

Workshop on Negotiation with the AHP

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The Evolution of Conflict Resolution - Origins

- 1957: Economist Kenneth Boulding of the University of Michigan and mathematician-biologist Anatol Rapoport, social psychologist Herbert Kelman and sociologist Robert Cooley Angell created the *Journal of Conflict Resolution*, and
- 1959: The Center for Research in Conflict Resolution;
- 1960: Johan Galtung, the founder of Peace Research, created a unit within the Institute of Social Research at the University of Oslo, that later became the International Peace Research Institute Oslo, and
- 1964: created the *Journal of Peace Research*; and
- Later years: John Burton developed a new way of studying conflicts based on problem-solving methodologies such as game theory and organizational behavior.

Principled Negotiation

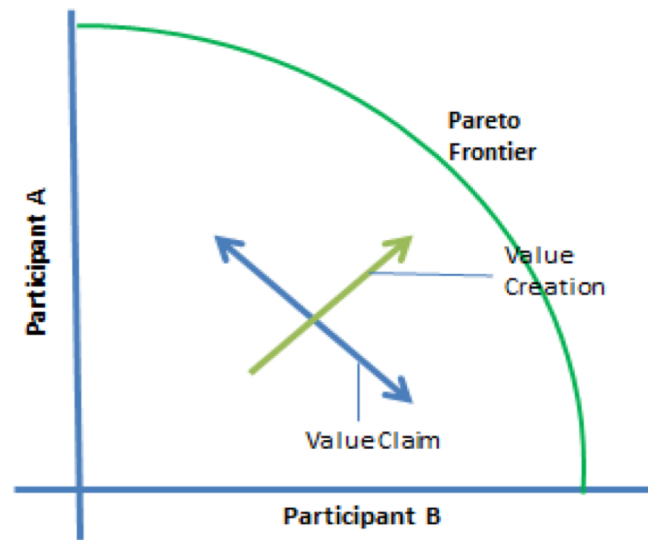
- In 1981 Fisher and Ury wrote the book *Getting to Yes*. The participants are problem solvers.
- Four principles:
 - (1) Separate the people from the problem,
 - (2) Focus on interests not positions,
 - (3) Invent options for mutual gain, and
 - (4) Insist on using objective criteria.
- What is missing is: A measure of the gains and losses of the parties for different options, to be able to perceive how fair the proposed solution is to both parties.

What is a Negotiation

- A negotiation can be thought as a process to arrive at a contract.
- The dictionary definition of “contract” is
 - “a binding agreement between two or more persons or parties” or “a document describing the terms of a contract.”
- A contract/negotiation has multiple dimensions and the parties must agree on each of the dimensions.

Outcomes of a Negotiation

- There are two types of outcome at work when two parties negotiate: Value claim, and Value creation



Dimensions of a Negotiation

- Value Claim: one party captures value from the other party
- (1) Distributive: What one party gains, the other party experiences as a comparable loss;
- (2) Integrative: When multiple factors are negotiated – some of which are more important to one of the parties, and some of which are more important to the other party;
- (3) Compatible: Factors where the same element is perceived as a gain for both parties

Dimensions of a Negotiation

- Value Creation:
 - Both parties are made better off during the negotiation.
 - When value creation occurs, the parties move closer towards the Pareto frontier – the point at which neither party can be made better off without the counterparty being made worse off.

Simple Example: Recruiter vs. Candidate

Dimensions	Type
SIGNING BONUS (SB)	Benefit
SALARY (S)	Cost
JOB ASSIGNMENT (JA)	Cost
COMPANY CAR (CC)	Benefit
STARTING DATE (SD)	Benefit
VACATION DAYS (VD)	Benefit
MOVING EXPENSES REIMB (MER)	Benefit
INSURANCE COVERAGE (IC)	Benefit

Importance of the Dimensions

	Priorities	
Benefits	Recruiter	Employee
SIGNING BONUS (SB)	0.270	0.270
COMPANY CAR (CC)	0.081	0.081
STARTING DATE (SD)	0.108	0.270
VACATION DAYS (VD)	0.270	0.108
MOVING EXPENSES (MER)	0.054	0.216
INSURANCE COVERAGE (IC)	0.216	0.054
	Priorities	
Costs	Recruiter	Employee
SALARY (S)	0.75	0.75
JOB ASSIGNMENT (JA)	0.25	0.25

Payoffs for Different Levels of the Dimensions

	INTENSITY	RECRUITER	CANDIDATE
SIGNING BONUS (SB)	10%	0	4000
	8%	1000	3000
	6%	2000	2000
	4%	3000	1000
	2%	4000	0
SALARY(S)	\$ 60,000.00	-6000	0
	\$ 58,000.00	-4500	-1500
	\$ 56,000.00	-3000	-3000
	\$ 54,000.00	-1500	-4500
	\$ 52,000.00	0	-6000
JOB ASSIGNMENT (JA)	Division A	0	0
	Division B	-600	-600
	Division C	-1200	-1200
	Division D	-1800	-1800
	Division E	-2400	-2400
COMPANY CAR (CC)	LUX EX2	1200	1200
	MOD 250	900	900
	RAND XTR	600	600
	DE PAS 450	300	300
	PALO LSR	0	0
STARTING DATE (SD)	1-Jun	1600	0
	15-Jun	1200	1000
	1-Jul	800	2000
	15-Jul	400	3000
	1-Aug	0	4000
VACATION DAYS (VD)	30 days	0	1600
	25 days	1000	1200
	20 days	2000	800
	15 days	3000	400
	10 days	4000	0
MOVING EXPENSES	100%	0	3200
REIMBURSEMENT (MER)	90%	200	2400
	80%	400	1600
	70%	600	800
	60%	800	0
INSURANCE COVERAGE (IC)	Allen Insurance	0	800
	ABC Insurance	800	600
	Good Health Insurance	1600	400
	Best Insurance Co.	2400	200
	Insure Alba	3200	0

Solution with Relative Measurement

DIMENSIONS	PRIORITIES				Scale Priorities						Value for	
	RECRUITER		CANDIDATE		INTENSITY	RECRUITER		CANDIDATE		Optimal	Recruiter	Candidate
	BENEFITS	COSTS	BENEFITS	COSTS		BENEFITS	COSTS	BENEFITS	COSTS	Alternative		
w_i^R	v_i^R	w_i^C	v_i^C	b_{ij}^R	c_{ij}^R	b_{ij}^C	c_{ij}^C	x_{ij}				
SIGNING BONUS (SB)	0.2703		0.2703		10%	0.00		1.00		0	0.0000	0.0000
					8%	0.25		0.75		0	0.0000	0.0000
					6%	0.50		0.50		1	0.1351	0.1351
					4%	0.75		0.25		0	0.0000	0.0000
					2%	1.00		0.00		0	0.0000	0.0000
SALARY (S)		0.7143		0.7143	\$ 60,000.00		1.00		0.00	0	0.0000	0.0000
					\$ 58,000.00		0.75		0.25	0	0.0000	0.0000
					\$ 56,000.00		0.50		0.50	1	0.3571	0.3571
					\$ 54,000.00		0.25		0.75	0	0.0000	0.0000
					\$ 52,000.00		0.00		1.00	0	0.0000	0.0000
JOB ASSIGNMENT (JA)		0.2857		0.2857	Division A		0.00		0.00	1	0.0000	0.0000
					Division B		0.25		0.25	0	0.0000	0.0000
					Division C		0.50		0.50	0	0.0000	0.0000
					Division D		0.75		0.75	0	0.0000	0.0000
					Division E		1.00		1.00	0	0.0000	0.0000
COMPANY CAR (CC)	0.0811		0.0811		LUX EX2	1.00		1.00		1	0.0811	0.0811
					MOD 250	0.75		0.75		0	0.0000	0.0000
					RAND XTR	0.50		0.50		0	0.0000	0.0000
					DE PAS 450	0.25		0.25		0	0.0000	0.0000
					PALO LSR	0.00		0.00		0	0.0000	0.0000
STARTING DATE (SD)	0.1081		0.2703		1-Jun	1.00		0.00		0	0.0000	0.0000
					15-Jun	0.75		0.25		0	0.0000	0.0000
					1-Jul	0.50		0.50		0	0.0000	0.0000
					15-Jul	0.25		0.75		0	0.0000	0.0000
					1-Aug	0.00		1.00		1	0.0000	0.2703
VACATION DAYS (VD)	0.2703		0.1081		30 days	0.00		1.00		0	0.0000	0.0000
					25 days	0.25		0.75		0	0.0000	0.0000
					20 days	0.50		0.50		0	0.0000	0.0000
					15 days	0.75		0.25		0	0.0000	0.0000
					10 days	1.00		0.00		1	0.2703	0.0000
MOVING EXPENSES	0.0541		0.2162		100%	0.00		1.00		1	0.0000	0.2162
REIMBURSEMENT (MER)					90%	0.25		0.75		0	0.0000	0.0000
					80%	0.50		0.50		0	0.0000	0.0000
					70%	0.75		0.25		0	0.0000	0.0000
					60%	1.00		0.00		0	0.0000	0.0000
INSURANCE COVERAGE (IC)	0.2162		0.0541		Allen Insurance	0.00		1.00		0	0.0000	0.0000
					ABC Insurance	0.25		0.75		0	0.0000	0.0000
					Good Health Insurance	0.50		0.50		0	0.0000	0.0000
					Best Insurance Co.	0.75		0.25		0	0.0000	0.0000
					Insure Alba	1.00		0.00		1	0.2162	0.0000
									B/C Ratios	1.9676	1.9676	

Let b_{ij}^R (b_{ij}^C) and c_{ij}^R (c_{ij}^C) be the benefit and cost corresponding to the j^{th} intensity of the i^{th} dimension for the recruiter (candidate).

To find the solution of this problem we model it with integer programming. An offer is represented by an 8-by-5 matrix (x_{ij}) of 0's and 1's. Each row corresponds to a dimension and each column corresponds to an intensity of the scale corresponding to that dimension. $x_{ij} = 1$ if the i^{th} dimension is set to the j^{th} intensity value.

The benefits/costs ratio of the recruiter, $r_R(x)$, and the candidate, $r_C(x)$, are given by

$$r_R(x) = \frac{\text{benefits}}{\text{costs}} = \frac{\sum_i w_i^R \sum_j x_{ij} b_{ij}^R}{\sum_i v_i^R \sum_j x_{ij} c_{ij}^R} \text{ and } r_C(x) = \frac{\text{benefits}}{\text{costs}} = \frac{\sum_i w_i^C \sum_j x_{ij} b_{ij}^C}{\sum_i v_i^C \sum_j x_{ij} c_{ij}^C}, \text{ respectively.}$$

$$r_R(x^*) = r_C(x^*) = \underset{x \in X_S}{\text{Max}} \{ \text{Min} \{ r_R(x), r_C(x) \} \}$$

The Agreement

A Solution	Intensities					Recruiter		Candidate	
	1	2	3	4	5	Benefits	Costs	Benefits	Costs
SB	0	0	1	0	0	0.135135	0	0.135135	0
S	0	1	0	0	0	0	0.535714	0	0.178571
JA	0	1	0	0	0	0	0.071429	0	0.071429
CC	1	0	0	0	0	0.081081	0	0.081081	0
SD	0	0	1	0	0	0.054054	0	0.135135	0
VD	0	1	0	0	0	0.067568	0	0.081081	0
MER	0	0	1	0	0	0.027027	0	0.108108	0
IC	0	0	1	0	0	0.108108	0	0.027027	0
						B/C Ratio	0.7790		2.2703

Optimal Solution	Intensities					Recruiter		Candidate	
	1	2	3	4	5	Benefits	Costs	Benefits	Costs
SB	0	0	1	0	0	0.135135	0	0.135135	0
S	0	0	1	0	0	0	0.357143	0	0.357143
JA	1	0	0	0	0	0	0	0	0
CC	1	0	0	0	0	0.081081	0	0.081081	0
SD	0	0	0	0	1	0	0	0.27027	0
VD	0	0	0	0	1	0.27027	0	0	0
MER	1	0	0	0	0	0	0	0.216216	0
IC	0	0	0	0	1	0.216216	0	0	0
						B/C Ratio	1.9676		1.9676

Objective/Purpose of the Negotiation

- Find the mix of levels of the dimensions that would maximize the payoff for each party.

	SB	S	JA	CC	SD	VD	MER	IC	Total
	6%	\$ 56,000.00	Division A	LUX EX2	1-Aug	10 days	100%	Insure Alba	Points
Recruiter	2000	-3000	0	1200	0	4000	0	3200	7400
Candidate	2000	-3000	0	1200	4000	0	3200	0	7400

The Concept of a Tradeoff

Definition of TRADE-OFF (MERRIAM-WEBSTER)

- **1:** a balancing of factors all of which are not attainable at the same time. For example, the education versus experience *trade-off* which governs personnel practices—H. S. White.
- **2:** a giving up of one thing in return for another : [EXCHANGE](#)
- TRADEOFF ARE SOMETIMES REFERRED TO AS CONCESSIONS.

How to evaluate a Tradeoff

- **Each party identifies a set of concessions (trade-offs) it requires from the other party.**
- Each concession (trade-off) that a party gives away, yields for that party a set of costs (not necessarily monetary) and a perceived set of benefits for the party receiving it.
- Each trade-off that a party receives generates a set of benefits and a perceived set of losses for the party giving it away.
- The benefits, costs, perceived benefits and perceived costs are prioritized using the AHP.
- The concessions (trade-offs) are evaluated according to the benefits, costs, perceived benefits, and perceived costs.
- Gain-loss ratios are constructed for each pair of concessions. Gain-loss ratios are not symmetric for the parties.
- Only the pairs of concessions (trade-offs) in which both parties benefit from the trade-off, i.e., the gain-loss ratio is greater than 1, are selected. These are deemed acceptable concessions. Acceptable pairs of trade-offs are identified with the additional condition that the gain-loss ratio of a pair of concessions is as close as possible for the parties (i.e., within a small percentage of each other).
- The traded acceptable concessions are merged into a cohesive set of guidelines.

The Israeli-Palestinian Conflict as a Retributive Conflict

- A retributive conflict assumes that the parties involved provide tradeoffs not just because of their gains but also because of the perceived costs they may cause.

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Israeli's Concessions

Israeli's Concessions	Description
1	Abandon the Idea of a Jewish State
2	Accept One-State Solution (Binational)
3	Accept UN Declaration of Human Rights
4	Adhere to International Law
5	Comply with UN Resolutions
6	Implementation of Refugee Rights (Right of Return)
7	Palestinian control of Own Natural Resources
8	Palestinian Freedom of Movement and Safety in Historical land of Palestine
9	Release of Political Prisoners
10	Removal of Wall & Other Barriers
11	Respect the Territorial Integrity of Gaza and West Bank
12	Right to a Free Economy, Economic Development & Trade
13	Right to Education
14	Shared Administration of Resources
15	Shared Control of Holy Places
16	Shared Jerusalem
17	Turnover Settlement w / wo Compensation

Palestinian Concessions

Palestinian's Concessions	Description
1	Accept a Demilitarized Palestinian State (not including Jerusalem)
2	Accept Sharing of Natural Resources
3	Accept Two-State Solution (Israeli Control of Jerusalem)
4	Accept Two-State Solution (Joint Control of Jerusalem)
5	Acceptance of Non-Contiguous Palestinian State
6	Acceptance of the Rule of Law and Human Rights in Palestinian Territories
7	Acknowledge Israel's Existence as a Jewish State
8	Acknowledge Israel's Existence as an Independent State
9	Adhere to International Law
10	Allow Jewish Settlers to Stay in Judea and Samaria W/ Israeli Citizenship and Under Israeli Law
11	Allow Jewish Settlers to Stay Under Palestinian Law
12	Drop Opposition to Trade & Normal Relations w/ Israel
13	End of Incitement of Anti-Israeli Sentiment in School
14	Free access to Holy Sites
15	Free Access, Safety, and Movement of Israelis in Palestinian Territory
16	Give up the Demand for Return
17	Lobby Arab States for Compensation for Jewish Refugees from Arab Lands
18	Palestinian Declaration Against Iranian Nuclear Development
19	Release of Gilad Shalit
20	Renounce & Reign in Violence
21	Seek a Resolution w/ Israelis to Settlement of Refugees in the Palestinian State (not including Jerusalem)
22	Work Cooperatively w/ Israel

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Costs and Perceived Benefits

Israeli Costs from its Concessions	Priorities	Israeli Perception of Palestinian Benefits from Israeli Concessions	Priorities	Palestinian Costs from its Concessions	Priorities	Palestinian Perception of Israeli Benefits from Palestinian Concessions	Priorities
End of claims and end of conflict	0.2093	Control of the Muslim holy places	0.0853	Accommodation and rehabilitation of Palestinian refugees not allowed to return to Israel	0.1192	Acknowledgement of Israeli control over the Wailing Wall and the Jewish Quarter in the Old City of Jerusalem	0.1626
Integrity and unity of Israeli society post agreement	0.0659	East Jerusalem as the capital of Palestine	0.1361	Conflict between Palestinian diaspora and the internal leadership	0.0948	Economic relations and new markets including tourism with neighboring Arab and Islamic countries	0.0999
Legitimization of the State of Israel	0.0778	Economic stability and prosperity	0.0219	Dislocation and fragmentation of Palestinian social fabric	0.0392	End of claims by the Palestinians	0.2556
Maintain the Jewish majority of Israel alongside with the Arab minority	0.2249	Evacuation of the settlers in the settlements	0.0661	Giving up the claim over historic Palestine occupied in 1948 and known later as the State of Israel	0.2055	Gaining legitimacy of the Palestinian and Arab and Muslim world	0.1111
Make Israel more attractive to Jewish diaspora and Israelis citizens	0.0322	Freedom, dignity and feeling of equality	0.1449	Loss of military capability to defend the State of Palestine	0.0575	Integration in the Middle East with normal relations with its neighbors and Arab World	0.0658
Peace, economy and stability in region	0.086	Independent state	0.2145	Loss of property rights	0.0395	Obtaining security by acceptance and recognition of the Palestinians and Arab and Muslim world	0.108
Security	0.1831	International recognition & permanent borders	0.0368	Partial loss/depletion of natural resources by sharing them with Israel	0.1257	Obtaining territorial gains	0.1184
Stop being occupiers	0.0477	Maximization of the area (land)	0.0816	Restrictions on national sovereignty by accepting demilitarization and multinational monitoring	0.1013	Reduction of military expenditures enabling national development	0.0239
Strengthening the alliance with the United States	0.0457	Solve the refugees problem	0.2128	Territorial loss as a result of unfair land swap	0.2173	Regional cooperation against external threats	0.0333
Weakening the radical forces in the Middle East headed by Iran	0.0274					Sharing the Palestinians with their own natural resources	0.0215

Benefits and Perceived Costs

Israeli Benefits from Palestinian Concessions	Priorities	Israeli Perception of Palestinian Costs from Palestinian Concessions	Priorities	Palestinian Benefits from Israeli Concessions	Priorities	Palestinina Perception of Israeli Costs from Israeli Concessions	Priorities
End of claims	0.2216	Giving up on the Idea of a Greater Palestine	0.088	East Jerusalem as the capital of the State of Palestine	0.1654	Changing of Zionist narrative	0.4541
Integrity and unity of Israeli society post agreement	0.0753	Loss of 'victim' status	0.0288	Evacuation of the Israeli settlements	0.0415	Property restitution and compensation	0.0689
Legitimization of the State of Israel	0.0654	Loss of International financial support	0.0252	Having full control over air space, maritime, borders and outlets	0.1086	Rehabilitating evacuated settlers from the Palestinian territories	0.2047
Maintain the Jewish majority of Israel alongside with the Arab minority	0.1899	Loss of land (67 Border) / wap	0.15	International guarantees and assurances to protect Palestine State security and integrity	0.0403	Settlements evacuation	0.2723
Make Israel more attractive to Jewish diaspora and Israelis citizens	0.0397	Partial control of East Jerusalem as the capital of Palestine	0.1735	Permanent borders	0.2095		
Peace, prosperity and stability in region	0.0959	Partial control of the Muslim holy places	0.128	Release of political prisoners including those who are Israeli citizens	0.0186		
Security	0.1636	Partial solution refuge problem	0.3101	Resolution of the refugee problem	0.0654		
Stop being occupiers	0.0529	Remainder of part of the Settlement Community	0.0964	Respect the integrity of West Bank and Gaza	0.0571		
Strengthening the alliance with the United States	0.0477			Share of water and other resources	0.0181		
Weakening the radical forces in the Middle East headed by Iran	0.0479			Shared control of Jerusalem and holy places	0.0613		
				Sovereign Palestinian State	0.2054		
				Stop incitment and raging hatred	0.0087		

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Priorities of Benefits, Costs, Perceived Benefits and Perceived Costs

Israelis' Concessions	Israelis' Costs	Israelis' _Perception_of_Palestinians' _Benefits	Israelis' Total Loss	Palestinians' Benefits	Palestinians' _Perception_of_Israelis' _Costs	Palestinians' Total Gain
1	1	1	1000000	0.882978723	0.968343964	855027.1172
2	0.64450239	0.763651407	492175.1568	0.989361702	0.971651311	961314.5951
3	0.905149935	0.270546056	244884.7452	0.957446809	0.783486889	750147.0211
4	0.946979574	0.825289575	781532.3705	0.882978723	0.95145287	840112.6408
5	0.196110387	0.540540541	106005.6145	0.79787234	0.758327427	605048.4793
6	0.882442416	0.428019857	377702.8765	0.542553191	0.740963855	402012.3045
7	0.198392003	0.514892443	102150.5434	0.978723404	0.905386251	886122.7136
8	0.829856584	0.806811914	669538.1789	1	0.969170801	969170.8009
9	0.054541504	0.82046332	44749.30322	0.978723404	0.907984881	888666.0535
10	0.100608431	0.532266961	53550.54387	0.808510638	0.5459485	441405.1701
11	0.112016515	0.285300607	31958.37957	0.670212766	0.525986298	352522.7317
12	0.859626249	0.957115279	822761.4172	0.978723404	0.907512403	888203.628
13	0.359300304	0.891478213	320308.3931	0.925531915	1	925531.9149
14	0.51781834	0.478075014	247556.01	0.755319149	0.650838649	491590.8942
15	0.163298566	0.602730281	98424.99053	0.85106383	0.733404205	624173.7915
16	0.180573664	0.732901269	132342.6671	0.882978723	0.917434444	810075.0939
17	0.074098218	0.111003861	8225.18831	0.414893617	0.499055044	207054.7522

Priorities of Benefits, Costs, Perceived Benefits and Perceived Costs

Palestinians' Concessions	Palestinians' Costs	Palestinians' _Perception_of_ _Israelis' _Benefits	Palestinians' Total Loss	Israelis' Benefits	Israelis' _Perception_of_ _Palestinians' _Costs	Israelis' Total Gain
1	0.934927361	0.2	186985.4722	0.923276309	0.635294118	586552.0081
2	0.887711864	0.2	177542.3729	0.233281493	0.474346405	110656.2376
3	0.810078692	0.2	162015.7385	0.703265941	0.110620915	77795.92189
4	0.851846247	0.894694918	762142.508	0.994401244	0.166013072	165083.6052
5	0.843825666	0.2	168765.1332	0.754276827	0.301143791	227145.7831
6	0.903450363	0.934522861	844295.0184	0.874131674	1	874131.6744
7	0.863498789	0.2	172699.7579	0.805495075	0.619607843	499091.0662
8	0.929782082	0.957304445	890084.5201	1	0.855718954	855718.9542
9	0.871822034	0.2	174364.4068	0.596785899	0.135294118	80741.62169
10	0.769067797	0.233073124	179249.034	0.70305858	0.335457516	235846.2849
11	0.895732446	0.2	179146.4891	0.659201659	0.109640523	72275.21456
12	0.552209443	0.2	110441.8886	0.396785899	0.034803922	13809.70532
13	0.687802663	0.2	137560.5327	0.615344738	0.111928105	68874.37021
14	0.509836562	0.2	101967.3123	0.496734059	0.044281046	21995.9036
15	0.811894673	0.2	162378.9346	0.200933126	0.366339869	73609.8151
16	1	1	100000	0.925142561	0.622058824	575493.093
17	0.579600484	0.2	115920.0969	0.854121306	0.525326797	448692.8105
18	0.735169492	0.2	147033.8983	0.758320373	0.187091503	141875.2986
19	0.862136804	0.390951091	337053.3243	0.957179886	0.872385621	835029.9691
20	0.815829298	0.2	163165.8596	0.406946604	0.054411765	22142.68289
21	0.2	0.2	40000	0.761327112	0.185784314	141442.6351

How to evaluate a Tradeoff

- Each party identifies a set of concessions (trade-offs) it requires from the other party.
- Each concession (trade-off) that a party gives away, yields for that party a set of costs (not necessarily monetary) and a perceived set of benefits for the party receiving it.
- Each trade-off that a party receives generates a set of benefits and a perceived set of losses for the party giving it away.
- The benefits, costs, perceived benefits and perceived costs are prioritized using the AHP.
- The concessions (trade-offs) are evaluated according to the benefits, costs, perceived benefits, and perceived costs.
- **Gain-loss ratios are constructed for each pair of concessions. Gain-loss ratios are not symmetric for the parties.**
- Only the pairs of concessions (trade-offs) in which both parties benefit from the trade-off, i.e., the gain-loss ratio is greater than 1, are selected. These are deemed acceptable concessions. Acceptable pairs of trade-offs are identified with the additional condition that the gain-loss ratio of a pair of concessions is as close as possible for the parties (i.e., within a small percentage of each other).
- The traded acceptable concessions are merged into a cohesive set of guidelines.

Tradeoffs' Gain/Loss Ratio - Israeli's Ratios

Israelis' Ratios	Accept mutually agreed upon land swap	Accept settlers under Palestinian sovereignty as residents	Accept the temporary presence of multinational military monitoring system in Jordan Valley	Accept Two-State Solution	Acceptance a Two-State solution which includes a Non-Contiguous State	Acknowledge Israel's Existence as a Jewish State	Acknowledge Israel's Existence as an Independent State	Agree to Compromise to the Demand of the Right of Return	Agreeing with Palestinian demilitarized state	Preserve the Status Quo in the Holy places of Jerusalem	Allow Israel to use Palestinian airspace	Declare Against Iranian Nuclear Development	Denounce & Reign in Violence	Denounce Iranian pursuit of nuclear arms and support Israeli's effort to remove the threat	Lobby Arab States to Allow both Israelis and Palestinians to Have the Right to Return to their land of origin	Make Compromise on the Status of Jerusalem	Palestinians must guarantee that any agreement reached with Israel will be accepted and supported by the majority of the Palestinian people both in Gaza and the West Bank	Refrain and work against any anti-Israel sentiments in Palestinian schools	Seek Assistance for a Legitimate Settlement of Refugees	Sharing of Natural Resources	Work Cooperatively and in active engagement w/ Israel
Abandon the Idea of Jewish State	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Accept Palestinian full control of the borders of the Palestinian State and its outlets	1.192	0.000	0.000	0.000	0.000	1.776	1.014	1.739	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.169	0.000	0.000	1.697	0.000	0.000
Accept the historical responsibility for the Palestinian refugee problem	2.395	0.000	0.000	0.000	0.000	3.570	2.038	3.494	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.350	1.832	0.000	3.410	0.000	0.000
Accept the Palestinian refugee rights to return	0.000	0.000	0.000	0.000	0.000	1.118	0.000	1.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.068	0.000	0.000
Accept to abide by the status quo in the holy places in Jerusalem	5.533	1.044	0.000	1.557	2.143	8.246	4.708	8.072	0.000	2.225	0.000	0.000	0.000	0.000	0.000	5.429	4.233	1.338	7.877	0.000	1.334
Accept to abolish law of return	1.553	0.000	0.000	0.000	0.000	2.314	1.321	2.266	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.524	1.188	0.000	2.211	0.000	0.000
Accept to respect the integrity of the West Bank and Gaza by allowing free and safe passage between the two areas.	5.742	1.083	0.000	1.616	2.224	8.557	4.886	8.377	0.000	2.309	0.000	0.000	0.000	0.000	0.000	5.634	4.392	1.389	8.175	0.000	1.385
Accept East Jerusalem as the capital of the Palestinian State	0.000	0.000	0.000	0.000	0.000	1.306	0.000	1.278	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.247	0.000	0.000
Accept Two-State Solution on the borders of the 4th of June 1967	13.108	2.473	1.738	3.689	5.076	19.534	11.153	19.123	1.804	5.270	1.615	0.000	1.539	0.000	1.645	12.860	10.027	3.170	18.660	0.000	3.161
Allow all parties to have equal access to and control of religious sites and holy places	10.953	2.066	1.453	3.083	4.242	16.323	9.320	15.980	1.508	4.404	1.350	0.000	1.286	0.000	1.375	10.747	8.379	2.649	15.593	0.000	2.641
Allow the sharing of all natural resources between Palestinians and Israelis	18.354	3.463	2.434	5.166	7.108	27.352	15.617	26.776	2.526	7.380	2.262	0.000	2.155	0.000	2.303	18.008	14.040	4.439	26.129	0.000	4.426
Comply with all applicable UN Resolutions	0.000	0.000	0.000	0.000	0.000	1.062	0.000	1.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.015	0.000	0.000
Evacuate settlers of Jewish settlements on land claimed by the Palestinians with or without compensation	1.831	0.000	0.000	0.000	0.000	2.729	1.558	2.672	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.797	1.401	0.000	2.607	0.000	0.000
Release all political prisoners including those who are Israeli citizens	2.369	0.000	0.000	0.000	0.000	3.531	2.016	3.457	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.325	1.812	0.000	3.373	0.000	0.000
Share Jerusalem as two capitals of two states	5.959	1.124	0.000	1.677	2.308	8.881	5.071	8.694	0.000	2.396	0.000	0.000	0.000	0.000	0.000	5.847	4.559	1.441	8.484	0.000	1.437
Solve the Palestinian refugee problem in a just and agreed upon manner	4.432	0.000	0.000	1.247	1.716	6.605	3.771	6.466	0.000	1.782	0.000	0.000	0.000	0.000	0.000	4.349	3.390	1.072	6.310	0.000	1.069
Stop incitement by the religious and national education and religious leaders in Israel against Muslims and Arabs	71.312	13.453	9.458	20.070	27.616	106.275	60.678	104.036	9.816	28.674	8.787	1.679	8.374	2.674	8.949	69.967	54.551	17.249	101.521	2.692	17.196

Tradeoffs' Gain/Loss Ratio - Palestinian's Ratios

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Palestinians' Ratios	Accept mutually agreed upon land swap	Accept settlers under Palestinian sovereignty as residents	Accept the temporary presence of multinational military monitoring system in Jordan Valley	Accept Two-State Solution	Acceptance a Two-State solution which includes a Non-Contiguous State	Acknowledge Israel's Existence as a Jewish State	Acknowledge Israel's Existence as an Independent State	Agree to Compromise to the Demand of the Right of Return	Agreeing with Palestinian demilitarized state	Preserve the Status Quo in the Holy places of Jerusalem	Allow Israel to use Palestinian airspace	Declare Against Iranian Nuclear Development	Denounce & Reign in Violence	Denounce Iranian pursuit of nuclear arms and support Israelis effort to remove the threat	Lobby Arab States to Allow both Israelis and Palestinians to Have the Right to Return to their land of origin	Make Compromise on the Status of Jerusalem	Palestinians must guarantee that any agreement reached with Israel will be accepted and supported by the majority of the Palestinian people both in Gaza and the West Bank	Refrain and work against any anti-Israel sentiments in Palestinian schools	Seek Assistance for a Legitimate Settlement of Refugees	Sharing of Natural Resources	Work Cooperatively and in active engagement w/ Israel
Abandon the Idea of Jewish State	4.573	4.816	5.277	1.122	5.066	1.013	4.951	0.000	4.904	4.770	4.773	7.742	6.216	8.385	5.266	0.000	7.376	5.815	2.537	5.240	21.376
Accept Palestinian full control of the borders of the Palestinian State and its outlets	5.141	5.415	5.933	1.261	5.696	1.139	5.566	1.080	5.513	5.363	5.366	8.704	6.988	9.428	5.920	0.000	8.293	6.538	2.852	5.892	24.033
Accept the historical responsibility for the Palestinian refugee problem	4.012	4.225	4.630	0.000	4.445	0.000	4.344	0.000	4.302	4.185	4.187	6.792	5.453	7.357	4.620	0.000	6.471	5.102	2.226	4.597	18.754
Accept the Palestinian refugee rights to return	4.493	4.732	5.185	1.102	4.978	0.000	4.865	0.000	4.818	4.687	4.690	7.607	6.107	8.239	5.174	0.000	7.247	5.714	2.493	5.149	21.003
Accept to abide by the status quo in the holy places in Jerusalem	3.236	3.408	3.735	0.000	3.585	0.000	3.503	0.000	3.470	3.375	3.377	5.478	4.398	5.934	3.726	0.000	5.220	4.115	1.795	3.708	15.126
Accept to abolish law of return	2.150	2.264	2.481	0.000	2.382	0.000	2.328	0.000	2.306	2.243	2.244	3.640	2.922	3.943	2.476	0.000	3.468	2.734	1.193	2.464	10.050
Accept to respect the integrity of the West Bank and Gaza by allowing free and safe passage between the two areas.	4.739	4.991	5.469	1.163	5.251	1.050	5.131	0.000	5.082	4.944	4.946	8.023	6.442	8.690	5.457	0.000	7.644	6.027	2.629	5.431	22.153
Accept East Jerusalem as the capital of the Palestinian State	5.183	5.459	5.982	1.272	5.743	1.148	5.612	1.089	5.558	5.407	5.410	8.775	7.045	9.505	5.969	0.000	8.361	6.591	2.875	5.940	24.229
Accept Two-State Solution on the borders of the 4th of June 1967	4.753	5.005	5.485	1.166	5.266	1.053	5.146	0.000	5.097	4.958	4.961	8.046	6.460	8.715	5.473	0.000	7.666	6.044	2.637	5.446	22.217
Allow all parties to have equal access to and control of religious sites and holy places	2.361	2.486	2.724	0.000	2.615	0.000	2.556	0.000	2.532	2.463	2.464	3.997	3.209	4.329	2.718	0.000	3.808	3.002	1.310	2.705	11.035
Allow the sharing of all natural resources between Palestinians and Israelis	1.885	1.986	2.176	0.000	2.089	0.000	2.041	0.000	2.022	1.967	1.968	3.192	2.563	3.457	2.171	0.000	3.041	2.398	1.046	2.161	8.813
Comply with all applicable UN Resolutions	4.750	5.003	5.482	1.165	5.263	1.052	5.143	0.000	5.094	4.955	4.958	8.042	6.457	8.711	5.470	0.000	7.662	6.041	2.635	5.444	22.205
Evacuate settlers of Jewish settlements on land claimed by the Palestinians with or without compensation	4.950	5.213	5.713	1.214	5.484	1.096	5.359	1.040	5.308	5.163	5.166	8.380	6.728	9.077	5.700	0.000	7.984	6.295	2.746	5.672	23.138
Release all political prisoners including those who are Israeli citizens	2.629	2.769	3.034	0.000	2.913	0.000	2.847	0.000	2.819	2.743	2.744	4.451	3.574	4.821	3.027	0.000	4.241	3.343	1.458	3.013	12.290
Share Jerusalem as two capitals of two states	3.338	3.516	3.853	0.000	3.698	0.000	3.614	0.000	3.580	3.482	3.484	5.652	4.537	6.121	3.844	0.000	5.385	4.245	1.852	3.825	15.604
Solve the Palestinian refugee problem in a just and agreed upon manner	4.332	4.563	5.000	1.063	4.800	0.000	4.691	0.000	4.646	4.519	4.522	7.335	5.889	7.944	4.989	0.000	6.988	5.509	2.403	4.965	20.252
Stop incitement by the religious and national education and religious leaders in Israel against Muslims and Arabs	1.107	1.166	1.278	0.000	1.227	0.000	1.199	0.000	1.187	1.155	1.156	1.875	1.505	2.031	1.275	0.000	1.786	1.408	0.000	1.269	5.176

Example: I2 vs P1

I2 - Accept Palestinian full control of the borders of the Palestinian State and its outlets

P1 - Accept mutually agreed upon land swap

- Israeli ratio = $\frac{\text{Gain from P2}(586552)}{\text{Loss from I1}(492175)} = 1.192$

- Palestinian ratio = $\frac{\text{Gain from I1}(961314)}{\text{Loss from P2}(186985)} = 5.141$

How to evaluate a Tradeoff

- Each party identifies a set of concessions (trade-offs) it requires from the other party.
- Each concession (trade-off) that a party gives away, yields for that party a set of costs (not necessarily monetary) and a perceived set of benefits for the party receiving it.
- Each trade-off that a party receives generates a set of benefits and a perceived set of losses for the party giving it away.
- The benefits, costs, perceived benefits and perceived costs are prioritized using the AHP.
- The concessions (trade-offs) are evaluated according to the benefits, costs, perceived benefits, and perceived costs.
- Gain-loss ratios are constructed for each pair of concessions. Gain-loss ratios are not symmetric for the parties.
- **Only the pairs of concessions (trade-offs) in which both parties benefit from the trade-off, i.e., the gain-loss ratio is greater than 1, are selected. These are deemed acceptable concessions. Acceptable pairs of trade-offs are identified with the additional condition that the gain-loss ratio of a pair of concessions is as close as possible for the parties (i.e., within a small percentage of each other).**
- The traded acceptable concessions are merged into a cohesive set of guidelines.

Fair and Equitable Tradeoffs

Let T_A and T_B be the sets of concessions (trade-offs) of parties A and B, respectively. Let $w(C_A | T_A)$ and $w(C_B | T_B)$ be the relative costs of the trade-offs for each party; let $w_A(PB_B | T_A)$ and $w_B(PB_A | T_B)$ be the relative perceived benefits of a party from a concession by the other party. For example, $w_A(PB_B | T_A)$ represents A's relative perceived benefits of B from A's concessions. Let $w(Ben_A | T_B)$ and $w(Ben_B | T_A)$ be the relative benefits from the concessions of the other party; and let $w_B(PC_A | T_A)$ and $w_A(PC_B | T_B)$ a party's relative perceived costs of the other party from its own concessions. The gain-loss ratios are formed as follows:

Gain-Loss Ratios

$$\text{A's ratios: } R_A(T_A, T_B) = \frac{w(\text{Ben}_A | T_B) * w_A(PC_B | T_B)}{w(C_A | T_A) * w_A(PB_B | T_A)},$$

$$\text{B's ratios: } R_B(T_A, T_B) = \frac{w(\text{Ben}_B | T_A) * w_B(PC_A | T_A)}{w(C_B | T_B) * w_B(PB_A | T_B)}$$

A Fair and Equitable Agreement

$$\begin{array}{l} \textit{Max} \\ (i,j) \in T_A \times T_B \end{array} \quad \begin{array}{l} \textit{Min} \\ x_{ij} = 0,1 \\ |R_A(i,j) - R_B(i,j)| < \varepsilon \end{array} \quad \left\{ R_A(i,j)x_{ij}, R_B(i,j)x_{ij} \right\}$$

Paired Concessions and Gain-Loss Ratios

	Israeli Concessions				Palestinian Concessions	
12	Comply with all applicable UN Resolutions	1.06	0.01	6	Acknowledge Israel's existence as a Jewish State	1.05
9	Accept Two-State Solution on the borders of the 4th of June 1967	5.08	0.05	5	Accept a Two-State solution which includes a non-contiguous state	5.26
7	Accept to respect the integrity of the West Bank and Gaza by allowing free and safe passage between the two areas	4.88	0.05	7	Acknowledge Israel's existence as an independent State	5.13
16	Solve the Palestinian refugee problem in a just and agreed upon manner	4.43	0.05	1	Accept mutually agreed upon land swap	4.33
13	Evacuate settlers of Jewish settlements on land claimed by the Palestinians with or without compensation	4.61	0.05	19	Seek assistance for a legitimate settlement of refugees	2.75
11	Allow the sharing of all natural resources between Palestinians and Israelis	2.3	0.1	15	Lobby Arab states to allow both Israelis and Palestinians to have the right to return to their land of origin	2.17
15	Share Jerusalem as two capitals of two states	4.56	0.1	17	Palestinians must guarantee that any agreement reached with Israel will be accepted and supported by the majority of the Palestinian people, both in Gaza and the West Bank	5.38
10	Allow all parties to have equal access to and control of religious sites and holy places	2.64	0.1	18	Refrain and work against any anti-Israel sentiments in Palestinian schools	3
17	Stop incitement by the religious and national education and religious leaders in Israel against Muslims and Arabs	1.68	0.1	12	Declare against Iranian nuclear development	1.87
8	Accept East Jerusalem as the capital of the Palestinian State	1.28	0.1	8	Agree to compromise to the demand of the right of return	1.09
2	Accept Palestinian full control of the borders of the Palestinian State and its outlets	5.43	0.01	2	Accept settlers under Palestinian sovereignty as residents	5.41
5	Accept to abide by the status quo in the holy places in Jerusalem			16	Make compromises on the status of Jerusalem	

The set of six concessions from each party that survived (unpaired)

# Israeli Concessions				# Palestinian Concessions	
2	Accept Palestinian full control of the borders of the Palestinian State and its outlets			1	Accept mutually agreed upon land swap
7	Accept to respect the integrity of the West Bank and Gaza by allowing free and safe passage between the two areas.			3	Accept the temporary presence of multinational military monitoring system in Jordan Valley
8	Accept East Jerusalem as the capital of the Palestinian State			6	Acknowledge Israel's Existence as a Jewish State
9	Accept Two-State Solution on the borders of the 4th of June 1967			9	Agreeing with Palestinian demilitarized state
13	Evacuate settlers of Jewish settlements on land claimed by the Palestinians with or without compensation			10	Preserve the Status Quo in the Holy places of Jerusalem
16	Solve the Palestinian refugee problem in a just and agreed upon manner			17	Palestinians must guarantee that any agreement reached with Israel will be accepted and supported by the majority of the Palestinian people both in Gaza and the West Bank

Israeli-Palestinian Pittsburgh Declaration of Principles	
	August 2011
1	A Two-State Solution on the borders of the 4th of June 1967, with mutually agreed upon land swap
2	Israel must respect the integrity of the West Bank and Gaza by allowing free and safe passage between the two areas, and the Palestinian State must guarantee that any agreement reached with Israel will be accepted and supported by the majority of the Palestinian people both in Gaza and the West Bank
3	East Jerusalem is the capital of the Palestinian State. The parties will maintain the Status Quo of the Holy places in Jerusalem.
4	Acknowledge Israel's Existence as a Jewish State without jeopardizing the rights of its minority Israeli citizens.
5	Evacuation of Israeli settlers from the Palestinian territories that are not included in the land swap.
6	Palestinian full control of the borders of the Palestinian State and its outlets, and deployment of a temporary agreed upon multinational military monitoring system in the Jordan Valley.
7	Solve the Palestinian refugee problem in a just and agreed upon manner
8	A demilitarized Palestinian state
9	Agreed upon international monitoring mechanism and agreed upon binding international arbitration mechanisms.
10	The full implementation of these principles concludes end of the conflict and claims of the two parties