Simulation of the Effectiveness of Protection and Assistance for Victims of Armed Conflict (Sepavac): An Example from Mali, West Africa

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Taking as a point of departure the philosopher Karl Popper's (1974) well-known dictum that it was better to let scientific hypotheses die rather than human beings, this paper investigates a case of humanitarian action by means of computer simulation. It looks at a segment of the programme that the International Committee of the Red Cross (ICRC) has been carrying out, since 1991, for the benefit of victims of low-intensity warfare in Mali, West Africa. Scenarios with different arrangements between protection and assistance activities are examined in a formal model using a discrete-event generator simulating the occurrence of violent abuses against the civilian population. The various mixes of protection and assistance are compared for their relative effectiveness in helping reduce the violence. Protection and assistance achieve that by dampening violence- and famine-related tensions. The link between humanitarian activity and conflict behaviour is made through the different social clockworks that regulate retaliation against the opposing ethnic group as well as famine pressures.

Tentative results of a small number of simulation runs point to surprising aspects of humanitarian effectiveness in the Malian setting. For example, delays in fielding the relief are shown to have less disastrous effects than one would fear by un-aided reasoning. However, short-time food assistance (to reverse a famine build-up) may be less effective than traditionally believed even if after the end of distribution the delegates enhance their protection activities.

Computer simulation is new for most humanitarian agencies. At this stage of early introduction, the emphasis should be less on programming sophistication than on changing the organizational culture for greater use of scenarios with explicit assumptions about the world in which humanitarian strategies are to work. Computer simulation may be welcomed as a means of scientifically improving methods to help save more victims of war.

Background

Over the last 100 years, the international community has created legal instruments for the conduct of armed conflict as well as for the protection of victims. The international humanitarian law, as enshrined notably in the 1949 Geneva Conventions regarding wounded, shipwrecked and captured members of the armed forces as well as civilians in armed conflict, has been adopted by almost all the states of the world. In addition, machinery has been set up to help the victims of armed conflicts. Organizational growth in this field has been impressive. As one of many organized movements, Red Cross and Red Crescent societies all over the world harness the energies of thousands of professionals and volunteers committed to disseminating humanitarian norms and to protecting and assisting disaster victims. They include a specialized agency mandated to work in conflictual areas, the International Committee of the Red Cross (ICRC), based in Geneva, Switzerland. With a staff of over 5000 employees and with the support of the national Red Cross and Red Crescent societies, the ICRC is currently active in some 50 theatres of war all over the world.

Humanitarian organizations working for victims of armed conflict share their efforts between ensuring that the parties to the conflict treat civilians and disabled enemy fighters well and taking relief to the suffering. Only an integrated approach, teaching the armed forces respect for non-combatants, mounting a protective presence in the conflict zone and delivering appropriate assistance for the distressed can limit the damage that tension and hostilities invariably bring upon the people that the law is supposed to protect.

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Experiments in humanitarian decision making

In practice, however, humanitarian workers continuously must make decisions as to how to develop the various components of their programmes. War creates for the decision-makers an environment of extreme insecurity and uncertainty in which only the determination of the warring factions to inflict damage to their adversaries may be taken for granted. Moreover, humanitarian activities fall into diverse categories that obey different technical and social imperatives. For example, teaching army unit commanders rules for the conduct of hostilities and running an air bridge for food relief require specific professionals and equipment. These are invariably in short supply because of funding constraints or are underutilized because access to victims is blocked.

Against the frightening number of unknowns in the task environment and in order to maximize the humanitarian benefit, it would often be desirable to experiment with different strategies for fielding protection and assistance. For that purpose, it would be helpful to vary types of activity and methods of work in a controlled fashion so as to study different outcomes and then select strategies that are best for the victims. Would prisoners be safer if the ICRC obtained their transfer from army barracks to the central sports stadium? If that is far from certain, could one start by transferring a section of prisoners? Do we need to distribute food in remote villages? If we do, most of the delegates will be drawn into cumbersome logistics work, obliging them to decrease protection activities. A smaller food

distribution than suggested by nutritionist's assessment may mitigate the dilemma, but just how small may it be in order to make a useful impact?

Decision making procedures in humanitarian organizations are tailored to creating, exploring and selecting useful alternatives. Exploration proceeds largely by debate and thought experiment. Real experiment in the sense of choosing victims of equal condition for differential treatment, however, is ruled out by the ethics of humanitarianism. It is unthinkable that a subset of starving civilians should be singled out as a control group receiving no food or little food to test their vulnerability *vis-à-vis* a group of beneficiaries being given full rations. In addition to being inhumane, any such scheme would quickly come to be regarded as a breach of the neutrality and impartiality to which most humanitarian organizations subscribe.

If the term 'experiment' is applied in the sense of trying out something new, then, of course, humanitarian organizations do design and perform their own experiments. New technologies become available, unorthodox work methods are forced by the situation. Some of those may be of a large scale. In recent times, to cite but one example, the disaster of Somalia has been of such vast magnitude that the Red Cross and other agencies were obliged to virtually feed the entire population of a country. This was new in the history of relief agencies, obliging them to part with orthodox methods of work. The Somalia operation was, and still is, a large-scale experiment in humanitarian work.

When such experiments are decided, they are based on hypotheses assuming certain
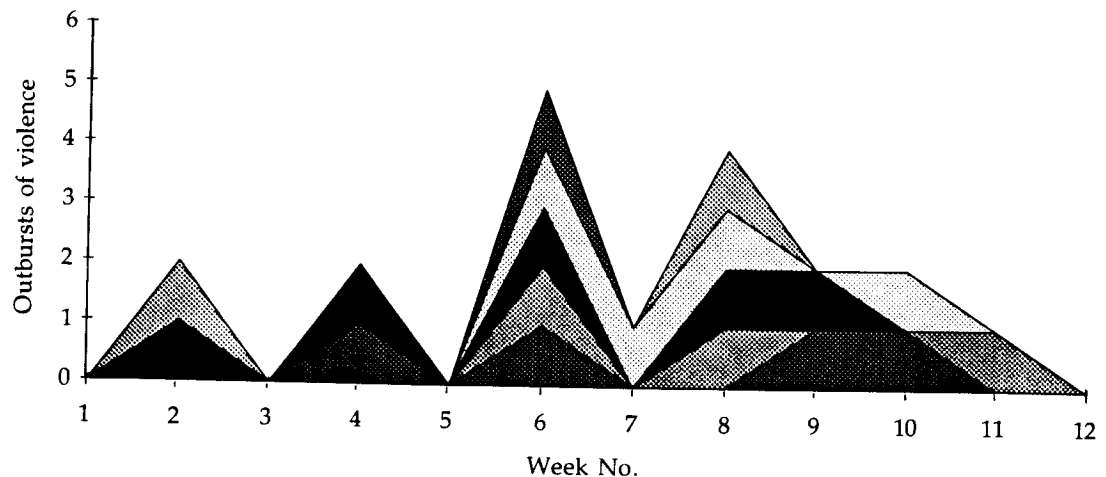
Source: Benini (own calculations) (segment frozen from one of the violence matrix outputs)

Figure 1: War produces turbulent and bizarre work environments

relationships between organizational behaviour and desired outcomes. These relationships are supposed to hold in the uncertainty which the dynamics of the conflict as well as the humanitarian intervention create. During decision making, some of the hypotheses may be discussed explicitly. Some may be recognized as paramount for the working of the proposed strategy. In the case of Somalia, during much of the year 1992, relief agencies were agonizing over the fact that local militias would be stealing a large part of the relief food, leaving the civilians for whom it was meant to starve and die.

The ICRC, rather than abandoning its relief operation, then decided to scale it up, literally flooding the country with ship- and airborn supplies. This was done on the premise that the militias, once their personal and family needs were met, would allow the bigger part of the food to reach the deserving. The ICRC convinced the international community to fund a colossal relief operation landing over 20,000 MT of food every month and to accept that the losses would be big all along its course. Relief in Somalia in 1992 saved an estimated one million human lives. Eventually, the militias found ways of extorting ever increasing payments. The situation deteriorated again, necessitating armed intervention by the United Nations. The hypothesis 'Let us drown them in food' was refuted, but the relief was successful in bridging the period till the arrival of a new type of humanitarian intervention.

Humanitarian emergencies limit the time during which strategy — and the hypotheses underlying it — can be debated. The examina-

tion of some of its most momentous underpinnings may therefore remain shallow. In addition to favouring rapid decisions, organizational culture invariably relies on 'taken-for-granted' assumptions. Where these emerge in debate, discussion may be further hampered by urgency; unaided by anything deeper than informal thought.

This need not be so. In a number of situations, humanitarian workers gain enough psychological detachment from the surrounding emergency as well as sufficient knowledge of patterns in their task environment, in order to sit down and think through possible courses of action with greater use of formal reasoning, systematic data review and bold model construction. It is in this context that computer simulation usefully comes to the field hospital, the refugee camp, or to the emergency water plant. It can improve — as well as increase — the range of experimentation in a domain whose moral code forbids scientific experiment on human beings. When it does so, more of our hypotheses probably will die and more people will live.

The philosopher Karl Popper (1974) was guided by his leading idea that science was meant to make sure that hypotheses, not human beings, were killed. In this sense, computer simulation is a justified scientific import into an ethics-dominated sphere such as protection and assistance for war victims.

To our knowledge, this is a new field of application for computer simulation. In 1990, the author used computer simulation in order to help the relief committee in a besieged town in Sudan to appeal against a decision by its main food donor that it considered harmful for

Table 1: Violent events randomly generated in one running of the computer model
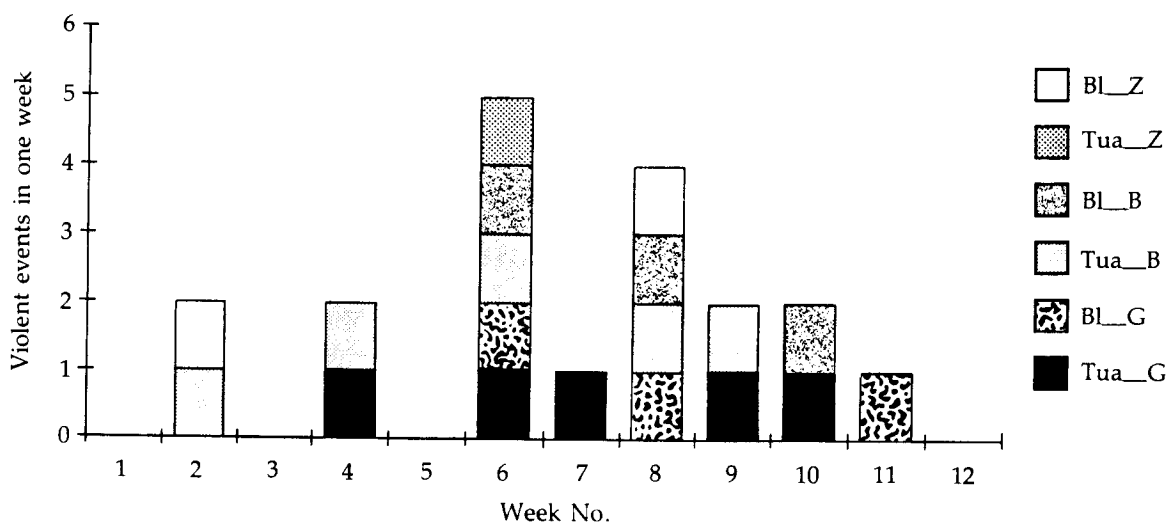
Source: Benini (own calculations)

the population threatened by famine. The scenarios presented (Benini, 1991: 331–339) carried enough credibility for the donor agency to sanction the action proposed by the local relief committee.

That simulation was used to influence a one-off decision. The following exercise, inspired by the author's work as an ICRC delegate in another African country, was done *post-factum* to show the potential of computer simulation for exploring the interaction between humanitarian alternatives and their violent environment, focussing on how far combinations of protection and assistance might reduce the amount of violence.

The setting: armed conflict in a poor desert country

Mali, a poor, land-locked country in West Africa, straddles the fault lines between important different climate and cultural areas. Much of its northern part is covered by the Sahara desert and is run through by one of Africa's major rivers, the Niger. The river sustains farming along its banks and also in and around a system of lakes fed by its seasonal overflow. It is in this area of ever-fragile balance between man and nature that farmers of black African tribes and nomadic traders and cattle breeders of Arabic descent have grown a fascinating web of coexistence and exchange over hundreds of years. While outsiders know the place best by the famous city of Timbuctu and the camel-riding Tuareg desert-dwellers, survival is predicated essentially on the working of rotational (weekly) markets in central villages, remittances from migrant labourers and smuggling of consumer goods from Algeria. Specifically, the nomads depend for their food balance on the sale of their animals in the markets that procure them calory-rich grain (chiefly millet). The amount of pasture that their goats, donkeys, cows and camels can find varies widely with scarce and erratic rainfall. In recent years, tourist services became an important sector.

In 1990, hostilities broke out between the Malian government and Tuareg tribesmen. The underlying causes lay in the long-time marginalization of the 'white nomads' under both colonial and modern nation-state rule and in their economic ruin in the great droughts of the 1970s and 1980s. The outbreak of violence was helped by the return of Tuareg mercenaries laid off by their foreign patrons. In the following year, the conflict became particularly virulent in the region of Timbuctu and the conduct of hostilities changed from attacks on military and administrative targets to the

slaughter of civilians and looting along ethnic lines. Large sections of the Tuareg and other Arabic communities fled to the desert and to Mauretania. The regional economy became depressed with the virtual halt of several important activities — tourism, smuggling with Algeria and the export of cattle.

Violence remained sporadic, following a pattern typical of low-intensity warfare, fluctuating between periods with numerous episodes and more tranquil ones. Much of it occurred in the sub-region of Goundam, west of Timbuctu, inhabited by some 120,000 people (25,000 of them nomads). This had become a buffer zone between the rebel sanctuaries in the desert and the towns of the riverine area held by the government.

By autumn 1991, hostilities had settled to a discernible regional and social pattern. The armed forces of the two sides to the conflict would avoid direct engagements, directing their violence to the civilians of the opposed ethnic groups in the contested zone. This forced black people to abandon the villages around the western half of the major lake, Lac Faguibine, and to take shelter in places not yet attacked. Conversely, the Tuareg left for the north or the west or remained cut off from the main markets, hiding around pockets of pasture and water where they could survive precariously. Two of the four weekly fairs around Lake Faguibine ceased definitively. The three remaining markets in the region were seriously disturbed from October onwards when the entire area around the eastern part of Lake Faguibine became engulfed in a cycle of violence. In many camps, nomad families suffered severe hunger, eating for weeks only 'famine foods' (wild seeds) that they collected on pastures. This triggered a new style of violence, away from stealing the cattle of rich villagers (for sale in Mauretania) towards robbing caravans carrying grain from the lakes to the farmers' homes (for immediate consumption) (Benini, 1992: 240–248).

At the invitation of both the government and of the organized parts of the rebellion, the ICRC arrived in Goundam in September 1991. Its aim being chiefly to protect civilians, delegates initially concentrated on touring villages, fairs and army posts. Such contacts served to collect allegations of atrocities which were, if found credible, transmitted to the command of the incriminated party for enquiry and sanction and to mount a reassuring presence in the weekly fairs so that the nomads could return to safely sell animals and buy grain.

This presence was used also to encourage government medical officers to return to their outposts that they had abandoned under the

threat of attack and thus to ensure minimum medical services. When the presence of the ICRC was not enough to prevent abuses, it changed strategy and took relief to those displaced and encircled groups which it could reach. At times, the ICRC was able to combine protection and assistance, negotiating safe conduct for part of the afflicted population to collect relief from government-held towns or places nearby. In the Goundam sub-region, work remained concentrated on the market towns of Goundam and Bintagoungou. Logistical difficulties reduced the ICRC presence in the Zouarat fair on the northern edge of Lake Faguibine to rare brief visits. The humanitarian effort was gratified when in April 1992 the parties to the conflict invited the ICRC to help carry out an exchange of POWs immediately followed by a peace. However, dissident elements in the rebellion continued their armed struggle and the ICRC maintained its protective presence and strengthened medical work. Food assistance was discontinued on the grounds that given the chronic poverty of the region as well as the bad logistics of transporting food in desert terrain and distributing it to remote, dispersed beneficiaries, it was inefficient compared to the humanitarian yield of the protection and medical activities. In fact, excess mortality was caused chiefly by violence and measles, not by famine.

For all its ups and downs during the three years that it has been going on, the armed conflict in northern Mali engaged relatively small numbers of fighters and knew few periods with intensive activity. That accounts for the modest number of violent deaths, most of which concerned civilians. However, economic and social disruption has been serious, auguring ill for the rehabilitation of a population already chronically poor before the war should real peace ever come back to the Timbuktu region.

Research hypotheses: social 'clockworks' affecting violence

The ICRC delegates becoming familiar with the Goundam sub-region found several characeristics of the conflict that were highly significant for the path of violence as well as for the impact that protection and assistance were making for the principal victims, the civilian population on both sides.

First, violent events would occur with astoundingly variable frequency. An attack would create severe tension in the affected area often exploding into retaliatory action. Such bursts of tit-for-tat violence would surge and die down within a few weeks. Moreover, the tension created by incidents would, in great measure, depend on where and to whom they happened. This was, at least for the black tribes and the army dominated by them, closely correlated with the position that the place attacked was occupying in the hierarchy of central places. For example, the May 1991 attack on Goundam sent violent explosions far outside the sub-region. One level down the hierarchy, when Bintagoungou was attacked several times starting from October of the same year, virtually each of the attacks was followed by the army moving from Goundam town to Lake Faguibine. Incidents on the northern shore of the lake, however, would have to come in sufficient numbers and intensity for the army to respond with a one-off expedition, if at all. The response pattern was compounded by the behaviour of armed villagers in the grey area. Within their limited means, they would launch their own retaliatory attacks or persecute cattle-stealing gangs into the desert. Thus the tension provoking a violent response was a function of both centrality and distance. Cycles of violence were thus initiated, acted out and interrupted by fairly long periods of tranquility. This was helped — one wishes to think — of course also by the protective presence of the ICRC which discouraged the armed forces from attacks on civilians of the ethnic groups deemed adversary.

Secondly, as the conflict lengthened in time, heightening the distress of the population, the incidence of hunger-motivated attacks, with the chief purpose of collecting food, would increase. The rebels seemed to be receiving greater support even from those nomad camps ideologically opposed to the insurrection, in the hope of receiving a share of the looted food. In the same line, ICRC food distributions would noticeably reduce ethnic tension. The relaxation was usually not very durable, to be undone when fresh violent events occurred. Nevertheless, food assistance seemed to be lessening a powerful incentive for participation. This was true both of the Tuareg, severed from their habitual marketing conduits, as well as of the black communities burdened with displaced persons from abandoned villages.

Apparantly, the rhythm of violence was dictated by two different social clockworks. Part of the violence was explosions of tensions created by attacks that had struck groups of one's own ethnic affiliations. These tensions would surge immediately and to dramatic intensity and then often die down soon unless sustained by more incidents. In other words, the social memory of the 'violence against my own group' was relatively short. Economic disruption installed a second, much slower,

yet assiduous, clockwork congenial to the slow onset of famine and to the inability to recover from economic dilapidation during the spells of tranquility. Possibly, there was a third clockwork, the one regulating the activity of cattle razzias across the border.

If there is indeed a plurality of social clockworks (Zerubavel, 1979; 1981) operating in concert to bring about the pattern of violent events,[1] then this may have important consequences that humanitarian agencies working in war-torn and economically devastated countries like Mali may wish to study. Here comes to the mind the likelihood that food assistance makes an impact for the good of the victims that goes far beyond its direct nutritional value. We may assume that in a number of situations similar to Mali, food assistance is an important tension reducing agent because it removes the famine-related part of incentives for participation in violence. When given in sufficient quantity and through effective distributions, food assistance may thus indirectly break cycles of violence that otherwise would become self-sustained in a famished area. In other settings though, such as those permitting stolen food to be sold easily and even in bulk quantity, assistance may in fact present a stronger incentive for violence. This may have been the case for Somalia in 1992.

Humanitarian agencies may therefore need to base decisions regarding food assistance on assessments that take account of a broader range of variables than those traditionally considered by agriculture and medical specialists. The ICRC has already modified its philosophy by including in its repertoire agricultural and veterinary rehabilitation to lead the victim population back to sustenance levels that should avert famine both during the conflict (conditions permitting movements of farmers and husbanders) and when local production can be expanded at the end of a conflict.

In addition, while the hostilities as well as abuses against protected persons go on, there is need to better understand what impact food aid has on their continuation. The present computer simulation investigates how different arrangements between protection and assistance activities succeed in dampening the spread of violence in a conflict setting that has responded rather well to the ICRC presence.

In a modeling framework that looks at the number of violent incidents as its central research variable, the following specific questions are asked: Humanitarian agencies may not be able to work in all, or even in the larger part, of the conflictual area. Some of it may receive only protection or only assistance or neither. Nevertheless, on account of social, political, military connections, violent in-

cidents in the zones not reached by the agencies may kindle tension also in the areas covered. Sometimes access may be possible to a zone, but expensive logistical requirements discourage work there. Various constraints then suggest alternatives of 'humanitarian realism' in the sense of concentrating work on a limited number of places. How much does regional concentration, by the scope it leaves for unreduced tension to spill over from the excluded areas, impair the effectiveness of the overall programme?

The logistical requirements of food assistance — purchase and transportation of the food, identification of beneficiaries in the war zone — often create delays even when the parties to the conflict allow relief convoys in. Protection activities, in the ICRC experience, have simpler logistical requirements. Food assistance may therefore often begin with a delay behind the start of protection. While it is being assembled, food scarcities and even famine may be gaining momentum. They will supply the conflict with famine-related violence till the effect of food assistance has removed the incentive to fight for food. How sensitive is the humanitarian process to delay in food assistance?

Evidence that delegates collect on the nutritional status of persons threatened by the famine is key to decisions about the length of the period during which food assistance ought to be given. Once the threat of famine has been cleared, it seems logical to end the assistance. This will encourage local food production and trade. Where the devastation of the economy has deprived large groups of people of their entitlements to food — even if some were offered in the markets — cutting back on assistance may leave intact sufficient incentive to obtain food by violent means in order to frustrate agricultural and commercial recovery. In some situations at least, short-time programmes, even where and when they avert an impending famine, may not take full advantage of the contribution that food assistance may be offering to reducing tension, concomitant violence and disruption reproducing famine conditions. While the model under discussion is silent about the number of famine deaths (in fact, about all sorts of mortality), scenarios with continuous versus short-time food assistance are compared for their violence record.

Finally, for various reasons, notably those of cost-effectiveness, a humanitarian programme may never feature any food assistance. Although the model under discussion does not allow for cost programme components — it deals with effectiveness (degree of goal attainment), not efficiency questions (cost/benefit)

[1] Within the large field of the sociology of time, social clockworks have not been developed in formal models very much. Zerubavel in his books *Patterns of Time in Hospital Life* and *Hidden Rhythms: Schedules and Calendars in Social Life*, comes close to the concept of a interactive plurality of clockworks, such as when explaining the competing imperatives that regulate staff rosters in hospitals. However, in the settings that he describes, the clockworks are integrated by an overriding expectation to cooperate. For armed conflict, such a theoretical framework will not do. The integration — the ability to produce a violent act or not at time T — of the different clockworks is brought about by a different mechanism of expectation. With mounting tension, actors no longer have a rational basis to expect that others will not use or repeat violence and therefore they 'cooperate' in the vicious cycle to produce more violence themselves.

— the performance of a scenario with protection activities is looked at. For easier comparison with the previous scenario featuring increased protection activities at the end of the short-time assistance activity, this scenario also sees its protection activities increased after some months.

While working in Mali, the author regretted the fact that the ICRC could not extend a continuous presence to the entire Goundam subregion. Contacts in the field suggested that at least the Tuareg held strong expectations of receiving protection and assistance also in the badly accessible area north of the Lake Faguibine. There, in fact, members of both ethnic groups had been subject to abuses and turmoil, leaving the survivors in difficult circumstances of hiding and hunger. Although it was known that the army was not very concerned with what was happening north of Lake Faguibine, the first hypothesis, inspired by personal field exposure, was that because the ICRC had to concentrate work on the southern and middle parts of Goundam, the district as a whole suffered significantly higher amounts of violence than if it had been able to work also in the north. In other words, the relative effectiveness of its 'humanitarian realism' would be shown to be seriously reduced in a formal model that took account of sub-regionally connected violence generation.

Out of a mixture of common-sense assumptions about famine build-up and of the theoretical importance in this simulation of different social clockworks, the second hypothesis is but the expectation that the effectiveness of humanitarian interventions in poor countries will be extremely sensitive to delayed delivery of food assistance. One expects that if this programme component was started with only a short delay behind the start of the protection programme, another significant increment in violence was to be found.

A hypothesis about the relative effectiveness of a programme with short-time food assistance only was not formulated. Assuming that the termination of food assistance would release manpower for more protection-related work, it was hoped that this would compensate, violence reduction-wise, for the lost benefit of the food programme. However, and this is the third hypothesis, it was expected strongly that compared to the results of that, giving no food assistance at any time would leave the field open for much greater violence to happen.

Simulation approach

Effectiveness was calculated in a model that random-generated series of violent events using probabilities determined by the violence and ICRC programme histories. In fact, the two first graphs (see table 1 and figure 1) are nothing else but frozen images of the violence generated in one of the model runs. The basic event was defined as

$X(a,e,w) = 1$ if during week w (1 ... 48, equal to 12 months of 4 weeks each) civilians of ethnic group e (Tuareg or black) in area a (Goundam, Bintagoungou or Zouarat) suffered at least one occurrence of violence;

$= 0$ if otherwise.

$X = 1$ if random$[0;1] >$ ProbX. For the discrete-event generator, the linear logit equation as described by Crane (1991: 1226-1259) was used. Its argument is the tension $T(a,e,w)$ provoking violence or not against group e in area a during week w. Its form is

$$\text{ProbX} = 1/(1 + e^T)$$

The *Total Tension T* is the following sum (we omit the fact here that in the calculations, for technical reasons, high tension is expressed by negative values, as one may see from the above equation):

Tension from outside + Violence-generated tension + Famine-related tension.

'Tension from outside' is the element determining the probability of X if violence-generated tension and famine pressure were absent. It is influenced by such factors as the attitudes of the armed forces sent from outside the Goundam region and by the secular history of inter-tribal cohabitation. In this model, different values were set, using the author's personal estimates for each of the three areas and the two ethnic groups living in them. For each combination of area x group, the value was held constant over the 48 weeks during which the model was run. Of course, changes during the year could be made to reflect, say, the different appreciation that a new military commander has for the humanitarian law, but the hypotheses did not require to investigate the outcome of such variation.

'Violence-generated tension' is the difference between tension created by violence inflicted to the opposed ethnic group (who want to take revenge or carry out preventive strikes) and the impact of ICRC protection activities in the area. This tension is the sum of violent events that occurred in the various

areas in the past, discounted by factors of regional connectivity and depth of time. The ICRC protection activities are measured by the presence or otherwise of its delegates in the particular area and week (other models might use different measures that have a meaningful relation with tension reduction, such as the number of prisoner-of-war camps visited).

Famine-related tension against one group is in proportion to the famine pressure suffered by the opposed group, which is, as one may easily anticipate, mitigated by the ICRC food assistance. Famine pressure is related to the destruction of the economy by the war and thus modelled as a function of the history of violent events perpetrated against one's ethnic group in the various sub-areas.[2] In the Malian model, this pressure is modelled to translate throughout Goundam Circle because violence in one area sets refugees moving to other areas where the communities then are burdened with their feeding. Obviously, in a setting that interdicts refugee movements, famine-related tension could not be calculated in proportion simply of the sum of the famine pressures working in the sub-areas. ICRC food assistance was measured as a simple yes/no variable according to whether the delegates distributed any food or not. In further developments of the model, it will be desirable to use the quantities or the caloric value of the food

distributed. Graphically, the structure of the basic model is shown in Figure 2.

This is the place where the modeling of social clockworks belongs. Making abstraction of the ICRC activities for a moment, violence-generated tension is the sum of all violent events (to be exact: of the weeks with at least one violent incident) perpetrated against the opposed group, over all three areas and weighed for the strength of solidarity (group ties, speed at which news travels, radius of armed forces' movements, etc) between the areas in point as well as for each of the past four weeks. A limit to four weeks, plus fast-fading memory strengths as we count through weeks -1 through -4, makes for an extremely short-lived clock that has to be rewound frequently by fresh violence.

Not so for famine-pressure. The model presupposes that it grows apace with the destruction of the local economy. The extent of destruction, for a proxy measure, is set to be equal to the number of weeks with violence since week 1. Moreover, refugee movements ensure that famine-pressure be translated into tension throughout the region. Thus, there is a summing of famine-pressure across the three areas, within one group, to calculate the related tension, but no weighing with a regional connectivity factor. Famine pressure therefore is built to keep its momentum unless

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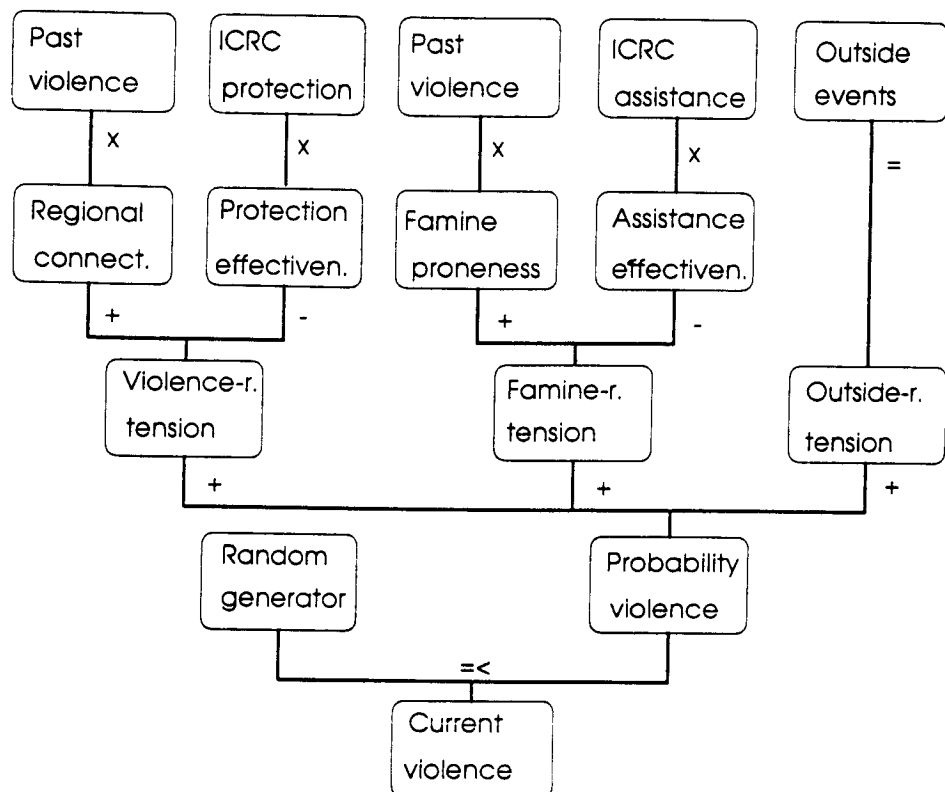

Figure 2: The basic structure of the model

Examples of clockworks:

The clockwork for violence:

$$CLOCK1 = \sum_{i=1}^{4} 0.8^{i-1} X_{t-i} \; ; \; X \in \{0;1\}$$

The clockwork for famine pressure:

$$CLOCK2 = 0.1 \sum_{i=1}^{t \leq 52} 0.99^{i-1} X_{t-i} \; ; \; X \in \{0;1\}$$

where X stands for a week with violent events or not. (In actual calculations, coefficients are slightly different, e.g. for calculation ease, 0.99 in clock2 is corrected equal to 1)

Figure 3

reduced by food assistance. This assumption is defensible only for a period of time not exceeding one harvest and was made here basically for calculation convenience. If and when a new harvest intervenes, the situation would have to be reviewed.

At the core of the calculations, therefore, lie the formulae for the different social clockworks of violence and famine-related tension (see Figure 3).

Graphing the result for a period of intense violence, followed by absolute tranquillity, shows how the violence-related part of the tension collapsed when calm returns while a wrecked economy keeps the famine pressure alive for much longer (see Figure 4).

As far as the empirical data to be inputed are concerned, the simulation, at its current state of modelling, makes use of expert judgments on three aspects of the model:

• Tension from outside;
• the strength of connections among the three areas as regards the diffusion of violence-generated tension; and

• vulnerability to famine.

In lieu of an extensive treatment, an example of famine vulnerability is provided (see Table 2).

None of the rest of the parameters is estimated. The place of estimation is taken over by several stages of calibration of parameters so as to produce a realistic model. The various senarios are then calculated for their respective effectiveness as against a 'no humanitarian intervention' (ICRC absent) and and maximalist intervention model. The order of calibrations is given in Appendix 1.

The calibrations done, the model can be run for various scenarios to test the hypotheses. The number of runs for any particular scenario has so far remained modest (10 or 20) because of programming and time constraints and in the desire to discuss tentative results before more complex variants and extensive testing is undertaken. No analytic statistics is used at this stage and results are not now tested for their statistical significance. These choices were deliberate: while the work was done in
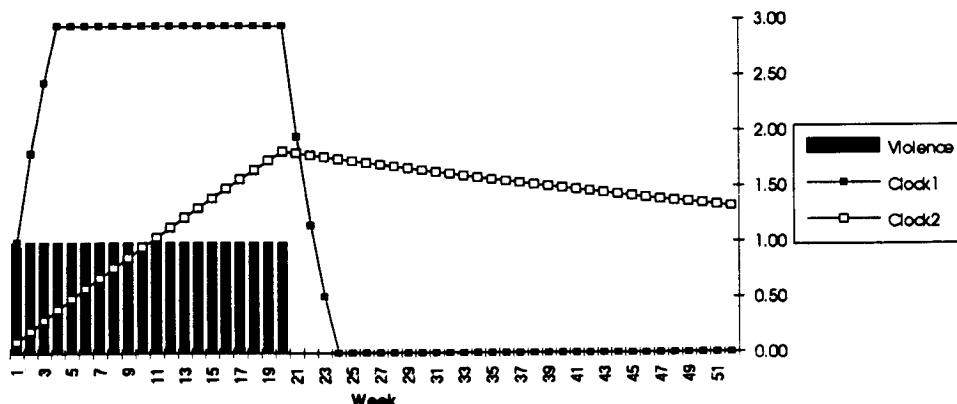

Figure 4: How violence loads the clocks
Source: Benini (own calculations)

Table 2

Group	Relative famine proneness	Reason
Tuareg in Goundam	1	Economically marginalized already before war broke out
Blacks in Goundam	0	High participation in lake-soil farming, not disturbed
Tuareg in Bintagoungou	1	Economically marginalized already before war broke out
Blacks in Bintagoungou	0.4	Significant agriculture; stored grain exposed to attack
Tuareg in Zouarat	1	Economically marginalized already before war broke out
Blacks in Zouarat	1	Economically marginalized already before war broke out

Switzerland, using personal notes from Mali, the instrument should not be developed beyond fieldwork conditions, exactly as the author had done for his first simulation in Africa.

Scenarios simulated

Four scenarios were developed and run on the computer, each creating a situation pertinent to one of the research questions. To be realistic, all four scenarios have in common that the violence is allowed to develop unchecked for a period of time till humanitarian concern has been effectively addressed and the ICRC appears on the local scene. This happens in month 4 of a period of one year during which violence, protection and assistance activities are simulated. In all the scenarios, the ICRC conducts protection activities right from month 4 throughout the rest of the year. The period of time during which assistance is given varies from scenario to scenario, from simultaneous with protection to zero. Scenarios with assistance going on while there are no protection activities are not developed; they would contradict ICRC orthodoxy asserting that persons whom it cannot protect cannot use the assistance effectively.

In the first scenario, the ICRC sustains protection and assistance activities of equal intensity throughout the eight months of its active presence during the year. These activities equally benefit two of the three areas in the region modelled whereas there is no ICRC activity carried out in the third area. That, as we have seen, corresponded well to the actual geographical distribution of the ICRC presence in Goundam district where it was able to cover

the areas of Goundam town and of Bintagoungou, but not the area lying in the north of Lake Faguibine. This scenario is dubbed 'humanitarian realism' as the ICRC avoids going to badly accessible areas.

The rest of the scenarios reduces assistance activities and modifies the protection ones in accordance with the research hypotheses. In Scenario 2, food assistance is begun with a three-month delay behind the starting date of the protection activities. This is a frequent pattern; the procurement and logistics of food assistance taking commonly much more time than for the start of protection activities. The equally frequent phenomenon that on the level of political negotiation, gaining access to prisoners may take years longer than obtaining permission to distribute food, as the ICRC experiences in many countries other than Mali, is not discussed here. In this scenario, too, the ICRC work remains constrained to the southern and middle areas of the district.

Scenario 3 limits food distributions to a period of two months. The one-time assistance may seem justified, that is the assistance may be discontinued after a short time, because nutritional surveys show that malnutrition levels have not further progressed or have started falling or simply because the organization may no longer be able to obtain or move (rainy season!) the food. However, the end of food distributions liberates delegate manpower and it is particularly relevant to investigate if the compensation for food assistance by increased protection activities can help contain the violence. Thus, for the last four months, the ICRC develops protection activities also in the north of Lake Faguibine.

Scenario 4 is different from Scenario 3 simply by the total absence of food assistance.
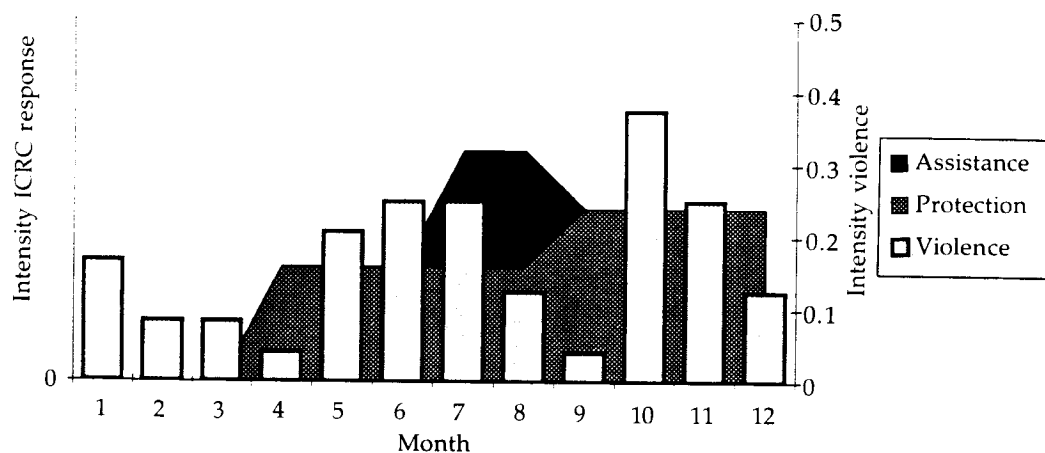
Source: Benini (own calculations)

Figure 5: One-time assistance, followed by expanded protection

For the different scenarios, the simulations were run (recalculated) 10 or, for some, 20 times. The effectiveness of the ICRC strategies was calculated against a standard developed from the violence-reduction effects of a 'no intervention at all' and of a maximum activity model (see Appendix 1). A particular run is diagrammed here from the simulation of Scenario 3. As can be easily grasped from the bar overshooting the shaded area (see Figure 5), violence comes back viciously two months after food assistance ended. This is the graph of an individual run with its unique fluctuations month-by-month, not of average monthly values. Other runs would yield different fluctuations of monthly violence rates, but the didactic purpose is the same: less effective strategies frequently produce graphs with violence bars shooting over the shaded areas representing the protection and assistance activities.

Tentative results

The following table (see Table 3) summarizes the expected with the calculated results of the simulations. In contrast to the graph that shows the fluctuations within an individual run, the results are average results for the full number of recalculations done in a particular scenario. The results, though tentative because of the small number of runs, do hold a good number of suprises.

First and foremost, the result obtained for the scenario concentrating the ICRC programme on the two easily accessible areas (Goundam and Bintagoungou) of the three sub-regions visited by the conflict suggests that 'humanitarian realism' is not only a necessity, but also that it pays! The loss of effectiveness

(a mere 10 points) is more than offset by the gain in efficiency; taking into account the huge cost that a regular presence north of Lake Faguibine — and all the more so movement of food there — would have imposed on the ICRC. The loss is that slight — it is surmised here — because of the feedback mechanism in the diffusion of tensions: The part of violence averted by ICRC work in the two areas prevents a large part of potential tension from spreading to Zouarat, so much so that this place itself experiences much less violence. The low level of violence in Zouarat in turn feeds back, by low tension, to Bintagoungou and Goundam, helping to avoid violence there.

Another surprisingly slight loss of effectiveness is reported for Scenario 2. The fact that the ICRC begins distributing food two months after its arrival on the Goundam scene has not allowed the famine build-up to gain sufficient momentum for subsequent famine-driven violence to frustrate the humanitarian intervention. At this stage, we have not tried scenarios with longer delays nor investigated this one more deeply, but we speculate that it is essentially due to the fact that once food assistance has begun it is also continued in a consistent and durable way till the end of the year. This explanation would be supported by the results of the last two scenarios.

Scenario 3 returns a result that sheds doubt on the effectiveness of short-time food assistance in the situation modelled. Let us recall two scenario parameters: food is distributed for two months. After that, protection is expanded. In spite of that, a full 16 points is lost vis-à-vis Scenario 2. To the other side, when this amount of food is not given at all (Scenario 4), a mere 5 point is added to the loss.

Table 3

Scenario	Number runs	Intensity of violence 12th month	Expected effectiveness	Calculated effectiveness
Baseline: no humanitarian intervention	10	0.51	0	0
Maximum activity	10	0.03	100	100
1 'Humanitarian realism': work in easily accessible areas	20	0.08	66 (= 2 out of 3 areas)	90
2 Early protection, delayed assistance	20	0.12	Significantly lower than 1	81
3 Short-time assistance; then expanded protection	10	0.20	Significantly lower than 2	65
4 Expanded protection; no assistance	10	0.22	Significantly lower than 3	60

Source: Benini (own calculations)

Discussion and outlook

The reported simulations may have value chiefly in terms of fresh questions they help the practitioner of protection and relief management to ask about his or her profession's work. The timing of food assistance as well as its substitution by protection activities may pose the greatest challenge to orthodox views that look at famine basically from economic and nutritional perspectives, or look at protection from the perspective of law and psychology that regulates and explains violence. For example, and for the sake of provocation, a radical might say: The Malian case teaches us that limited-time food assistance does not work even when it kills the famine. On the other side, delays in starting up the distributions have less severe consequences than we used to fear if only because, once begun, the assistance is given for an extended period of time. However, that will not be universally true and for the study of other situations, the appropriate models may incorporate other variable and/or specify different relationships between the ones used here. Modelling needs to remain *creative* as well as vigilant.

The comparison of the four scenarios from Mali also suggest another effect that may need much greater investigation in order to fathom out its philosophical implications for humanitarian agencies: it seems as though decisions affecting the *spatial* dimension of protection and assistance activities (such as going to the north of Lake Faguibine or not) have less severe consequences than those regulating the *temporal* pattern of activities (such as the duration of food assistance). We have not been able

to determine whether the difference is real or simply due to modelling effects. However, as a political question, it is manifestly — and sometimes virulently — important in several contexts. In Somalia, the question was discussed if the relatively weak presence of aid agencies in the north (in what is called Somalialand) could have destabilizing effects; leaving a centre of violence to build up there and eventually spread back to the south. In former Yugoslavia, it seems that international politics is nowadays more concerned with containing violence and refugee movements within the space of the republics already engulfed in hot war rather than enforcing a time limit beyond which the parties must not continue fighting to consolidate their territorial positions. Obviously, the discrepancy is so important, also morally, as to require a larger theoretical and philosophical framework for its further study than the present simulation can offer.

Apart from incrementally improving the professional stock of knowledge as one instrument besides many others, simulations could also be used in training new recruits in humanitarian agency. Personnel turnover at low levels of field personnel is comparatively high, chiefly because work in violent settings is abrasive. Frequent departures contribute to the loss of collective memory and complaints are common that the new relief workers sent to the field for the first time have not been trained in several of the key lessons that seniors with long experience should have taught them. For example, it is part of the ICRC drill to learn that protection for POWs cannot be effective unless their detention places are visited repeatedly. However, on the side of food assistance, very little is said on the

adequate length of time during which it needs to be given. Simulations will not yield tenets for orthodoxy, but can enliven discussion and help discover relationships between factors and decisions that novice relief workers must soon be able to master.

Before creating more complex, better validated or empirically estimated models of the interaction between armed conflict and humanitarian policies, the product extant needs to be advertised to the humanitarian community who, in general, have little experience with computer simulation. The dialogue should not try to sell a particular model or method of simulation, but to help change organizational cultures in the sense of encouraging more colleagues, notably in the field, to try for themselves. This may mean that modelling should be helped, where possible, using fairly easy to learn programmes such as a spreadsheet software with which the agency equips its field offices routinely, rather than relying on advanced programming languages accessible only to experts. More importantly, a changed culture will open debates

for discussing scenarios making explicit more of their basic assumptions thereby creating more alternatives. It would be preposterous to believe that every protection delegate and relief worker has the personality of the hypothesis killer, but certainly all want to study methods of work — computer simulations or others — that could save more human lives.

Appendix 1

Sequence of calibrations

The objective is to so construct the realistic base models that, step-by-step, the linear proportions among the expert judgment-based group parameters are conserved. Calibration is also used to make protection and assistance activities commensurable (a problem of adding apples and pears): for each, a non-dimensional unit activity is mulitiplied with its co-efficient to be so varied so as to produce equal impact on violence in the baseline model.

The calibrations proceed in this order:

Step	Calibrating for parameters of which variables	Result
	Violence before humanitarian intervention	
1.1	Tension from outside	Initial probability of violence (in week 1) 11 per cent for high-risk, 5 per cent for other groups and places
1.2	Famine-pressure	Contribution of violence to winding up famine clock (see 1.3)
1.3	Local violence-generated tension	Sets this clock so that elasticities of one-year total violence biased (for Mali!) to external and famine influences, that is for: — external factors: 3.3 — local violence: 2.3 — famine-pressure: 7.8 producing low, but increasing intensity of violence, with 25 per cent violence over one year, and 50 per cent in the last (12th) month
	Humanitarian intervention	
2.1	Protection	Protection effectiveness coefficient such that, if no assistance, violence over one year reduced by 50 per cent
2.2	Assistance	Assistance effectiveness coefficient such that, if no protection, violence over one year reduced by 50 per cent
2.3	Effectiveness standard	Set = 100 for violence reduction achieved *in the 12th month*, in model in which both protection and assistance activities run continuously, month 4 through to month 12 in all three areas; = 0 when no humanitarian intervention

Source: Benini (own calculations)

Effectiveness of different humanitarian intervention strategies — in this case different arrangements between protection and assistance activities — is defined by their comparative ability to reduce violence. The reduction obtained by the maximalist scenario — the ICRC arriving on the scene three months after the outbreak of the conflict working in all the three areas with full unit-intensity assistance and protection activities for both ethnic groups continuously till month 12 — was gauged to 100. On the other end of the scale, the no-intervention scenario receives a value of zero, there being no violence reduction. To that standard, the reductions obtained by the other scenarios are compared.

One qualification is important, however: Calibrations 1.2 through 2.2 were based on the number of violent events happening over the full period of one year (to obtain common-sense values for low-intensity warfare and for the average impact of protection and assistance [the 50 per cent reduction in 3.1 and 3.2].

Our effectiveness measure is different, wishing to exploit the predictive power of the model: What does it tell us as to how the ICRC has been able to crush the momentum of violence at the end of the period (month 12) when we look forward to the next year? For that reason, it uses the reduction achieved of the violence in the 12th month rather than over the full year. A year-based value would not be helpful to tell us how the programme has taken care of the famine build-up, which, as we know, is slow, shooting into its own kind of tension dramatically at the end of several months of growth only.

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