

Computer assisted learning to prevent HIV-spread: Visions, delays and opportunities

Jose J. Gonzalez

Agder University College

N-4876 Grimstad, Norway

Jose.J.Gonzalez@hia.no

Abstract

The AIDS epidemic is one of the toughest challenges facing human society today. Due to the very long incubation period of AIDS with its 'hidden' epidemic, policy-makers tend to underestimate the seriousness of the problem. One cannot expect a breakthrough in prevention of HIV-spread unless such hidden features are dealt with. The computer program "AIDS Information, Modification and Simulation – AIMS" focuses on the very features that make the AIDS epidemic such a tough challenge. Research questions are posed that should be pursued in collaboration between the authors of AIMS and educational scientists.

Introduction

Ibsen's play *Brand* (Ibsen, 1866, 1966) contains a premonition of consequences of environmental pollution:

And now worse visions of a viler age
Loom through the darkness of future's night.
A sickening fog of smoke from British coal
Drops in a grimy pall upon the land,
Befouls the vernal green and chokes to death
Each lovely shoot, drifts low in poisoned clouds,
And steals the sun and daylight from the place,
Or falls, like that volcanic ash which rained
On the doomed cities of antiquity.

Long-term consequences of environmental pollution manifested themselves when entire fish populations mysteriously began to disappear from lakes in southern Scandinavia in the 1920-ies, i.e. sixty years after the appearance of Ibsen's play. The causal provenience from industrial pollution in Britain and central Europe was recognized in the 1970s – more than hundred years after Brand's premonition. More long-term consequences, came in the 1980s with dy-

ing forests in Germany and other countries.

Human society is quite helpless against delayed, protracted problems. All cronical calamities, some of them potential catastrophes, are caused by continuing events occurring years or even decades before their impact: Overpopulation, depletion of natural resources, deforestation, formation of slums, growing criminality, ethnic riots and racial persecution, acid rain and forest death, ozon hole, global warming, drug addiction... Indeed, those problems share additional characteristics that make them difficult or even impossible to solve (Dörner, 1980, 1989, 1990; Dörner, Kreuzig, Reither & Stäudel, 1983; Dörner, & Pfeifer, 1993; Dörner & Schaub, 1994; Dörner & Wearing 1995; Gonzalez, 1985).

The threat of the AIDS epidemic

To the list of chronic problems above one can now add the AIDS epidemic (Koch, 1987). In several Third World countries in Africa, Asia and the Caribbean, HIV-spread has proven virtually uncontainable. Developed countries face a similar kind of threat as the drug epidemic: A slow, but unrelenting, growth. It is becoming obvious that the strategies so far employed to halt the spread of the causative agent of AIDS, HIV, are inadequate.

Coping with the AIDS epidemic

The formidable challenge posed by the spread of HIV infections should not be taken lightly. In particular, there should be room for a strategy derived from studies concerned with human problem-solving behavior in complex, dynamic problem situations. Such an approach is provided by the computer program "AIDS Information, Modification and Simulation – AIMS", developed by J.J. Gonzalez, M.

Myrtveit and L. Vavik, ModellData AS, under the auspices the Norwegian Ministry of Education, Research and Church Affairs. AIMS is in use in many Norwegian and Danish schools as well as in some schools and universities in other countries. A new and enhanced English version is to appear Spring 1995 in collaboration with Softworks Publishing, a Canadian company.

The aim of this paper is to give an introduction to the potential of AIMS, as seen by its authors, and to suggest research questions for future investigation in col-

laboration with educational scientists in different countries.

Using the “Maps” module to understand patterns of HIV-spread

AIMS contains a cartographic module (“Maps” module), which allows the user to associate data for AIDS prevalence and incidence with maps for continents, countries, regions and cities. The data can be represented in various formats and is easily retrieved, transformed, compared and even printed.

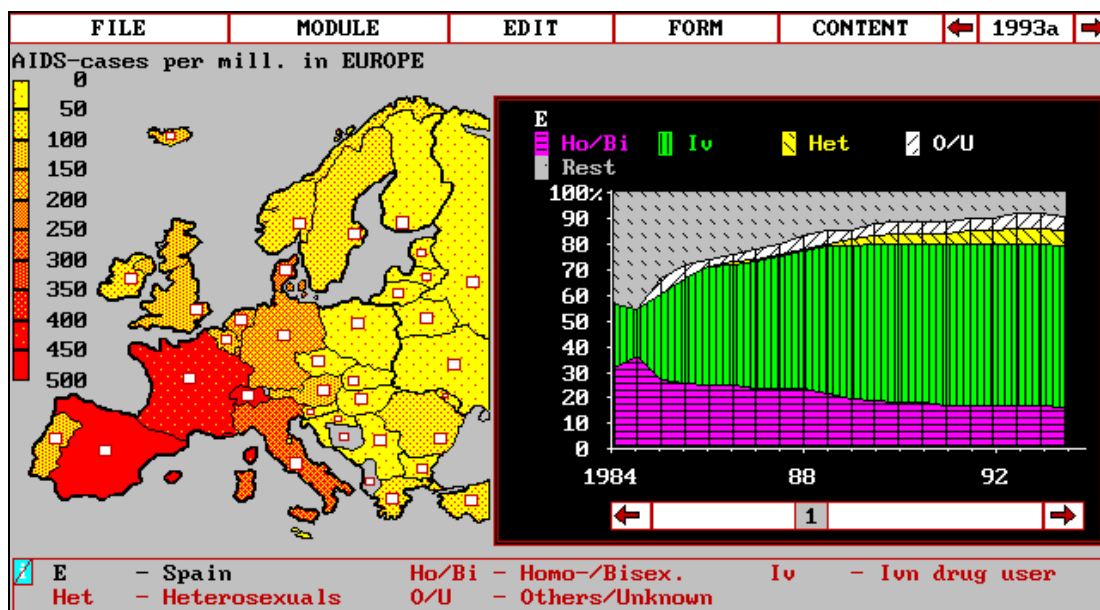


FIGURE 1 The Maps Module contains the statistics for AIDS cases in countries and regions as dynamical maps, curves, graphs and tables. The student discovers the connection between sociocultural factors and patterns of HIV-spread.

In a typical session, participants are given the following tasks relating to the Maps module:

Europe

- Identify countries having high number of AIDS cases per capita.
- Identify countries having low number of AIDS cases per capita.
- Identify countries having a rapidly changing (i.e. increasing) spread of AIDS.
- Using the AIDS-statistics for transmission groups, try to explain the patterns discovered above.

- Estimate the doubling period of the AIDS epidemic in different countries.

Third World countries

- Analyze the AIDS statistics of African countries. Making allowance of characteristics of the social, economic and health systems in Third World countries draw inferences about AIDS-spread in affected countries in Africa, Asia, South America.

These tasks are closely related to the mechanisms for HIV-spread (i.e. risk behaviors associated with sociocultural factors). The Maps module discloses the connection between such factors and patterns of HIV-spread.

Among the research questions arising we mention: How awareness of links between sociocultural factors and HIV infection risks influence attitudes and behavior. How understanding the role of drug addiction as main engine of the HIV-spread could be used to derive counterstrategies against both threats. How to incorporate anti HIV-spread strategies in help programs to developing countries.

Using the “Models” module to understand key characteristics of epidemics

We use analogies to accommodate new phenomena in the frame of past experience. Analogies, however, can lead us astray.

False analogies are responsible for the inadequate response to the threat of AIDS. These false analogies are fostered by an inaccurate understanding of the nature of HIV infection and of how HIV spreads. To reveal particular features of the AIDS epidemic, one can employ AIMS to model both “conventional” epidemics and the entirely new situation posed by HIV, thus disclosing the great differences between the two.

In a typical session participants are given the following tasks relating to the Models module:

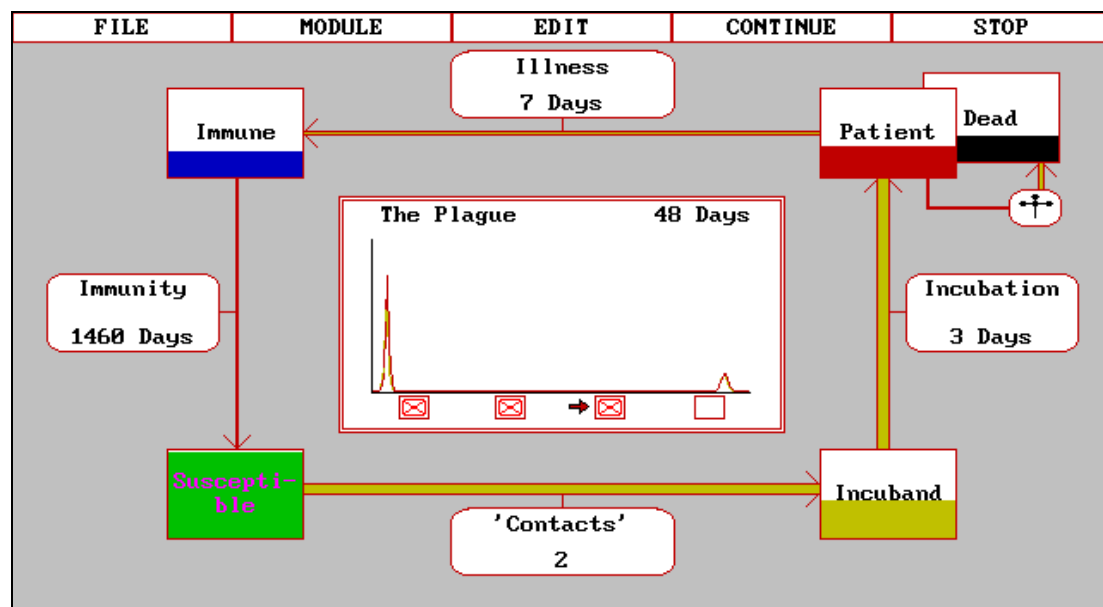


FIGURE 2 The Models Module contains ‘compartment’ models of different epidemics. The student discovers key characteristics of epidemics and grasps what makes the AIDS epidemic such a formidable challenge to Society. The crucial importance of long-term prevention strategies springs to mind.

Black Death (The Plague)

- Simulate the (historical) Black Death epidemic. Record typical characteristics.
- Observe the second wave of the epidemic. Explain why the second epidemic wave of Black Death was called the “Childrens’ Plague”.
- Run a second simulation of the Black Death epidemic. Interfere by stopping the spread of the agent as

soon as doctors recognize the epidemic. What happens with the observable epidemic (i.e. with the number of sick people, the number of deaths occurring)?

AIDS

- Simulate the AIDS epidemic. Record typical characteristics.
- Why is there not a “second” wave of the AIDS epidemic? Could you expect some kind of a “Childrens’ Plague” in the case of AIDS?

- Run a second simulation of the AIDS epidemic. Interfere by completely stopping the spread of the HIV as soon as physicians discover the epidemic (i.e., when AIDS cases start to appear). What happens with the observable epidemic (i.e. with the number of AIDS cases, the number of deaths occurring)? Estimate the percentage of the AIDS still to occur if a miracle happens and nobody else gets infected from tonight on.
- The Human Immunodeficiency Virus is probably more than 500 years old. HIV has almost certainly been introduced to European and North-American countries many times before the AIDS epidemic took off in the seventies/eighties. Make whatever assumptions you think may describe typical sexual (and other so-called risky) behavior patterns in the forties/fifties/sixties. Run a third simulation of the AIDS epidemic using your assumed parameters. Does AIDS-spread occur?

Research questions are connected to sustaining awareness despite delayed consequences (long-term effects, slow spread, thresholds, etc.). Instead of teaching about observed facts (i.e. the consequences of events that occurred more than a decade ago), students should confront simulated scenarios presenting the consequences of what is happening today. Their thinking and their acting should be channelled toward facing the future that is already in the pipeline.

Using the “Dance” module to raise motivation and help behave responsibly

The “Dance” module is a simulated, high-risk environment – a hypothetical disco where one of the regular attendees is infected with the HIV. The simulation model deals with single individuals, each represented by various behaviour parameters (frequency of temporary relationships, duration of permanent relationships, sexual habits, frequency of extrapartnership affairs, etc.) both in the “Dance” and in the population at large. One can define sexual habits for the individuals and also define the statistics of those habits.

Temporary relationships and more permanent partnerships are formed and broken up. The computer follows the events determined by the behaviour parameters of the simulated individuals, including the transmission of HIV and the progression of the disease through its different stages.

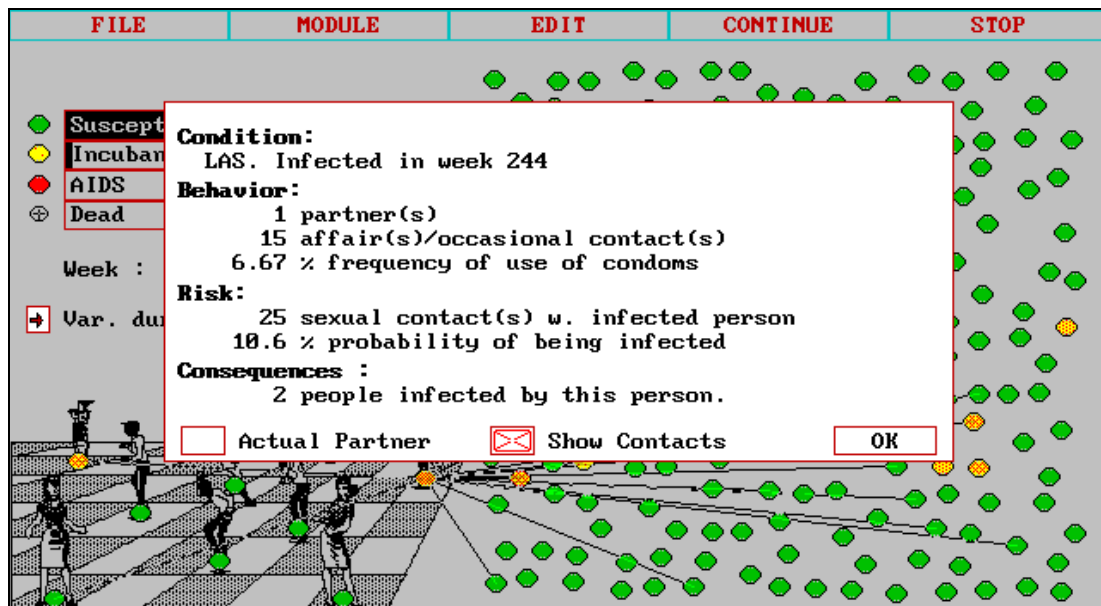


FIGURE 3 The Dance Module simulates single individuals, each represented by various behaviour parameters. The students identify themselves with particular cases and trace the consequences of risk behavior. They learn how risk behavior, aided by chance, sooner or later lead to HIV-infection. Users of AIMS report increased sense of responsibility and higher motivation to take a stance against HIV-spread.

In a typical session participants are given the following tasks relating to the “Dance”-module:

- Using simple behavior patterns make inferences about the correlation between behavior and risk.
- According to empirical data, the average high-risk person uses condoms in sexual intercourse with occasional partners on less than 20% of the occasions. Run two sets of simulations with two behavior patterns that only differ in the frequency of use of condoms: a) 20%; b) 0%. Compare. Explain what you observe.
- Place a low-risk person in a high-risk environment. Assume that he/she would fall in love with a typical-risk person there (i.e. sooner or later have have sexual intercourse her/him). Run a set of simulations.
- Place a high-risk person (not yet HIV-infected) in a low-risk environment. Assume that he/she would fall in love with a typical-risk person there (i.e. sooner or later have have sexual intercourse

her/him). Run a set of simulations. Compare. Explain the results.

Among numerous research questions, we propose a study related to the following paradox: Despite massive efforts to promote so-called “safe(r) sex”, studies in schools in the USA and Canada show that condom use declines with age. One sees the same – and even more pronounced patterns – in many other studies, including studies of male homosexuals who (still) have many different partners. Some studies report condom use in 15% of the cases or less, some high-risk persons even drop using condoms after a while.

We suggest that this worrying pattern may be related to the following factors:

1. The threat of HIV infection applies for thousands of events, i.e. individuals risk potential infection during most of their sexual life.
2. HIV has low infectivity, i.e. single potentially infectious contacts may not result in HIV-infection.
3. Condoms must be used in most (all) potential risk situations to be effective in the long run.

Most people dislike condoms, i.e. they prefer having sex without them. Sooner or later a situation arises when a couple

wants sex but no condom is at hand...or the condom breaks. They get shocked but in 99.9% of the cases nothing happens (most unprotected sex occurs between uninfected people, and even when one of the sexual partners is HIV-infected the probability of becoming HIV-infected is low – probably 1% or less). After several such occurrences, people “discover” that they can afford to have unprotected sex (which most people like much better, anyhow) without getting infected. Next time they don’t use the condom they still do not get infected. Their cavalier attitude gets reinforced and they attain a false sense of security.

Two crucial research questions arise in this connection: How to counteract the erosion of “safe sex” attitudes. How to supplement “safe sex” campaigns with other protective measures.

For such studies **AIMS** provides scenarios and tools that disclose hidden patterns of HIV-spread, display risk of infection (in terms of cumulative probability of getting infected) and make the causal connections apparent.

A very important issue is the implications of local cultural practices and values for AIDS education. While AIMS contains scenarios which are typical of developed countries, the tutor can to a certain extent configure the AIMS-program with behavior patterns that should be recognizable in a wide range of urban conditions of developing countries.

Conclusion

Delayed and protracted problems are often met with inadequate or insufficient policies. Attention is preferably given to more ‘pressing’ problems. Consequences of wrong solutions do not become apparent until decades have passed. Appropriate strategies may contain unusual ideas, hence they do not find advocates until the situation has worsened.

Despite its having been available for years, it has proved very difficult to conduct systematic prevention studies using AIMS. Despite advocacy from leading educational researchers, several proposals for comparative studies have failed to re-

ceive grant support from relevant national and international research foundations.

Nevertheless, observations from use in Belgium, Denmark, Germany, Norway, Switzerland and the UK indicate that a comparative prevention study using AIMS would be worthwhile. As a preliminary conclusion, it seems that the authors’ goal – viz. to increase awareness of the audience toward the counterintuitive and hidden features of the AIDS epidemic – is likely to be achieved.

References

- Dörner, D. (1980). On the difficulties people have with complexity, *Simulation and games*, 106, 11-87.
- Dörner, D. (1989). *Die Logik des Mißlingens. (The logic of failure.)* Reinbek, Germany: Rowohlt.
- Dörner, D. (1990). The logic of failure. In D.E. Broadbent, A. Baddeley & J.T. Reason (Eds.), *Human factors in hazardous situations* (pp. 463-473). Proceedings of a Royal Society Discussion Meeting, Philosophical Transactions of the Royal Society. Oxford, United Kingdom: Clarendon Press.
- Dörner, D., Kreuzig, H., Reither, F., & Stäudel, T. (Eds.). (1983). *Lohhausen: Vom Umgang mit Unbestimmtheit and Komplexität. (Lohhausen: Dealing with uncertainty and complexity.)* Bern, Switzerland: Huber.
- Dörner, D. & Pfeifer, E. (1993). Strategic thinking and stress, *Ergonomics*, 36(11), 1345-1360.
- Dörner, D. & Schaub, H. (1994). Errors in planning and decision making and the nature of human information processing. In *Applied Psychology (An International Review Special Issue on Human Error)*, 43 (4), 433-453).
- Dörner, D. & Wearing, A.T. (1995). Complex problem-solving: Towards a (computer-simulated) theory. In J. Funke & P. Frensch (Eds.), *Complex problem solving – The European perspective* (in prep.). Hillsdale, New Jersey: Lawrence Erlbaum.
- Gonzalez, J. J. (1985) *Teaching problem solving in complex situations using simulation models*. In K. Duncan and D. Harris (Eds.), *Computers in education* (pp.

233-237). Amsterdam, Netherlands: Elsevier.

Ibsen, H. *Brand*. (1866). Copenhagen, Denmark: Gyldendal. English version: Ibsen, H. (1966) *Brand* (G.M. Gathorne-Hardy, Transl.) Oslo, Norway: Universitetsforlaget.

Koch M. G. (1987). *AIDS – vom Molekül zur Pandemie. (AIDS – from molecule to pandemic.)* Spektrum der Wissenschaft, Heidelberg.