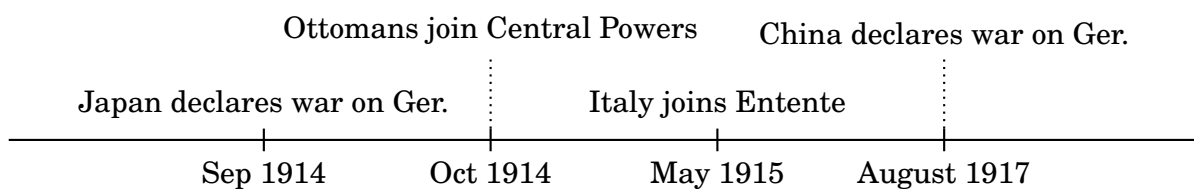
**Figure 8.4:** Arming to Change and Defend the Status Quo

		B	
		arm	$\neg$ arm
A	arm	$-a, V - b$	$V - a, 0$
	$\neg$ arm	$0, V - b$	$0, V$

# Chapter 9

## Choosing Sides: Building Military Coalitions

**Figure 9.1:** Other Powers Fall in Line, 1914-1917





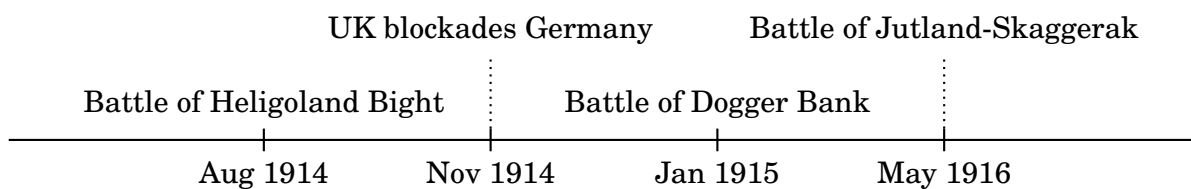
**Figure 9.2:** Italy Chooses Between Rival Coalitions

		Central Powers				Entente	
		honor	default			honor	default
Italy	high	2, 3	1, 4	Italy	high	6, 4	5, 2
	low	8, 1	4, 2		low	3, 1	2, 2

# Chapter 10

## Coordinating Caution: Naval War in The North Sea

**Figure 10.1:** The War in the North Sea, 1914-1916



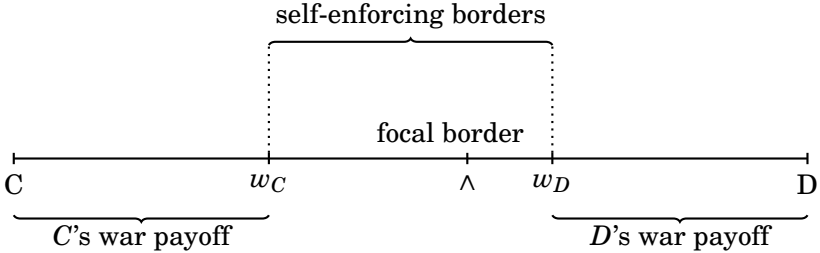
**Figure 10.2:** Naval Strategy in the North Sea

		G	
		total	limited
UK	total	2, 2	3, 1
	limited	1, 3	4, 4

**Figure 10.3:** The Sidewalk Problem

		2	
		left	right
1	left	1, 1	0, 0
	right	0, 0	1, 1

**Figure 10.4:** The Coordination Problem in Bargaining



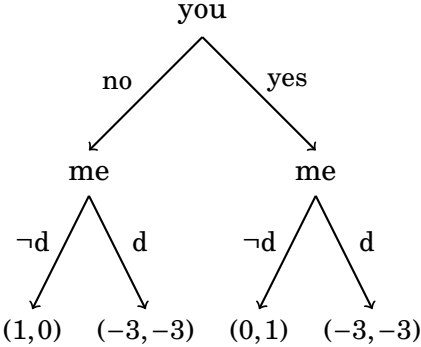
## **Chapter 11**

# **The Theory of War III: Commitment and War Termination**

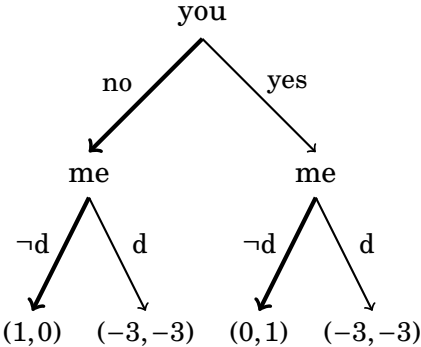
**Figure 11.1:** Extorting a dollar with a hand grenade

		you	
		yes	no
me	never	1, 0	0, 1
	if yes	-3, -3	0, 1
	if no	1, 0	-3, -3
	always	-3, -3	-3, -3

**Figure 11.2:** Extorting a dollar with a hand grenade (in the extensive form)



**Figure 11.3:** Backward induction in the dollar-grenade game



**Figure 11.4:** Incredible commitments and preventive war

		B	
		honor	renege
A	pass	4, 3	1, 4
	attack	2, 2	3, 2

**Figure 11.5:** Crisis bargaining and shifting power at  $t = 1$

		B	
		honor <sub>1</sub>	renege <sub>1</sub>
A	honor <sub>1</sub>	4, 2	3, 1
	renege <sub>1</sub>	3, 1	3, 1

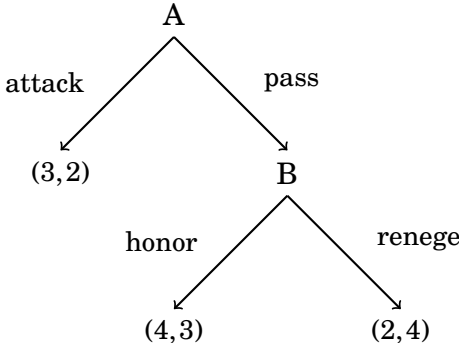
original distribution of power,  $t = 1$

**Figure 11.6:** Crisis bargaining at  $t = 2$  after shifted and preserved power

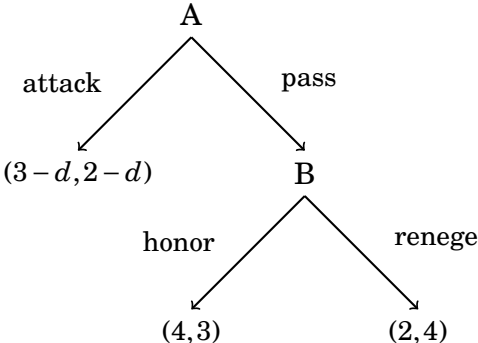
		B		B		
		honor <sub>2</sub> <sup>h</sup>	renege <sub>2</sub> <sup>h</sup>	honor <sub>2</sub> <sup>w</sup>	renege <sub>2</sub> <sup>w</sup>	
A	honor <sub>2</sub> <sup>h</sup>	4, 2	1, 3	A	3, 1	2, 0
	renege <sub>2</sub> <sup>h</sup>	1, 3	1, 3		2, 0	2, 0

$t = 2$  if peace at  $t = 1$ 
 $t = 2$  if war at  $t = 1$

**Figure 11.7:** Commitment and War in the Extensive Form



**Figure 11.8:** Trade and the Opportunity Costs of War



# Chapter 12

## The Theory of War IV: Information and War Termination

**Figure 12.1:** Ambushing a professor who just wants to get to happy hour

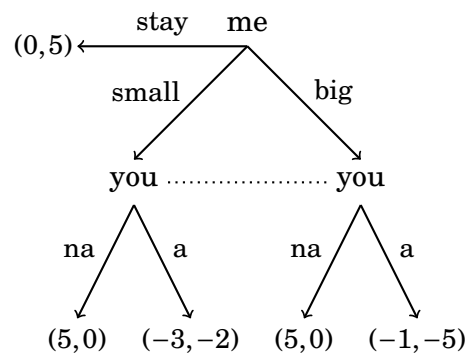




Figure 12.2: Information problems and war ( $t = 1$  and  $t = 2$  if no prior battle)

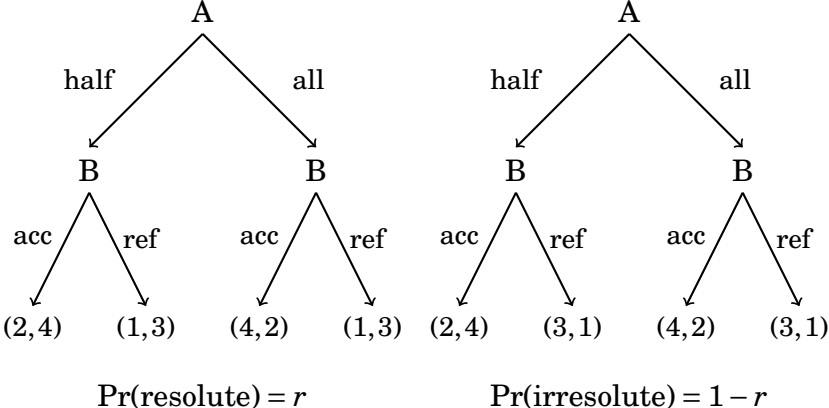


Figure 12.3: Information problems and war ( $t = 2$  following a battle at  $t = 1$ )

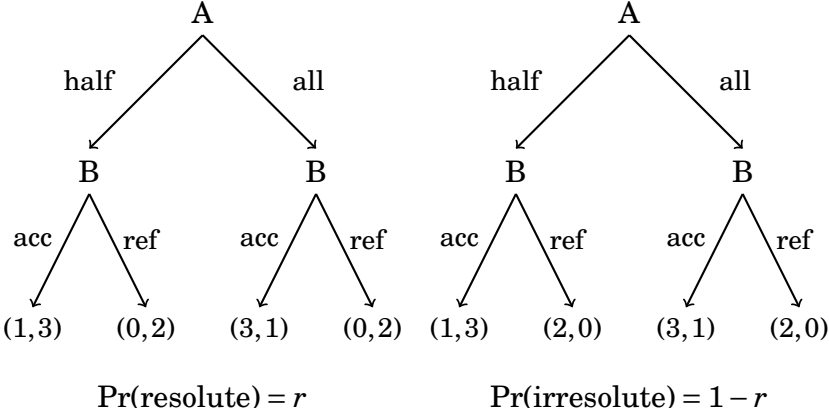
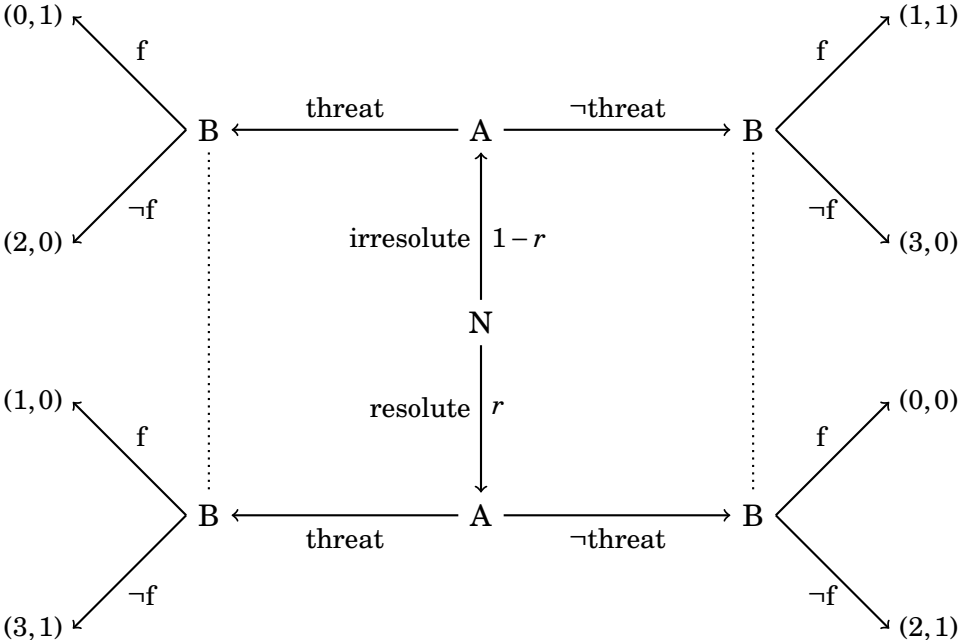


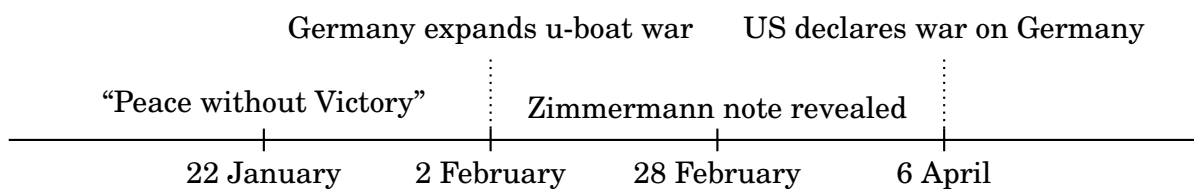
Figure 12.4: Threats and Crisis Communication



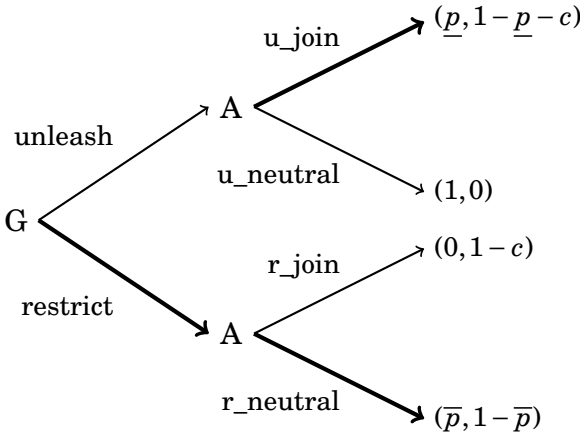
# Chapter 13

## Too Proud to Fight?: U-boats and American Neutrality

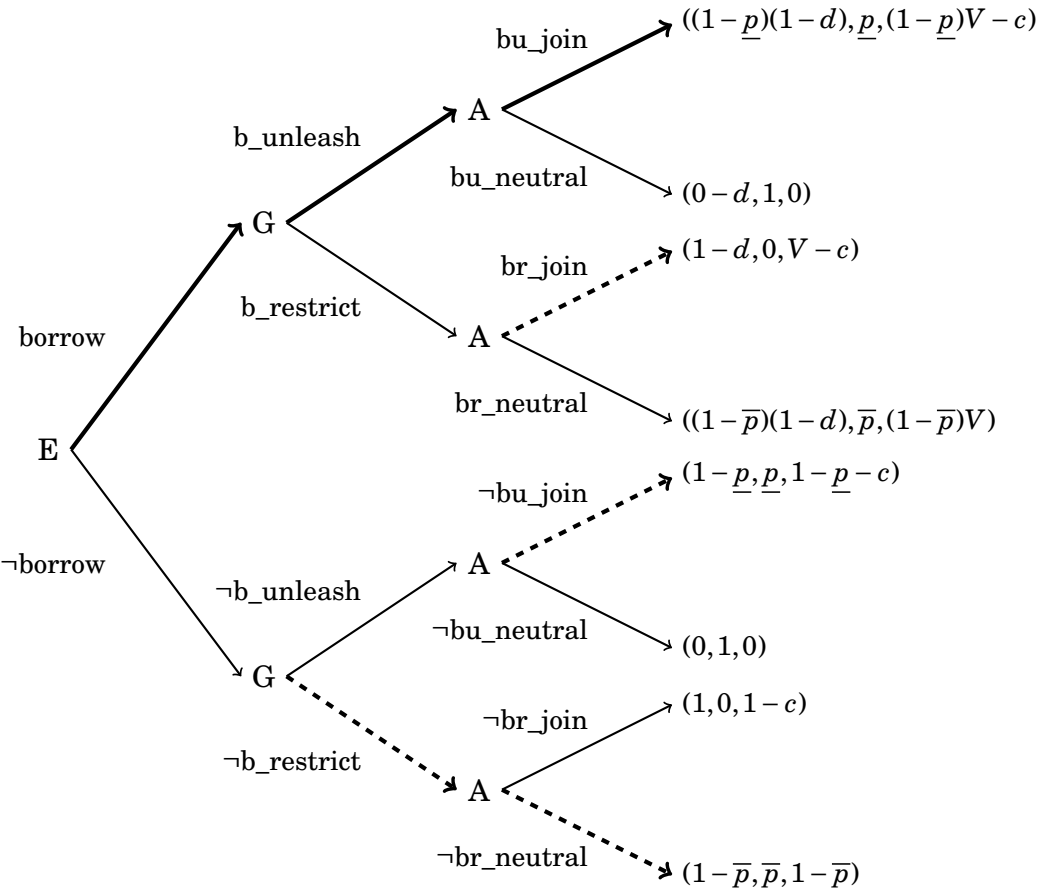
**Figure 13.1:** The End of American Neutrality, 1917



**Figure 13.2:** German Strategy and American Intervention



**Figure 13.3:** Entente Borrowing, German Strategy, and American Intervention



# Chapter 14

## The End of the Beginning: Victory, Defeat, and Peace

**Figure 14.1:** Endgame, 1918

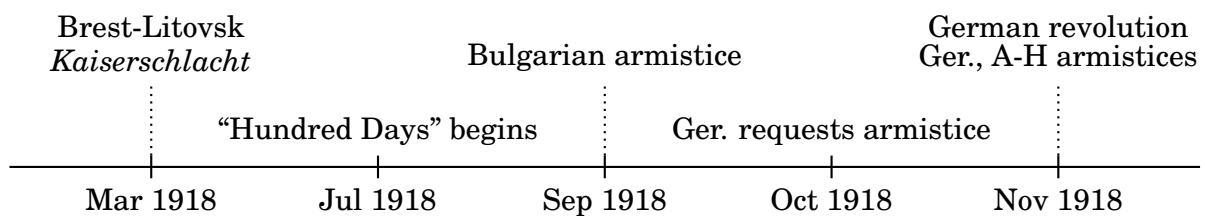
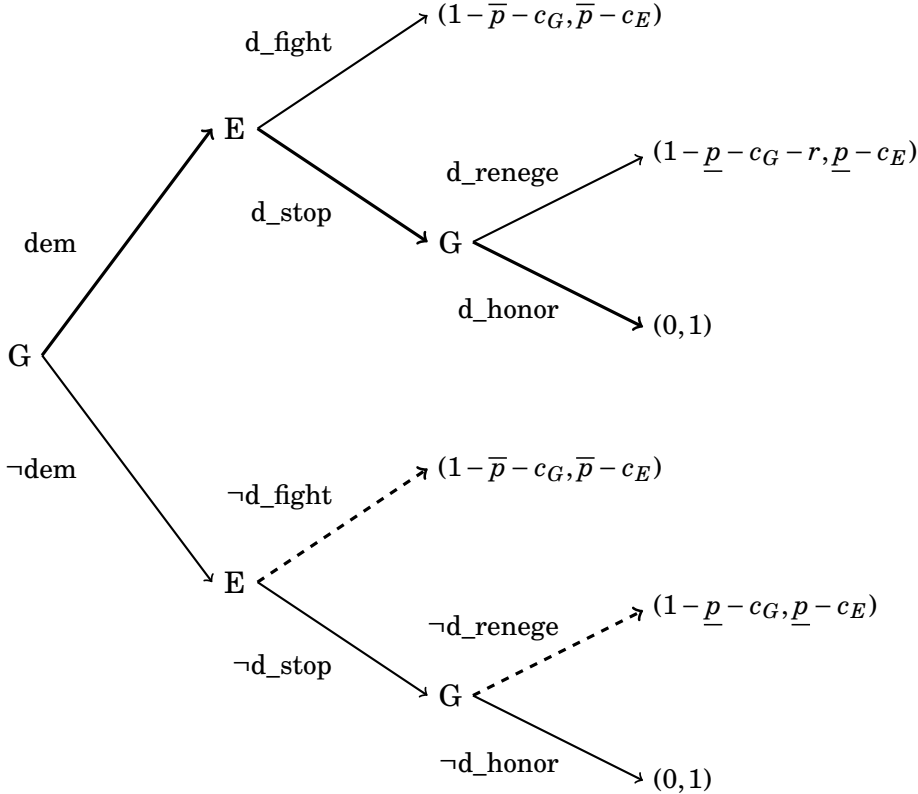


Figure 14.2: German Political Institutions and War Termination



# **Chapter 15**

## **Conclusion: History and the Present**

No graphics.