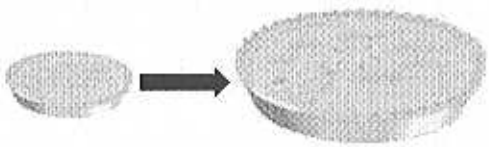
Applying Game Theory to Negotiation

Game theory is a branch of applied mathematics that is used in economics and other sciences. "Game theory attempts to mathematically capture behaviour in strategic situations, in which an individual's success in making choices depends on the choices of others."[1]

Any conflict and thus also negotiations must bee seen as such situations.

Generally, people tend to view conflicts and negotiations as zero-sum-games, and sometimes that's what they are. In a **zero-sum-game**, the benefits and losses of all players add up to zero, which means that one can only benefit at the equal expense of others. "The more I gain, the more the other one loses." (=win/lose-situation). This is often the case, when there is no pervious or future relation between the parties and there is only one issue at stake, that is there is only one resource (in most cases: money) to be distributed (assumption of a "fixed pie"). The matching approach to negotiation is then called **distributive, competitive or positional negotiation**.

Yet many conflicts are zero-sum-games only at first sight but eventually turn out to be **positive-sum-games** ("everybody wins something"; win/win) ore negative-sum-games (lose/lose). The latter happens e.g. when the parties to a conflict spent more and more energy, time and money in their attempts to prevail without actually reaching a settlement.
The win-win approach assumes that the "pie" is not fixed but can be expanded, by cooperation e.g. effective ways of sharing resources which lead to synergies. This is the case, when there are multiple issues, interests and resources at stake and the parties do have different preferences towards them. A negotiation then is about integrating the various interests into a solution, which includes trade-offs across the issues. **Integrative, cooperative or interest-based negotiation** is used as a term for it.



The main challenge then is to identify the underlying interests of the conflicting parties, which is often difficult because they tend to hide their real interests as well as information about additional resources they could contribute to an integrative solution, because of a lack of trust. The information, they legitimately fear, could possibly be misused by the other side. However, the dilemma is that if both sides then keep

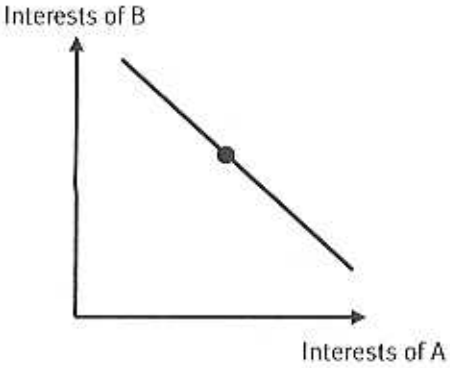
[1] Wikipedia, the free encyclopedia.

hiding their interests and information, they run back to a zero-sum-game and fail to "expand the pie" – in many cases rather tend to destroy it (lose-lose). This dire situation is captured by the game-theoretical concept of the **prisoners dilemma.**

A common critique towards game theory is that it relies on the paradigm that the players only act in order to maximize their wins (homo economicus model). While this proofs to be helpful to explain and predict human behaviour in a broad variety of contexts, it is certainly not the case in each and every conflict. Especially when relationship-issues are crucial, people tend to behave stubbornly and refrain from cooperating even if that does not serve their interests and thus can be called irrational in economic terms. During a negotiation-process this kind of behaviour can be overcome, if the relationship-issues are addressed properly and a renewed mutual understanding and trust can be established. This often includes recognition of other perspectives, acknowledgment to the feeling of being insulted and apologies.
In economic terms, the preferences of the conflict parties to the issues and interests at stake then dramatically change. While parties were at the beginning digging into their positions ("I want xyz and I am not ready to make any concession about it!"), they rather drop a number of points later. Stalemates can be overcome and the road is paved for an integrative solution. This approach to negotiation/mediation can be called **understanding-based** (because it focuses on mutual understanding and recognition) or **transformative**, because the original conflict (that is: the preferences of the parties towards the various issues) is transformed. As opposed to this, integrative bargaining relies on *given* preferences.

In many negotiation processes, all **three approaches** have to be **combined**. Relationship-issues have to be resolved first, with an understanding-based, transformative approach. Parties then are ready to attempting to expand the pie with an integrative approach. However, eventually even the bigger pie has to be shared – which is definitely easier than sharing a small pie! This is why a certain aspect of distributive bargaining still remains.

Distributive/ competitive/ positional Negotiation

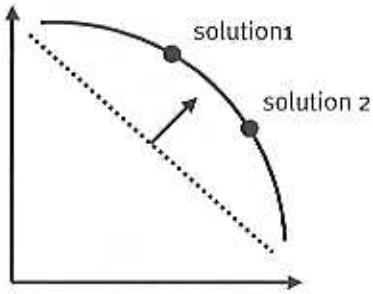


Zero-Sum-Game

- Single issue
- all possible outcomes illustrated by straight line (see left)
- no option available to expand the pie
- Power (BATNA[2]) dominates the outcome
- Specific decision making processes can be applied in order to reach a fair outcome, e.g. „one cuts, one chooses“
- Referring to objective criteria (principled negotiation; the Harvard-Model according to Fisher/Ury/Patton)

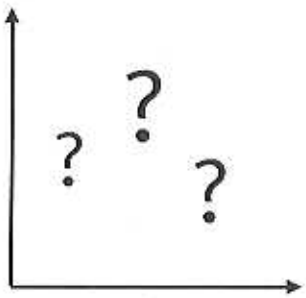
[2] Best Alternative to a negotiated agreement

Integrative/ cooperative/ interest-based negotiation



- Multiple issues can be integrated into a settlement
- Possible outcomes above the straight line (=added value)
- win-win („expanding the pie“) trade-offs based on different preferences
- positive-sum-game
- prisoners dilemma: revealing information is crucial but dangerous (misuse!) at the same time
- includes distributive bargaining-problem: How to distribute the added value?

Transformative/ understanding-based approach



- Preferences shift while the process of negotiation is running because of renewed mutual understanding, recognition, apologies
- Difficult relationship makes leads to irrational behaviour; negotiating substantial issues becomes impossible (previous insults leading to stubbornness regarding the positions)
- Homo-economicus-model and thus game-theory not applicable
- Often the case at escalation level 4 (and beyond) according to Glasl

The Prisoner's Dilemma[3]

The **prisoner's dilemma** constitutes a problem in game theory. In its classical form, the prisoner's dilemma ("PD") is presented as follows:

> Two suspects are arrested by the police. The police have insufficient evidence for a conviction, and, having separated both prisoners, visit each of them to offer the same deal. If one testifies (defects from the other) for the prosecution against the other and the other remains silent (cooperates with the other), the betrayer goes free and the silent accomplice receives the full 10-year sentence. If both remain silent, both prisoners are sentenced to only six months in jail for a minor charge. If each betrays the other, each receives a five-year sentence. Each prisoner must choose to betray the other or to remain silent. Each one is assured that the other would not know about the betrayal before the end of the investigation. How should the prisoners act?

If we assume that each player prefers shorter sentences to longer ones, and that each gets no utility out of lowering the other player's sentence, and that there are no reputation effects from a player's decision, then the prisoner's dilemma forms a non-zero-sum game in which two players may each cooperate with or defect from (betray) the other player. In this game, as in all game theory, the only concern of each individual player (prisoner) is maximizing his/her own payoff, without any concern for the other player's payoff. (…)Rational choice leads the two players to both play defect, even though each player's individual reward would be greater if they both played cooperatively.

In the **iterated prisoner's dilemma**, the game is played repeatedly. Thus each player has an opportunity to punish the other player for previous non-cooperative play. If the number of steps is known by both players in advance, economic theory says that the two players should defect again and again, no matter how many times the game is played. Only when the players play an indefinite or random number of times can cooperation be an economic equilibrium. In this case, the incentive to defect can be overcome by the threat of punishment. (…)

In casual usage, the label "prisoner's dilemma" may be applied to situations not strictly matching the formal criteria of the classic or iterative games, for instance, those in which two entities could gain important benefits from cooperating or suffer from the failure to do so, but find it merely difficult or expensive, not necessarily impossible, to coordinate their activities to achieve cooperation.The classical prisoner's dilemma can be summarized thus:

	Prisoner B Stays Silent	**Prisoner B Betrays**
Prisoner A Stays Silent	Each serves 6 months	Prisoner A: 10 years Prisoner B: goes free
Prisoner A Betrays	Prisoner A: goes free Prisoner B: 10 years	Each serves 5 years

Payoff-Matrix:

Example PD payoff matrix

	Cooperate	**Defect**
Cooperate	3, 3	0, 5
Defect	5, 0	1, 1

[3] Text derived from wikipedia

Analysing Negotiation Problems

Matrices are a most useful tool to analyse and prepare integrative negotiations. They can sometimes even be used in the negotiation itself to find the best solution (in economic/ game theoretic terms).

The preferences with regard to the respective issues (e.g. goods, resources to be distributed) are allocated by each party. Each party has to distribute 100% in a way that resembles the relation of the preferences. The optimal solution can now be found mathematically. The sum of the realised percentages of the parties is regularly far beyond 100 (=added value; win-win). Computer software is available, which uses such algorithms for settling disputes ("Adjusted-Winner-Procedure").

Example: Heritage

	Sibling A	Sibling B	Sibling C
Car	(70)	0	10
Furniture		10	(20)
Jewellery		(30)	30
Carpets	10	(40)	0
Piano	20	20	(40)
Solution (..)[4]	70	70	60

Non-Material interests can also be integrated in such a Matrix. E.g. in a business conflict which is about the (non-)payment of a certain bill, a companies interests might be

a) saving the money (30%)
b) saving time (settle quickly; 20%)
c) maintaining a good reputation (50%).

Any option can now be examined as to which extend it serves these interests and thus mathematically compared.

Negotiation Dilemma: *If parties do not distribute their numbers according to their real preferences but in a tactical way - assuming what the opponents preferences are and then distributing one's own numbers in a way that outbids the other one – then they end up immediately in the lose-lose corner of a prisoners dilemma!*

[4] Everyone gets the items which are put in brackets.

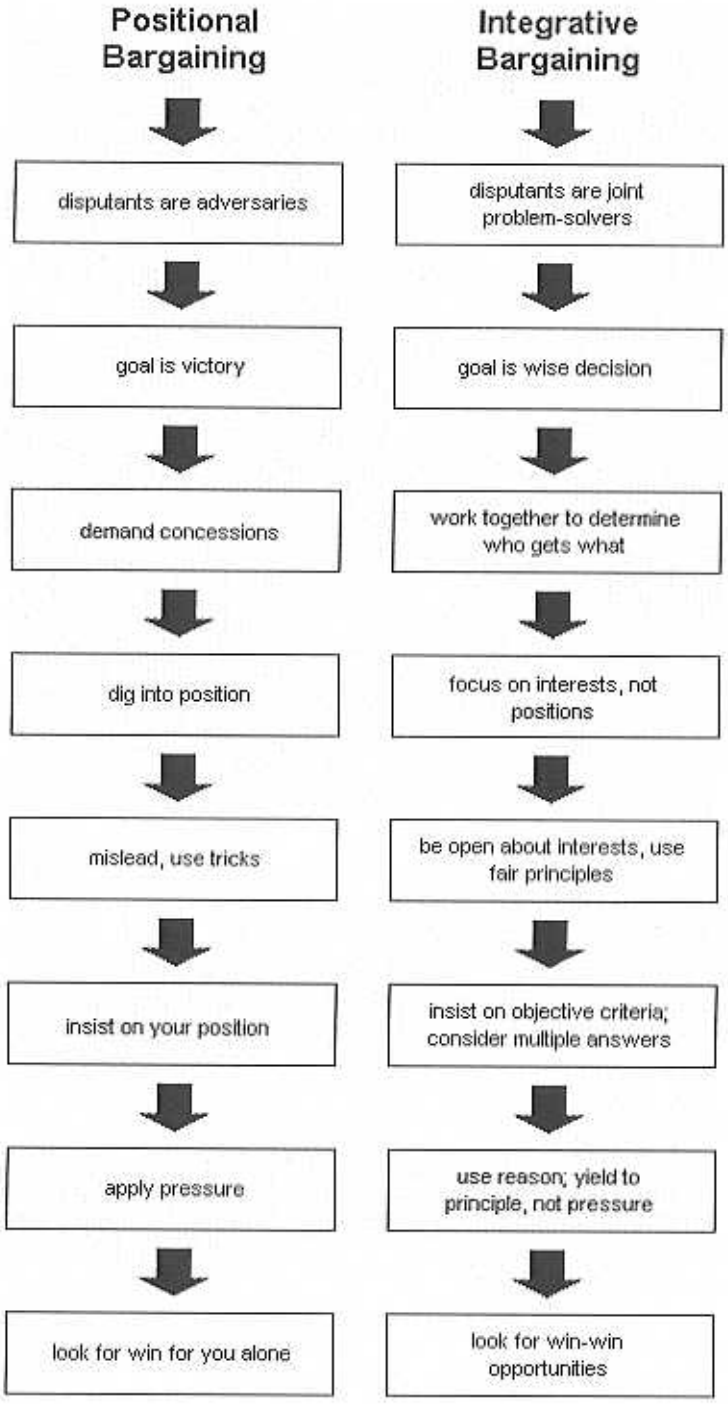


Illustration from: Sprangler, Brad 2003

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