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Modelling the International Climate Change Negotiations: A Non-Technical Outline of Model Architecture

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1. The basic elements

The overall purpose of the project is to develop a model enabling us to (1) explore systematically the political feasibility of alternative policy options, and (2) determine the settlement range - i.e. the set of politically feasible solutions - in the global climate change negotiations. Furthermore, the model should enable us to determine which of the options that fall within the settlement range (assuming there will be more than one) are more likely than others to be chosen. The purpose of this paper is to describe, in non-technical terms, the overall architecture of such a model, including its basic elements and the relationships among these elements.¹

A recurring dilemma in most modelling efforts is the trade-off between realism and complexity on the one hand and tractability and conclusiveness on the other. The way one decides to resolve this dilemma has important implications; the most tractable set of assumptions tend to “..exclude almost everything that is interesting and important about negotiations”,² while ambitions to cover everything that seems “relevant” would leave us with a burden that is bound to keep us grounded for ever. In this project we start out with a narrow rationalist conception of negotiation as a *decision-making* process, i.e. a process of *aggregating* actor preferences into a collective *choice* of policy. We do recognise that negotiations typically are also processes of problem-solving and learning - processes in which problems are jointly interpreted and diagnosed; solutions invented, explored and perhaps modified; and also processes where actor perceptions, beliefs and preferences often evolve and change in response to new information, ideas, or

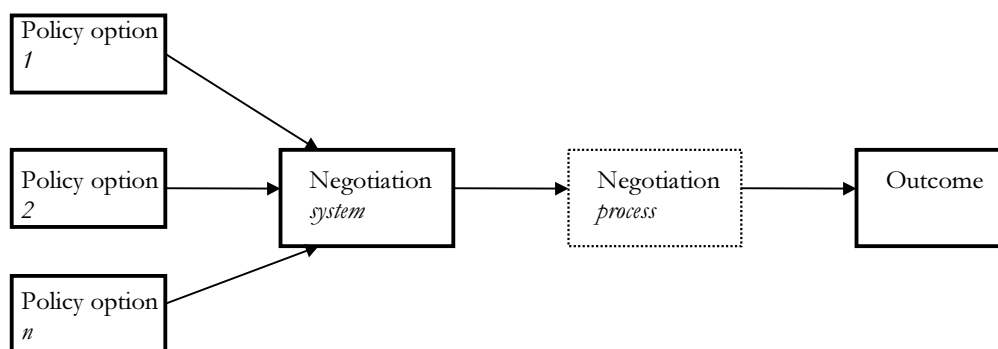
¹ Other papers describe in greater detail each of the main elements and research modules.

² Quoted from personal communication from Dr. Edward A. Parson, Harvard University.

arguments. We shall try to incorporate some of these elements as we proceed. However, as less is known about *how* to capture these aspects in modelling terms, our research strategy is one of starting out with a simple, static model and then cautiously build on from that core.

Most simply, the analytical task of determining the settlement range of a negotiation process can be described as one of “feeding” alternative policy options into a particular negotiation system and predicting what will come out of the decision-making process that is thereby generated (see figure 1).

Figure 1: Determining political feasibility: a simple flowchart.



Any model of such a process will thus have four basic elements:

- a set of *policy options*;
- a *negotiation system*, characterised by an institutional framework and a set of actors, each with preferences/positions and a certain amount of power;
- a *negotiation process*, through which actor preferences are articulated, modified, and aggregated; and finally;
- an *outcome*, most simply described in the dichotomous terms of “passed”/feasible vs. “rejected”/not feasible.

In the following pages we will explore how each of these components can be conceptualised and modelled, and how outcomes can be derived as a function of the overall model. The negotiation process component is marked with dotted lines to indicate that in this project we have no ambitions of exploring in depth the impact of negotiation behaviour or process dynamics on outcomes.

2. Policy options

In principle, the number of policy options available in the climate change negotiations is infinite. In practise, decision-makers seriously consider only a small subset of these options. For obvious reasons, only a small number of options can be examined in this project. The first task, then, becomes to determine which options to explore. Our principal guideline will be to focus first and foremost on options that at least some of the actors explicitly advocate, and, secondarily, on other options we may identify that have not (yet) been explicitly discussed in the negotiations but which seem to meet at least most of the major concerns of a critical minimum of parties, and hence might qualify as a compromise or package-deal solution.

The next question becomes how to characterise the options that we want to examine. Again, the principal guideline is simple and straightforward: policy options should be characterised in terms of the dimensions that decision-makers consider (most) important in their own evaluation of those options. This rule-of-thumb immediately leads to another question: which are actually the (most) important criteria by which decision-makers evaluate alternative climate change policies? An in-depth study would almost certainly produce a somewhat complex picture, identifying multiple criteria and some variance from one actor to another. We shall make some efforts at exploring actor concerns (see research module 2.b), but for modelling purposes we need to start out with a simple and analytically tractable description of policy options. We pursue a two-step strategy, premised on the assumption that state policies are driven primarily by economic self-interest, but constrained or modified by a set of normative principles and filtered through mechanisms of cognitive prominence.

2.1. Research module 1.a: impact on national economic welfare

In this module we assume that the principal criterion used by governments to evaluate a particular climate change policy is the impact it would have, if implemented, on the *economic welfare of the nation*. The impact of environmental policy on economic welfare can be seen as a function of the relationship between damage costs (i.e. the welfare loss caused by environmental damage) and abatement costs (i.e. the costs of avoiding such degradation). A rational actor will pursue environmental protection if, and only as long as, marginal damage costs are higher than marginal abatement costs.

The basis for calculating damage costs is knowledge about the causal link between human activities (notably emissions of “greenhouse gases”), climate change, and

damage to terrestrial or marine environmental systems or to other values or goods. At present natural science research can speak with some confidence about aggregate, global impacts of atmospheric greenhouse gas concentrations, but much remains to be done before one can specify the regional distribution of these impacts (beyond crude, ordinal level notions of differential vulnerability to specific effects such as e.g. sea-level rise). This implies that at present neither we nor policy-makers can have an adequate basis for calculating damage costs for each nation.³

Due to the difficulties related to calculating damage costs this research module focuses on the impact on national economic welfare from a climate agreement in terms of abatement costs. These are costs pertaining to climate policies that reduce emissions of climate gases. For this purpose an empirical model presented in Holtsmark (1997) is further developed to fit the project at hand. This model can briefly be described as follows:

Each country has a welfare function dependent on fossil fuel taxes, the production and consumption of fossil fuels, and the amount of public revenue generated by fossil fuel taxation. Countries are linked together through their relations to the fossil fuel markets, and they are assumed to react simultaneously to a climate agreement with specific national CO₂ emission reduction commitments. There is one global oil market, one global coal market, and three regional gas markets (North America, Europe including Eastern Europe and Russia, and the Pacific region). The countries do not coordinate their actions, and so far we have assumed that the fossil fuel markets are competitive. Thus the countries are price takers on both the demand and supply side. Each country maximises its national welfare under a national emission reduction constraint. The governments are assumed to redesign their fossil fuel taxation schemes in the light of the climate agreement and the other governments' reactions to the agreement. Another important simplification is that non-participating countries do not change their fossil fuel taxes or take other actions as a result of the climate agreement. The model is calibrated to the world economy as in 1993.

The model is able to indicate how the distribution of gains and losses among participating countries are sensitive to the different countries' position in the fossil fuel markets and their current and potential fossil fuel taxation schemes. Furthermore the model calculates to what extent resource rents are transferred from fossil fuel exporting

³ The problem is further compounded by the fact that different nations or social groups may *value* environmental goods or assets differently. Such differences in valuation raises hard questions about the validity of using one uniform formula for deriving social damage costs from biophysical change.

countries to fossil fuel importing countries when governments act strategically and take benefits from revenue recycling into account. Important determinants behind the model's cost estimates are the countries' energy demand patterns, prior tax distortions, and the size of the marginal excess burden of taxation in the countries. The marginal excess burden of taxation is a measure of the costs in terms of reduced national income from a marginal increase of public revenue brought about by increased taxes that distort the economy.

In Holtsmark (1997) an aggregated version of the model is described in detail together with an application on a climate agreement specifying flat rate emission reduction commitments. These estimated costs cost curves will constitute some of the basis for the analysis of the different countries' economic interests in the climate change issue. Results will be compared with those derived from other models (including Nordhaus 1994, Nordhaus & Yang 1996).

2.2. Research module 1.b: normative compellence and cognitive prominence

This second module builds on the assumption that impact on the economic welfare of one's own nation is not the *only* dimension that policy-makers consider when evaluating policy options. More specifically, we assume that (1) at least a significant number of policy-makers do recognise certain norms, including norms of fairness and justice, as valid in principle and also relevant to this particular issue; and (2) that some solutions are more likely to be chosen than others simply because they stand out as more visible or cognitively prominent than others. Let us briefly try to specify each of these assumptions.

One of the basic propositions of the "new institutionalism" is that political behaviour is sometimes, in fact quite often, guided by "the logic of appropriateness" rather than by the pursuit of (issue-specific) self-interest (March & Olsen, 1989). In unspecified form this is hardly a controversial statement, but as a premise for model construction it becomes useful only to the extent that we can specify what qualifies as "appropriate" in a particular context, and which decision rule(s) actors follow if "appropriateness" and self-interest collide. We shall deal with the latter question in section 3.2.2. Here a few words are required about the former problem.

In the context of international negotiations aimed at collective action, we can identify at least three *distributive* principles that seem to merit particular attention. One is

the simple norm of *equal* treatment.⁴ This principle seems to serve as the default option, leaving the burden of proof with anyone who would argue that circumstances are such that it would lead to a clearly “unfair” distribution. When such circumstances have been “proven” to exist, two other principles tend to come into focus. Assuming that we are dealing with the distribution of the *costs* of collective action, these norms can be described as the principle of *guilt* or responsibility and the principle of *capacity*. The former says, in essence, that the costs of solving a problem or repairing an object should be distributed in proportion to the role that each actor played in causing the problem or damage.⁵ The latter suggests that the costs of a project be distributed in proportion to the capacity of different actors to contribute. This is the basic principle of progressive taxation. These two principles will probably quite often, though not necessarily, have roughly similar implications. Thus, applied to the climate change negotiations they both leave the bulk of responsibility squarely with the rich, industrialised countries.

We repeat, though, that these and other principles of differentiation are assumed to be activated only where the default option of equal treatment has been set aside (because it is seen as leading to a distribution that violates more fundamental standards of fairness). According to Franck (1995:14) a solution is fair to the extent that it captures “..an agreed formula located at a conceptual intersection between various plausible formulas for allocation”, and further, that distinctions in the treatment of “likes” are justifiable in principled terms.⁶ The Framework Convention, giving pride of place in Art. 3 to the broad term “equity”, clearly suggests that a simple formula of equality has been found as wanting. This hint is confirmed in the phrase that burden-sharing should correspond to the “common but differentiated” responsibility and capacity, and further bolstered by the explication in paragraph four that sustainable development is an unalienable *right* (and not only an obligation) for developing countries.

While the norm of equal treatment, strictly interpreted, usually yields a unique solution, the two principles of differentiation seem to serve as “softer” guidelines; in international negotiations the distribution of costs is, it seems, rarely derived as a linear or some other clearly specified function of guilt/responsibility or capacity.

⁴ We do realise that this statement is open to diverging interpretations, but in this context we interpret it simply as prescribing a uniform mode of behaviour, or a uniform *change* in behaviour (for example, equal emission reductions, measured in per cent). Whenever abatement costs differ - as they almost always do in dealing with international environmental problems - uniform behavioural standards will, of course, lead to an unequal distribution of costs.

⁵ This norm does not apply without reservations if the perpetrator did not know or could not have known what damage he was causing.

⁶ See the discussion of Dworkin’s notion of coherence in Franck (1990:143f).

In addition to equality, capacity and guilt, also a set of non-distributive principles are relevant to our discussion. For example, in the climate negotiations, the principle of *cost-effectiveness* is saliently and frequently invoked in order to promote certain options, notably flexibility regarding type of measures, time frames, or the geographic locus of abatement efforts (“activities implemented jointly”). This norm is compelling because of the magnitude of the costs - social, economic, or even political - associated with abatement schemes in certain countries. Other relevant norms pertain to decision rules under uncertainty, for example the so-called “precautionary principle”.

At this stage, while these principles seem to stand out as clearly relevant, we do not have a sufficient basis for determining their relative normative compellence. They are expressed with roughly similar emphasis in the Convention’s Art. 3 as well as in other international agreements responding to similar problems, such as the OECD guidelines for environmental politics and LRTAP (emphasising guilt and cost-efficiency) or the Montreal Protocol and even the arrangement for financing the UN (stressing capacity). As a first cut, therefore, we would assume that firm connection with *any* of these principles would enhance the general attractiveness of a given option. Because fairness, as noted, is located at the intersection of several plausible formulas, such enhancement would presumably be especially pronounced if the option establishes a clear connection to *more than one* of them. The differentiation between Annex I-countries (i.e. industrialised countries) and the others, written into the 1992 Convention, is roughly compatible with both the principle of capacity and the principle of guilt. Beyond this, however, there could be reason to expect that a clear connection to a given principle will enhance the attractiveness of a given option more in the eyes of some states than in the eyes of others. For instance, due to its strong commitments at the various stages of the negotiations to flexibility, and thus cost-effectiveness, the United States would presumably be especially responsive to this aspect of a proposed formula.

The proposition that the *cognitive prominence* of an option enhances its chances of being chosen was most convincingly brought to bear on the study of coordination and bargaining by Schelling (1960). Schelling argued that actors tend to converge on what he called “focal points”, i.e. solutions that stand out from others as in some unambiguous way unique - e.g. a round number, a prominent geographical feature, a firmly established convention or practice etc. One example: in negotiations about a target for emission reductions, cuts of e.g. 10 or 20 per cent do not have to be substantively superior to targets of, say, 10.7 or 18.9 per cent to be more likely choices (unless the latter figures are

derived as the unique implications of a formula that itself serves as a focal point). Once again, however, we are dealing with a notion that can be useful in a modelling exercise only to the extent that it can be translated into specific form. In other words, we need to know what determines the cognitive prominence of an option, and what difference such prominence makes for the decisions that actors make.

In this project we propose to focus on two dimensions of cognitive prominence: round numbers (here operationally defined as numbers ending on 0 or 5), and isomorphy with formulas used in similar, recently negotiated agreements. Whereas conformity with established practice in general enhances the normative compellence of a proposition, recently agreed-upon formulas and principles also have the quality of being cognitively prominent - especially when they are simple.⁷

3. The negotiation system

3.1. Research module 2.a.: the institutional setting

The institutional setting can be described by answering the question: *who* are to decide on *what, how?* In other words, it identifies a set of *participants* (or specifies rules of access), formulates an *official purpose* and sets an *agenda*, and specifies “*the rules of the game*” (notably decision rules and rules of procedure). The institutional setting is itself a political construction, and as such it can be designed or used to favour some concerns or interests over others. Whenever actor interests are in conflict, institutional arrangements may therefore themselves become an issue of difficult and protracted negotiations.

Actors. For reasons of research economy, only a subset of actors can actually be included in the model. This subset is chosen with multiple criteria in mind, but four concerns are particularly salient: importance, interests at stake, representativeness, and feasibility. The criterion of *importance* implies that we want to select actors, or coalitions of actors, that carry particular weight in the “basic game” (in practise, countries serving as major emitters or sinks) or in the negotiation game itself. Secondly, we want to include some actors with substantial *interests at stake*, i.e. actors for whom abatement or damage costs are expected to be relatively high. These will presumably be the actors defining the range of policy options to be considered, and also be the most active participants. The criterion of *representativeness* implies that the subset selected, taken as a whole, should be roughly congruent with the “universe” in terms of range and configuration of

⁷ The default option of equal treatment probably serves also as a focal point, not only - perhaps not even primarily - as a norm of fairness. More generally, the distinction between cognitive prominence and

preferences or the distribution of power. Finally, the concern with *feasibility* is essentially a question about the availability of relevant, reliable data. Although the substantive criteria just mentioned clearly must be our principal guidelines, any project of this kind faces questions of trade-off between what is desirable and what is feasible. So do we.

These considerations have lead us to focus initially on a sample of 16 countries or coalitions of countries. These are listed in table 1, with reference to the selection criteria mentioned above.

Table 1: Actors tentatively included.

| | Importance in basic game: emissions/sinks | Likely to be influential in negotiation game | Vulnerable to adverse climate change effects | High (abatement) costs of climate mitigation policy | Representativeness: typical of larger group |
|------------------------|---|--|--|---|---|
| USA | ✓ | ✓ | | | ✓ |
| Japan | (✓) | | | ✓ | |
| EU | ✓ | ✓ | | | ✓ |
| Germany | | ✓ | | | |
| France or UK | | ✓ | | | |
| Denmark or Netherlands | | (✓) | | | |
| Norway | | | | ✓ | |
| India | ✓ | ✓ | (✓) | | ✓ |
| China | ✓ | ✓ | ✓ | | ✓ |
| Brazil | ✓ | ✓ | | | ✓ |
| AOSIS | | (✓) | ✓ | | |
| OPEC | | (✓) | | ✓ | |
| Russia | | ✓ | | | |
| Poland | | | | | ✓ |
| Cameroon | | | ✓ | | ✓ |
| Chile | | | (✓) | | ✓ |

A small subset of these - USA, EU, Germany, UK, and Norway - will be studied in greater depth, in order to determine, inter alia, the impact of *domestic* politics on negotiation positions (see section 3.2.3).⁸

Official purpose/agenda. The official purpose of the negotiations is given in the so-called “Berlin mandate”, formulated at the first Conference of the Parties to the FCCC, in Berlin in 1995. The essence of that mandate is to strengthen the obligations of ANNEX I countries by setting quantified emission limitations and reduction objectives (QELROs) within specified time-frames (i.e. by 2005, 2010, and 2020), and by otherwise elaborating policies and measures. The goal is to adopt a new agreement at the third session of the Conference of the Parties (COP-3), scheduled for December 1997.

normative compellence may be blurred in practise. For example, correspondence with salient norms may enhance the cognitive prominence of a particular option.

⁸ In this effort we plan to cooperate with another SAMRAM project in progress: Guri Bang Søfting, *Policy-making behavior in climate change policy - a comparative study of four annex I states* (NFR 117011/730).

Decision rules. We distinguish between the *negotiation game* and what might be called the *implementation game*. In the former the decision rule specifies the minimum amount of support that a policy option needs in order to be formally adopted by the conference. The decision rule of the implementation game specifies how decisions about actual emission control measures are to be made. One important difference between the two is that while any convention or protocol itself is, per definition, product of a *collective* decision, the measures required to carry an international agreement into effect are for all practical purposes subject to *individual* decisions by each party. Whenever the decision rule of the conference does not require unanimity, there is a distinct possibility that a winning coalition may form to pass a formally valid decision against the will of actors controlling the basic game. In such cases prospects for effective implementation on the part of the latter may be sombre (even though casting a negative vote need not be followed by defection at the implementation stage). Moreover, whatever decision rule is applied in the conference, there is a possibility that a subgroup of actors may agree to collaborate in carrying out a particular project on their own.

3.2. Actor preferences and positions

In this project we are building two data sets describing actor preferences. One is designed to define the basic standard by which actors evaluate alternative options. This evaluation standard is based mainly on the calculated impact of policy options on national economic welfare, and modified by normative concerns (see below). The other is a map of declared *positions*. The two are basically complementary, and will be used mainly for different analytical purposes. The former serves as the basis for scoring alternative options in terms of attractiveness for the various actors. The latter provides a snap-shot of the configuration of official negotiation positions at one particular point in time, and will be used essentially for determining “distance” or degree of “convergence” in the negotiations. To some extent the latter can also be used as a tool for checking the validity of the former. Declared positions should be roughly consistent with basic preferences. Major discrepancies at least call for explanation. However, a perfect match should not be expected, for - inter alia - the following reasons.

First of all, although positions presumably reflect interests and values, they are influenced also by strategic and tactical considerations. Thus, identical substantive interests need not lead to identical positions; they do so only if also negotiation tactics are

identical. Conversely, diverging positions need not imply conflict of substantive interests. Second, for reasons of research economy, any standard that we construct must be a simplified representation of those actually used by the parties themselves to evaluate policy options. For one thing, in module 1.a we assume that actors consider only national economic interests. In real life, they may have other concerns as well, such as various kinds of links to other issues, or hold different beliefs about how these interests and values are likely to be affected by changes in the biophysical environment. Moreover, in module 1.a we assume that states can be conceived of as unitary rational actors. In fact, governments are deeply involved in domestic policy games which tend to produce outcomes that deviate more or less systematically from those maximising national welfare, as conventionally understood in economics. Any deviation from such simplifying assumptions is captured in declared positions. Presumably, positions reflect actor concerns whatever they are.⁹ Thus, by contrasting declared positions with derived preferences we may be able to detect major flaws or gaps in the assumptions we make about the formation of policy preferences.

3.2.1. Research module 2.b: negotiating positions

To get a meaningful map of positions, we need first of all to specify “*coordinates*”, i.e. define a set of policy dimensions along which various positions can be systematically compared (see below). A second step is to identify discrete and relevant policy options along each of these dimensions. All options that are in fact advocated by one or more of the parties qualify as “relevant” in this context, but also other distinct options that are seen as plausible alternatives should be included. The end product of this second step is an ordinal *scale* for each policy dimension. A third and final step is to attribute scores (values) to each party or coalition of parties along each of this scales.¹⁰

Our initial set of coordinates includes six main policy dimensions, which together seem to cover the main substantive issues actually discussed in the negotiations so far. One, here labelled *comprehensiveness*, refers to the scope of regulation - more specifically the range of “greenhouse gases” to be included. The extreme values are, at the low end, only carbon dioxide (CO₂), and - at the other end - all (major) gases (including at least

⁹ An important question mark pertains, of course, to the word “reflect”. There is no guarantee that *declared* positions will always be perfectly congruent with the positions that actors *actually* hold.

¹⁰ Our approach is very much inspired by that developed by Friedheim (1993, 1977) and his team in a study of UNCLOS III. The major difference is that while Friedheim used a very elaborate and time-consuming quantitative technique for attributing scores to actors, we will rely on a more simple and straightforward qualitative method.

CO₂, CH₄, N₂O, and PFC).¹¹ Another dimension is *limitation level*, i.e. the amount of emission cutbacks required compared to some reference point (base year or trajectory) by a certain deadline. Here the low end value is obviously zero (no limitation), while the maximum will have to be determined on the basis of actor behaviour.¹² A third dimension refers to *differentiation of obligations*. Here, we have to proceed in two steps. First, we have to record positions with regard to the principle of differentiation (the minimum score being zero differentiation, i.e. uniform obligations for all). To the extent that differentiation is advocated, we then have to distinguish among different formulas for or patterns of differentiation. The range of possible formulas is infinite, but only a small subset will in fact be seriously considered by the parties themselves. A fourth dimension is the degree of *flexibility* with regard to the choice of policy instruments. Here the extreme values are zero flexibility and no constraints respectively. One important question is the extent to which a party can fulfil its commitments by inducing or assisting other countries in reducing their emissions (so-called “joint implementation”) or be permitted to purchase emission quotas from others (trading). Again, the extreme values are zero flexibility vs. no constraints. Finally, we include the dimension of *strength of commitments*. This dimension can most easily be dealt with in binary terms, where the values are legally binding commitments vs. political declarations of intent.

3.2.2. *Research module 2.c: preferences - combining economic interests, normative compellence, and cognitive prominence*

When policy options are to be evaluated with reference to two or more criteria, the question becomes how to *combine* these criteria. To answer this question we would first of all like to know how the negotiating parties *themselves* actually handle multiple-criteria decision-making. Since we have only scant evidence to build on, we shall have to turn to formal decision theory for guidance.¹³

A first observation is that the mechanism of cognitive prominence is different from that of normative compellence. While correspondence with salient principles of distribution presumably makes a solution “good” (in some specified sense, such as “fair”, “just” or “responsible”), cognitive prominence simply makes a solution *visible* and thereby a focus of attention. This suggests that cognitive prominence can be conceptualised as an

¹¹ There is also a question about whether to include targets and measures pertaining to *sinks* as well in the agreement.

¹² Clearly, the theoretical maximum (100 per cent reductions immediately) is of no practical interest.

¹³ From the perspective of model construction, one important advantage of constructs offered by decision theory is that they are designed to be analytically tractable (though not necessarily easily operationalised).

attention filter, determining which options will be considered or - if we conceive of search as a process of sequential satisficing (see below) - at least where search will begin. According to this line of reasoning, only options that pass this attention filter will be evaluated on substantive merits. We recognise that cognitive prominence may serve other functions as well and that the distinction will sometimes be blurred in practise (see footnote 6), but we propose to start out with this notion of cognitive prominence as a filter of attention.

This leaves us with two sets of substantive criteria: impact on national economic welfare, and correspondence with salient norms. Grossly simplified, decision theory suggests that these can be combined in two different ways. One - let us refer to it as the “synoptic” approach - is premised on the assumption that actors can transform scores on different criteria into *one* integrated measure of utility or welfare. More precisely, this requires that a certain relative weight (v) is ascribed to each criterion ($0 < v_{ki} < 1$; $\sum_i v_{ki} = 1$), and that an option’s score on each criterion is transformed into a common unit of measurement and given as a cardinal value. The overall utility of an option can then be calculated as a weighted aggregate of scores on the full set of criteria considered. Applied to the global climate change problem this implies that impact on national economic welfare and correspondence with salient norms are to be transformed into one common measure of utility or attractiveness. We know of no straightforward method for making such transformations. More importantly, we doubt that this is a kind of intellectual exercise that decision-makers usually perform.¹⁴

The other approach is based on the constitutive ideas of cybernetics (see e.g. Steinbruner 1976) and Simon’s concept of “bounded rationality” (cf. Simon 1957). The basic idea here is that evaluation occurs as a process of sequential satisficing. What this means in practise is that for each dimension that an actor considers to be important, (s)he forms an idea about what would qualify as a “satisfactory” solution. Moreover, the actor ranks relevant dimensions in some order of importance. Considering the most important dimensions first, options are then evaluated in dichotomous terms, as meeting or not meeting the specified requirement. The first solution that meets all requirements is selected. If none of the solutions considered satisfies all requirements, search continues in one or both of two directions: new options are considered, and/or one or more of the requirements are relaxed or abandoned completely, the least important dimension being

¹⁴ We recognise, though, that they often have to make *trade-offs*, and that trade-offs will have to be based on some notion about the relative importance of different interests/values and the magnitude of concessions and gains.

“sacrificed” first. In this approach each criterion is conceived of as a substantive *filter* that a solution must pass in order to be selected. In other words, each criterion defines a necessary condition that a solution shall have to meet in order to “pass”.

In choosing between these approaches we must consider at least two questions. One pertains to validity; as pointed out above, we would want to reconstruct - although in a simplified form - the kind of evaluation that actors in fact perform. It is not obvious which of these approaches comes closest to reality. We believe that decision-makers actually use some combination of the two methods; more precisely, that the latter serves as the default option, while a crude version of the “synoptic” approach is used to make trade-offs. Secondly, we are constrained by the requirement of analytical tractability. In this case the latter criterion clearly favours the sequential satisficing approach. On balance, we therefore conclude that for our purposes a case can be made for adopting the sequential satisficing approach, at least as a first cut.

We have already made the assumption that government policies on climate change are motivated primarily by a concern for national economic welfare. We now propose to start out with a stark interpretation of this assumption, suggesting that correspondence with salient principles of fairness makes a significant difference *only* in what might be called a “zone of indifference”, i.e. where the economic welfare calculus does *not* give clear-cut conclusions. This is tantamount to saying that state behaviour will be *guided* by norms of fairness only where economic self-interest is ambiguous.¹⁵ To those who argue that this assumption underrates the significance of norms, we can only say (1) that given the amount of certainty pertaining to global climate change even this “cynical” rule-of-thumb probably leaves a greater scope for influence than one might expect, and (2) that we would welcome inputs and advice that enables us to formulate a more “valid” and equally tractable decision rule.

One factor grossly complicating any attempt to describe the preferences of the bargaining parties is what we may call *contingency effects*, meaning that preferences are likely to be interdependent. In other words, the attitude of one government towards a given proposal is likely to be affected by that of other governments. At least four mechanisms - income effects, competition effects, sanction effects, and normative persuasion - contribute to this.

¹⁵ To avoid misunderstanding, let us emphasise that we are *not* assuming that actors whose economic self-interests are ambiguous give more weight to moral considerations than other actors. What we are saying is simply that we assume economic self-interest to have lexicographic priority for *all* actors, leaving a limited scope for considerations of fairness or equity to have a decisive influence on policy.

Income effects arise because preventing or mitigating damage to the global environment is a public good. Therefore, if one country allocates more resources for this purpose, it is equivalent to an increase of income for other countries. Other things being equal, this factor tends to reduce the latter's incentive to allocate resources for the same purpose.

Competition effects tend to pull in the opposite direction. As used here, this category includes two different kinds of contingencies. One is the impact on a country's competitive edge of imposing unilateral measures affecting product prices. The other refers to changes in energy markets (and, indirectly, also changes in markets for energy intensive products). Attempts to reduce the use of fossil fuels would have some impact on the absolute as well as relative prices of these fuels. For major producers of petroleum and coal these effects can lead to a substantial loss of income (see Torvanger et al. 1996).

Contingency effects can also stem from expectations of negative or positive *sanctions* (threats or promises). By credibly threatening to punish deviant behaviour, or promising to reward concurrent behaviour, a government might induce others to support its own proposal. Needless to say, expectations of punishment or rewards might play a role even if no threats or promises are actually being made explicitly.

Finally, when one state allocates more resources for the purpose of preventing or mitigating global climate change, it arguably becomes *morally and politically* more difficult to act as a "free rider". For example, in Norwegian public debate, the presumption is occasionally made that adopting unilateral Norwegian measures to reduce emissions of CO₂ would increase the moral and political pressure on others to reciprocate.¹⁶

Trying to model all of these various effects explicitly would be a very demanding task. We shall include the impact on fossil fuel markets in module 1.a. Moreover, we shall include a weak version of the moral/political persuasion argument in module 1.b. Beyond that, we will explore the theme of contingency effects separately (see Holtmark & Hovi, 1997).

3.2.3. Preparing to open the black-box of domestic politics

So far, we have conceived of states as unitary rational actors. As pointed out above, however, the positions that governments take in international negotiations are formed through more or less complex domestic decision-making processes which tend to produce outcomes that deviate more or less systematically from those maximising

national welfare (in conventional economic terms). In this project no effort will be made to incorporate domestic policy-making processes systematically into the model. However, focusing on a small number of countries (listed on p. 9), a small-scale exploratory study will be undertaken, with the dual purpose of helping us (a) get a rough idea about the general impact of domestic politics on negotiating behaviour, and (b) determine what would be a fruitful and parsimonious conceptual framework for modelling the domestic politics of international negotiations - one sub-question being to what extent domestic politics can be adequately captured in terms parallel to those that we use to study international negotiations.¹⁷ The latter implies exploring how far we can get by conceiving of the outcomes of domestic politics as a function of (1) the domestic configuration of interests and values, (2) the distribution of power and influence among domestic political actors, and (3) the institutional setting within which national policies and positions are formed (i.e. characteristics of the political system itself).

3.3. Power

3.3.1. Power as a component in negotiation modelling

For the purpose of determining the settlement range it is sufficient to identify *pivotal* actors or coalitions of actors, and determine their preferences. In negotiations only those options that satisfy the minimal requirements of all pivotal parties are politically feasible. This implies that the fate of each option will be determined by the most demanding pivotal party, leading to “the law of the least ambitious programme” (cf. Underdal 1980). The relative power of non-pivotal (combinations of) actors is irrelevant in this context.

Now, there are at least two reasons why we may want to go beyond the confines of this recipe. One is simply that once we introduce the notion of pivotal *combinations* of actors, we need to assign "weights" to individual parties who - although not pivotal in their own right - are potential or plausible members of such coalitions. Even if we use plausibility as a criterion for selection, the number of relevant actors may be quite high. Secondly, once we go beyond a simple dichotomous classification of options to explore which solutions - among those that belong to the settlement range - are most *likely* to be adopted, we also need to go beyond the simple dichotomy between pivotal and non-pivotal actors.

¹⁶ Another project (in progress) at SNF-Bergen examines the impact of unilateral measures in greater depth and partly with (quasi-)experimental tools (Moxnes et al., 1996).

¹⁷ For a well-known contribution that adopts this perspective, see Putnam 1988.

In the project proposal we suggested that a distinction be made between the relative *power of actors* and the relative *strength of bargaining positions*. Both are potentially useful concepts in the study of negotiations, but they are different in terms of substantive contents. The former measures the political “weight” with which an actor can promote or defend its interests. The strength of a bargaining position is usually conceived of as a function of the willingness of its proponent(s) to stick to it under pressure. We know of no straightforward method for translating one into the other. In this section we shall examine how both these notions can be conceptualised and measured. We shall focus on what might be called “structural” aspects only; the behavioural aspects of power will be dealt with briefly in section 4.

3.3.2. Research module 2.d: basic game power

In the project description we distinguished between power in the *basic game* (i.e. the system of activities subject to regulation) and power or influence in the *negotiation game* (i.e. the decision-making process itself). The former is a major determinant of the latter, but the negotiation process has its own logic and a role for other kinds of capabilities as well. By implication, it can rarely if ever be fully understood as a mere reflection of the basic game.

In our economic modelling focusing on damage and abatement costs (research module 1.a), power in the basic game will be expressed as the impact of one actor's behaviour upon the *incentives* (cost/benefit calculus) of other actors. From this perspective, a party who's own behaviour does not at all affect the climate policy incentives of any other party would have zero power over others, while an actor who's behaviour completely determines the incentives of all other actors would have maximum power (full control). The latter category is empty, so the interval that we are actually dealing with includes power vectors ranging from (close to) zero to a positive figure well below the theoretical maximum.

In the political analysis, one actor's *direct power* over another can be seen as a function of its relative control over events important to the latter (cf. Coleman 1973).¹⁸ In the context of a bilateral relationship, we can thus express A's direct power over B with regard to a particular issue (i) as $K_i^a \cdot U_i^b$, where K_i^a is A's share of control over event or issue *i* ($0 \leq K_i^a \leq 1$), and U_i^b is the relative interest of actor B in the outcome of the

¹⁸ Total power = direct + indirect power; indirect power being power over *third parties* who wield power over the target actor.

same issue ($0 \leq U_i^b \leq 1$). Conversely, we can express an actor's *autonomy* (or immunity to external pressure) as a function of the extent to which it effectively controls events important to itself (in the case of A, autonomy can be expressed as $K_i^a \cdot U_i^a$)

The next question becomes: how can we translate this notion of power as control over important events into an operational measure that can be useful in an attempt at analysing the international climate change issue? First of all, we shall have to determine what are the critical "events" or issues over which we want to measure control. The obvious categories of important "events" is greenhouse gas emissions and sequestration. Everything else the same, the larger a country's emissions, the greater its contribution to the problem and the more important becomes its participation in a scheme to reduce emissions. Similarly, the larger its actual or potential contribution to sequestration, the more important becomes its participation.

Let us pause for a minute to consider the implications of the statement about emissions. As indicated by the formulation, large emissions serve unambiguously as a source of *negative* power, i.e. as a source of direct control over the *problem* itself. It is less obvious whether - and if so how - it serves also as a source of *positive* power, enabling an actor to control the development and implementation of solutions. Clearly, the impact of a given emission control measure by a major polluter will be larger than the impact of the same measure undertaken by a minor polluter. This has two implications. First, it means that the impact of *unilateral* action upon the *problem* itself will be larger. Other things being equal, the larger an actor's "share" of the activities causing the problem, the less dependent it will be upon contributions from others to bring about preferred change. Second, the impact of emission control measures by a major polluter upon *the incentives of others* will, *ceteris paribus*, be larger than that of measures undertaken by a minor polluter. What is not a priori clear, however, is *in which direction* the incentives of other parties will be affected. What we have called "income effects" are likely to be negative, while the impact of moral persuasion or political compellence probably will be positive (see section 3.2.2.). The upshot of all this is that "positive" power over others - i.e. the ability to induce others to contribute - is a more complex concept, which seems to be related primarily to other capability indicators such as the size of a country's R&D establishment, its wealth, and the overall size of its economy (aggregate production and consumption). Combining a positive and a negative concept of power would complicate the analysis substantially. We are currently exploring how this might be done, but the conclusion may

very well be that the costs involved exceed the benefits we could hope to obtain in this project.

3.3.3. Actor power: negotiation game

An actor's "weight" in the negotiation game is heavily influenced by his basic game power, but in political processes there will usually be a role also for other capabilities that are specific to - and to some extent even generated by - the political game itself. I think sound reasons can be given for concentrating our efforts, at least at this stage, on finding a good measure of basic game power. Nevertheless, a few words should be added to indicate what kind of "power sources" would have to be considered in an analysis of the negotiation game itself.

First of all, it seems that influence in the negotiation game can be linked to *leadership roles* - formal (such as conference or committee chairmanship) as well as informal (e.g. based on the role of coalition spokesman, superior knowledge/privileged information, or reputation and prestige (cf. Young 1991, Underdal 1994). The relevant formal positions and their incumbents are easily identified, and we can probably get a fairly good picture of coalition leadership as well. The major problem is that we have no theory that enables us to determine in precise quantitative terms the influence "bonus" that comes with such roles.

Second, in multiparty conferences voting is often used as a (last resort) mechanism for aggregating preferences. Even though the role of voting in international conferences is quite different from that found in e.g. legislative assemblies, the "*centrality*" of an actor in making or breaking winning coalitions can be an asset also in the former setting. Formulas for calculating such centrality exist (see e.g. Shapley & Shubik, 1954); their relevance to international negotiations is, however, still an open question.

Finally, theoretical as well as empirical negotiation studies have demonstrated that *tactical effort and skill* can be an important source of influence. Skill is notoriously hard to estimate, but tactical effort is usually strongly correlated with interests at stake. We shall deal with this aspect in section 4.

In this project, we shall give priority to constructing a meaningful measure of basic game power. In addition, some exploratory work will be done to see how important dimensions of negotiation game capabilities *could* be incorporated, but our ambitions here are quite limited. No full-scale analysis of negotiation game power will be attempted.

3.3.4. Research module 2.e: the relative strength of negotiating positions

In this section we have referred to two different data matrices. One has *actors* (states) as its units, and preferences and power vectors as critical variables, the other has *positions* as its units, and attributes of these positions as variables. Our order of priorities is to concentrate time and energy on the former, but particularly when it comes to determining which of the solutions that fall within the settlement range are most likely to be chosen, a theory of “position strength” would be useful, even essential. Let me therefore add just a few words to indicate how the latter can be incorporated.

In strictly *distributive bargaining*, the confrontation between positions that fall within the settlement range is most often conceptualised as a game of *Chicken*, i.e. as a contest of nerves. Negotiation theory offers formulas for calculating the “critical risk” (of ending in the non-cooperative solution) that each actor is willing to bear, and this critical risk is derived as a function of the relationship between potential gain and potential loss (cf. Zeuthen 1930, Harsanyi 1956, and Midgaard 1976). Assume that an actor’s (A) own position, if implemented, would give itself an outcome with the value U_a , opponent’s offer V_a , and the non-cooperative solution the value O_a . The maximum or “critical” risk of breakdown that A is willing to take can be computed as

$$\frac{U_a - V_a}{U_a - O_a}$$

There are some puzzles or ambiguities in the application of these models to multilateral negotiations - and, of course, severe difficulties in operational measurement of utilities. Basically, however, we have the analytical tools required to estimate the relative strength of positions in strictly distributive bargaining, and research module 1.a. can give us a set of input values that can be used for this purpose.

The picture becomes more complicated once we assume that negotiations are “*mixed*” in the sense that they combine integrative and distributive aspects. In integrative and mixed negotiations, at least two other features of positions appear to be important. One is the extent to which a position is consistent with important, consensual norms. The other is cognitive prominence. Both are examined in section 2.2. (cf also 3.2.2.).

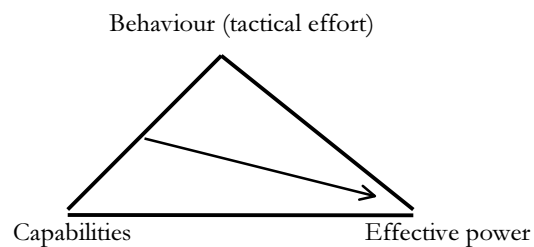
This module is introduced essentially as a device to help us determine which of the solutions that fall within the settlement range are more likely than others to be chosen. Accordingly, it will be activated only in the final step of the analysis (see section 5).

4. The negotiation process {research module 3}

In our model the negotiation process has the status of *intervening* variable, itself being substantially affected by the negotiation system, but also leaving its own independent imprint on outcomes. Modelling process dynamics has low priority in this project, for two main reasons. First, we bluntly assume that characteristics of the negotiation system - more precisely, the institutional setting, the configuration of preferences, and the distribution of power - are more important determinants of outcomes than behavioural tactics and process dynamics. Second, to study actor behaviour and process dynamics in depth would have required much more time and resources than we have available for this particular project. In particular, the impact of factors like tactical skill, process-generated stakes, and path-dependency are notoriously hard to determine empirically, even though most inside observers would agree that they can play a significant role in shaping outcomes. Rather than taking on the comprehensive and demanding agenda of process analysis, we shall focus on only two aspects that can be dealt with more easily: *tactical effort* and the pressure generated by *overwhelming majority* and “*momentum*”.

The notion of tactical effort is an attempt to capture one important behavioural aspect of power. Module 2.d is designed to represent power capabilities; effective power is, however, a function of capabilities and their *use* (see figure 2):

Figure 2: Effective power as a function of capabilities and behaviour



A plausible assumption is that, other things being equal, the greater the *efforts* made by an actor in promoting or defending his interests, the greater his influence will be. The amount of effort invested by an actor in a particular issue can most simply be seen as a function of (a) how much is at stake, and (b) available resources. A crude measure of relevant political resources is included in module 2.d. Stakes can simply be derived as a

function of damage or abatement costs; the greater the difference in damage or abatement costs between contending policy options, the more is at stake for an actor.¹⁹

The notions of *overwhelming majority* and *momentum* both refer to particular forms of contingency (see section 3.2.2). The basic argument is straightforward: other things being equal, the pressure felt by an “outlier” to conform tends to increase (a) the more overwhelming and more compact the majority it faces, and (b) the greater the “momentum” of the negotiation process - i.e. the greater the *rate* of convergence among other parties (see e.g. Friedheim 1993).

Empirical and experimental research corroborates all these propositions in general form. To be useful for our purposes, we once again have to transform them into specific form. We propose to model the impact of tactical effort simply as a *coefficient* “weighting” the impact of basic game capabilities. For example, ranking tactical effort crudely into three categories, we can attribute the coefficient 1.00 to actors in the high effort category and .xx and .yy to those in the categories of intermediate and low effort respectively ($1.00 > .xx > .yy$). With regard to the impact of overwhelming majority we can assume that it will be activated only if the skew exceeds a certain threshold, say 10:1, and that it can induce concessions only within a narrow range of options that are close to equal in overall attractiveness. The notion of momentum will be treated as a mechanism *reinforcing* the impact of overwhelming majority.

¹⁹ In negotiation theories, an actor’s interest in a particular issue is seen partly as a source of weakness, partly as a source of strength (Bacharach & Lawler 1981). The two propositions can, however, easily be reconciled if properly specified. The greater a party’s interest in a particular issue, the more it is willing to pay in order to obtain a favourable outcome, other things being equal. An opponent controlling the outcome of that issue can thus extract a high price for accepting a particular agreement. Now, the price that a party is willing to pay can, at least in part, be paid in the form of behavioural effort. The greater a party’s effort, the greater is likely to be its influence, *ceteris paribus*. Moreover, in integrative negotiations “need” will sometimes be an important criterion of distribution, favouring a party with much at stake over one which is only marginally affected.

5. Outcomes

Our model is designed to answer two questions about an actual or potential proposal. The first is whether the option belongs to the settlement range. If it does, a second question becomes whether it is more or less likely than other options satisfying the minimal requirements to be chosen as the final outcome.

Theoretically, an option belongs to the settlement range if it is preferred to no agreement by *all* negotiating parties. An option which satisfies this criterion will presumably obtain unanimous support *provided that no better alternative is available*. In practice, of course, such alternatives always exist for at least some actors, and sometimes even for all. Thus, belonging to the settlement range is only a *necessary* condition for an option to qualify as a final solution; it is definitely not a sufficient condition.

Deciding whether various options belong to the settlement range is only a first stage in separating more likely from less likely solutions. The second stage consists of trying to decide which option(s) in this range is (are) most likely to prevail. We propose to address this second question in two steps. The first consists of eliminating options which are Pareto-inferior, i.e., options which are considered less desirable than some other option by at least one country, and not more desirable by any other country. This elimination rule is not likely to take us far, however. In fact, if attention is restricted to proposals which have actually been advanced by some country during the process, the category of Pareto-inferior solutions could very well turn out to be empty. Therefore, we shall have to prepare for a second step, which involves ranking options in terms of the aggregate power of their advocates (module 2.d), and/or in terms of the relative strength of competing positions (module 2.e).

Answers to both these questions can be given for two alternative assumptions about participation. The default option is to take the set of participants as determined exogenously, and ask which solutions can this particular set of actors jointly approve of (and implement). The other option is to treat participation as an endogenous variable, and ask which solutions can be established by *some* (sub)group of actors. Whenever there are substantial differences among actors in terms of preferences and capabilities, problem-solving by coordinated action within a smaller subgroup is a distinct possibility. We shall examine feasibility from both these perspectives, but the former will serve as our point of departure.

Finally, a few words should be added to set our ambitions straight. In theory, political feasibility is a dichotomous concept; either an option belongs to the settlement

range, or it does not. Consistent with this conception, negotiation theory often uses concepts such as “resistance point” (Walton & McKersie, 1965) to draw a sharp line between acceptable and non-acceptable solutions. We have no ambitions of being able to give our answers with such a high degree of precision. Nor do we believe that the actors themselves always start out with well-defined resistance points. Particularly when dealing with issues characterised by considerable uncertainty - in this case mainly about (national) damage costs - and complexity, a more adequate understanding of the process would build on the assumption that actors start out with some more or less clear ideas about which solutions they will not accept and some ideas about what would qualify as a satisfactory solution. In between there will be a grey zone of “maybes”. For some actors this zone may be fairly large at the outset. The implications for our project can be summarised as follows: (1) Do not expect us to be able to draw a sharp line between politically feasible and non-feasible solutions (except in theory). However, (2), recall that lack of conclusiveness in this respect is not necessarily a symptom of model imperfections; *ambiguity and flux are, in fact, important features of the real-world negotiations that we are trying to model.*

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