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# An Expert System for Homeopathic Glaucoma Treatment (SEHO)

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**Abstract**—*In this article, an Expert System for Homeopathic Glaucoma Treatment (SEHO) is presented, the task of which is to assist ophthalmologists in selecting the most appropriate therapy for a patient diagnosed as having glaucoma. It is based on techniques proper to homeopathic medicine, a trend that is gaining more and more supporters all over the world, but in which real experts are few and far between. After a brief overview of the state of the art, the authors describe in detail on the development of the system, for which the IDEAL methodology, designed for knowledge-based system development, was used.*

## 1. INTRODUCTION

LAMENTABLY, GLAUCOMA is one of the most significant pathologies affecting sight, the number of cases making it one of the major visual disorders. This disease often leads to irreversible blindness and is accompanied by an inherited traumatic process, making glaucoma sufferers especially sensitive to the methods used in their treatment.

A marked partiality toward the field of alternative medicine has been observed within the blind community, on some occasions as a complement to traditional medicine and on others due to their openness to and acceptance of these branches of medicine, of which homeopathy is a clear example, which they consider to be less aggressive.

Homeopathic medicine is based on the activation of the organism's healing mechanisms by administering homeopathic dilutions corresponding to specific doses of these medicines.

It should not be forgotten that a blind person faces other problems besides sight impairment, such as difficulties in social integration, adaptation, and mobility, etc., as well as other underlying illnesses which in many cases originally induced the process leading to blind-

ness. As a result, these people can hardly be treated medically without their physical and mental characteristics being taken into account.

Homeopathy is in fact oriented in this direction, and, as far as visual disorders are concerned, homeopathic treatment depends on four factors (Rubio, 1988): the threat to vision, the kind of disorder and manner in which it evolves, the level of individual sensitivity, and the subject's potential for response.

And such treatment is composed of

- Remedies prescribed for local symptoms, and
- Remedies for the glaucomatous field (patient's physical and mental constitution).

The secretion of aqueous humour (an important factor in glaucoma) is closely linked with the sensitivity of the neurovegetative system and that the stress of everyday life and emotions affect pressure in the eyeball. Psychological tests have revealed that glaucoma sufferers are anxious, susceptible, and meticulous and that the glaucomatous subject's hypersensitivity affects the treatment of the patient. Homeopathic treatment is very often associated with traditional therapies, often permitting a reduction in the dosage and an increase in the patient's tolerance to the latter. So, we can say that the different therapies, far from being opposed to each other, are complementary, or as Blamentier states (Rubio, 1988), "it is the patients and not the therapies that differ."

It is important to observe how sensitive the patient is to a therapy that stimulates his defence potential. However, it is not easy to appreciate this potential, as it depends on many factors, such as age, the degree of sensitivity of the lesions, and the patient's characteristics and constitutional data. These make it possible

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for the homeopathic doctrine and clinical expertise to decide what is the most suitable treatment.

However, it is not possible to establish a general rule to cover the wide range of possibilities that crop up in the homeopathic doctor's surgery and, at all events, the only suitable guide he or she has personal experience. Therefore, it was thought necessary to employ knowledge engineering techniques to deal with this problem. This led to the development of the expert system described, which was developed at CETTICO (Centre of Technology Transfer in Knowledge Engineering) and is able to assign homeopathic treatment to glaucoma sufferers.

There are no similar expert systems on record. Visual disorders have been little dealt with in the past, and the therapy model has always been based on allopathic medicine. The CASNET system (Kulikowski & Weiss, 1982), oriented to the diagnosis and treatment of different kinds of glaucoma, is an example of this.

In addition, there is a knowledge gap in homeopathic glaucoma treatment, due both to the lack of experts in this kind of therapy and to the fact that they are concentrated in half a dozen countries.

Therefore, the system entails a qualitative advance in the treatment of the blind, bringing innovative techniques into an alternative approach to medicine that is held in high esteem by the blind community.

## 2. COMPUTER SYSTEMS IN HOMEOPATHIC MEDICINE

Until recently, the computer models used to simulate medical decision making in a computer system have been mainly based on probabilistic methods, as their machine representation is easy to obtain (Gorry, Silverman, & Pauker, 1978; Solomon & Papert, 1976).

Despite the fact that these programs have come up with very interesting results, the doctor does not identify his or her reasoning and manner of arriving at a diagnosis with theirs, and it is also difficult to evaluate the quality of a diagnosis proposed in this way.

In addition, it has been noted (Ledley & Lusted, 1979) that the majority of clinical errors are made by omission, that is, errors due to a failure to take into account all of the possibilities playing an important role in determining the illness suffered by the patient so as to arrive at the correct diagnosis and treatment. Therefore, a doctor needs assistance in establishing the diagnosis and a suitable therapy, especially in the case of unusual illnesses or when the patient's symptoms may lead to different interpretations. Considering that all of the information required on a patient can be stored and classified in a computer, along with the symptoms of the illnesses of a domain, it follows that, in such circumstances, a computer may come up with a more precise and rapid response than a doctor (Barr & Feigenbaum, 1982), especially when the knowledge

of the symptoms of an illness has been elicited from an expert doctor and incorporated into a knowledge base that interacts with an expert system.

A complete and adequate homeopathic study of a patient depends on the skill of the homeopath and his or her ability in identifying, storing, recording, referencing, analysing and evaluating any class of data or group of data. This requires a system of classification, according to which the concepts and relevant information are organized, and a coding, which facilitates their use.

Originally, the homeopath's traditional prescription and, later, data bases, which were and are of great help in homeopathic surgeries, were used for classification and coding. However, it has been noted on several occasions that doctors are generally somewhat reluctant to use computers as a tool and consider them to be little suited to establishing repertories, that is, what medicines cover the patient's symptoms, the number of symptoms, and to what extent.

On the other hand, medical reasoning is related to judgement problems, problem solving, decision making, and knowledge (Fieschi, 1987), which is why it has come to be a traditional working domain in knowledge engineering.

The introduction of ES into medical diagnosis and treatment has done away with initial scepticism, and they have come into more widespread use. Examples of this are MYCIN (Shortliffe, 1976), TEIREISIAS (Davis, 1976), INTERNIST (Pople, 1977), PIP (Pauker & Szolovitz, 1977), DIGITALIS THERAPY ADVISOR (Gorry et al., 1978), CENTAURI (Aikins, 1980), SAM (Gascuel, 1981), ATTENDING (Miller, 1988), CASNET (Kulikowski & Weiss, 1982), NESTOR (Cooper, 1984), KARDIO (Bratko, 1989).

Unfortunately, however, few ES have gained access to homeopathic surgeries, though several computer systems based on this alternative medicine have been developed, such as the following.

- RADAR (Shrogens, 1982), which contains several pharmacopoeias, including those by Allen, Hering, Heneman, and Boerick. It has access to 2,000 homeopathic remedies and their corresponding pharmacopoeias.
- HINEIRO (Bachelier, 1986) contains 2,535 Boeninghausen therapy rubrics (symptoms). Each of these rubrics is associated with a blackboard with the most common remedies.
- ABIES (Benson, 1980) is a clinical information system. In addition to carrying out medical treatment, it locates notes and treatments for patients using the RCC system (Real Clinical Classification) (Read & Benson, 1986), which is a hierarchical statistical classification of a nomenclature with four detail levels.
- STAPHISE (Salaün & Simonet, 1989), an information system using the Ken repertory, composed

of some 20,000 rubrics taken from different pharmacopoeias. Its information base may be customized.

As regards ES in homeopathic medicine, we should mention VES (Vithoukas, 1988), developed by the homeopath George Vithoukas. His working philosophy can be situated within the unitarian current of homeopathy. The VES system returns the best remedy with a given scoring and certainty factor, indicating to what extent any alternative remedies presented can be administered. VES is integrated into the RADAR system and takes advantage of its potential. It is a general medical application and is not specialized in any class of illness.

### 3. SEHO (ES FOR HOMEOPATHIC GLAUCOMA TREATMENT)

Considering homeopathy as complementary to traditional treatments of visual disorders causing blindness and taking into account its acceptance among the blind community, it was thought necessary to research and develop an ES to treat glaucoma. This would assist the homeopath in inference tasks and, finding the medicines most suited to each patient, would come up with the appropriate dilutions. The end result was the prototype system SEHO (Cristóbal & Ortiz Latierra, 1991).

As opposed to other systems, NEOMYCIN for example, which mainly use the description of the patient's illness to select the therapy (Clancey, 1981; Clancey & Shortliffe, 1984), SEHO compiles extensive and complete information on the patient through homeopathic questioning before suggesting any remedy and thus does not point the doctor in any particular direction that might lead him or her to overlook important data on the patient during the session.

The results of the questioning session are sent to the homeopathic techniques of the expert, which attempts to put together the most complete profile of the patient possible and to establish his or her characteristics and symptoms so as to apply the most suitable medicines. Optionally, the system can provide information on other possible, though less suited, medicines together with the patient's symptoms that each of them covers.

Like other ES, SEHO provides information on its reasoning process, explaining the intermediate conclusions and why it selects and incorporates each medicine into the working memory.

There are two different trends in homeopathic medicine: the unitarian trend, which suggests only one medicine as a remedy (e.g., VES) and the pluralist trend, to which SEHO belongs, which proposes different dilutions of several medicines. So, SEHO's dilutions contain several medicines.

SEHO is, therefore, the first ES for treating a visual disorder from the point of view of alternative medicine. Another important characteristic differentiating it from

other systems is the fact that it has been designed to be used by the blind, available Braille adaptations having been incorporated into the prototype system. Its line of reasoning, based on the techniques of the chosen expert, the Chairman of the Association of Homeopaths of Madrid, leads to scaled dilutions, that is, to the assignation of three or more medicines in most cases, some with low, some with intermediate, and others with high dilutions, except when any of these are superfluous.

The inference process passes through several stages before arriving at these recommendations. The first stage, medicine determination, covers all of the patient's symptoms, both those related with specific symptoms and their field characteristics. It selects the lowest possible number of the most suited medicines. Provisional dilutions are assigned in the second stage, and the scaled dilutions are established in the final one.

SEHO was developed using GURU, and its knowledge base is composed of seven rule bases, which contain a total of 72 rules based on public and expert knowledge on glaucoma, and five data bases, containing medicines and symptoms, categories and field. Its inference mechanism is backward chaining.

The prototype has been designed in such a way that its knowledge base and data bases, containing pharmacopoeias including the latest findings with respect to homeopathic remedies for glaucoma, can be expanded.

### 4. SPECIFICATION AND DEFINITION OF SEHO

The IDEAL methodology (Maté & Pazos, 1988), one of the most prestigious methodologies for ES development today, was used to define and develop the prototype system. This methodology brings together the most relevant ones in this area. Some of these methodologies are (Hayes-Roth, Waterman, & Lenat, 1983; Liebowitz & De Salvo, 1989; Waterman, 1986).

Requirements definition was based on the following general concepts:

- Interface faithfully reflecting the content and extent of homeopathic questioning on the patient's characteristics and constitutional data and his or her symptoms, and adapted for the blind.
- Storage of complete pharmacopoeias on each medicine.
- Assignation of scaled dilutions of the remedies in the final treatment: low (4 CH), intermediate (7 CH), and high (15 CH) dilutions.
- Assignation of the smallest possible number of necessary medicines.

The adequacy test was carried out to evaluate the application, and the characteristics were grouped in four dimensions according to the IDEAL methodology: plausibility, justification, success, and adequacy, using

**TABLE 1**  
**Evaluation of the Application**

Dimension	Dimension Value (geometric mean) (Vci)	Maximum Dimension Value (geometric mean) (Vcmi)
Plausibility	62	89.1
Justification	29.8	64.1
Adequacy	48.4	61.9
Success	46.8	66.5

$$Vg \text{ (General value)} = \sum_{i=1}^{i=4} Vci/4 = 46.75.$$

$$Vm \text{ (Maximum value)} = \sum_{i=1}^{i=4} Vcmi/4 = 70.4.$$

$$Vf \text{ (Final application value)} = \frac{Vg}{Vm} \times 10 = 6.64 > 5.$$

variable threshold values to accept or reject a characteristic and the geometric mean (Maté, 1988; Pazos, 1989) to evaluate the task. The application was found to be suitable for treatment using an ES (threshold values of  $6.64 > 5$ ) (Table 1).

SEHO is a decision support system for assigning homeopathic resources or remedies, which was considered central for its definition. There is an essential difference in the method used for assigning the appropriate treatment: it does not directly take account of the patient's pathology or type of glaucoma, as allopathic medicine would; the disease's manifestation is truly decisive, that is, the patient's symptoms and condition are determined by his or her field characteristics.

SEHO exclusively considers the symptoms typical of glaucoma and the psychological profile and personal factors of the subjects suffering from glaucoma. Surgical affections are excluded from this framework, though complementary treatment or therapy to improve tolerance to allopathic medicines may be assigned. Figure 1 shows the flow chart of the SEHO prototype.

There are two types of knowledge implemented in the system:

- Public knowledge, based on homeopathic pharmacopoeias (Barraza, 1980; Lathoud, 1988) in 5 databases, including lists of medicines along with specific symptoms, the categories and the field, as well as a list of antagonistic categories.
- Expert knowledge, contained in 7 production rule bases, elicited from the expert and based on the operative and heuristic procedure used by the expert himself to prepare treatment. The rules will be fired using a *backward chaining* control strategy, until all the premises in its antecedent are true or false.
- The response time has to be short (less than 5 minutes).
- During execution, the system offers information on the medicines that are being considered to cover the symptoms, category, and field, as well as comments on how it arrives at the scale of dilutions.
- Once executed, the system offers information on

medicines in the final solution, the dilution in which the medicine should be administered, dosage, length of the treatment until the next visit, symptoms and characteristics that the selected medicines cover, and medicines selected that are not included in the solution along with a list of the symptoms that they cover.

An ideal solution is one that assigns a scaled dilution or a single medicine per dilution. This ideal situation does not necessarily have to occur in every case: this depends on the patient and his or her characteristics.

## 5. CONCEPTUALIZATION AND FORMALIZATION OF SEHO

Knowledge acquisition for the conceptualization and subsequent formalization of the knowledge base was based on nonstructured interviews in the first stage. Cases were presented to the expert and the protocol was analysed during this process in the second stage. In the final stage, very explicit structured interviews were a means of solving the problems that arose.

It was found that a homeopath views a patient from three different but complementary angles, when establishing a therapy:

- Specific or local symptoms, related with the organ or organs affected by the illness (eyes, in the case of glaucoma). Symptoms such as congestive phenomena, increase in ocular pressure, sight impairment, alteration of the optical nerve, etc.
- Categories, as a means of classifying the symptoms. They specify the improvements or deterioration of a symptom or of the patient in general.
- Field, which establishes how the patient reacts to the illness and which is characterized by the patient's characteristics: physical, mental, and constitutional data, such as anxious, susceptible, meticulous, for example.

The result was the conceptual model shown in Figure 2 and the knowledge map shown in Figure 3.

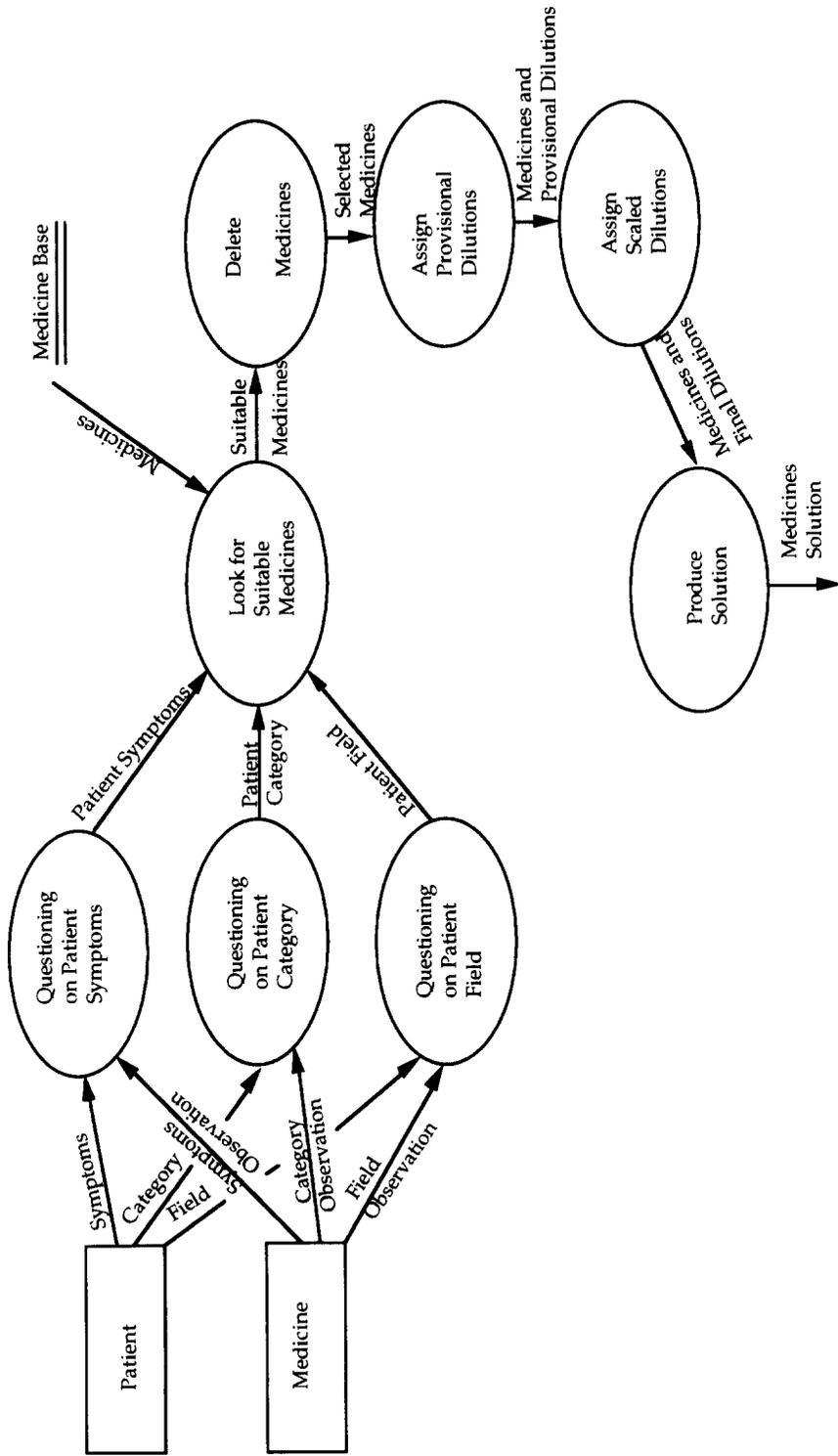


FIGURE 1. SEHO flow chart.

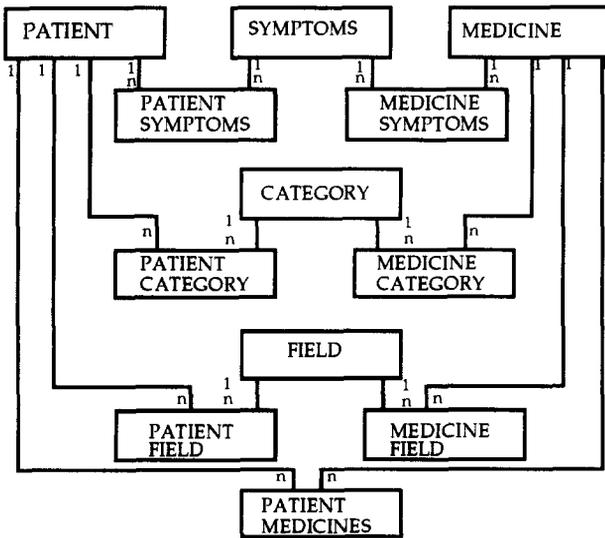


FIGURE 2. Conceptual model.

Knowledge formalization required that a distinction be made between two stages in the expert process: medicine determination and dilution assignment.

5.1. Selection of Medicine

Before medicines are selected, the patient's symptoms are elicited through questioning on individual symptoms, establishing their importance or otherwise, and on the patient's categories and fields.

Considering the following definitions:

- $x, y, z$  Medicines
- $SI(x)$  Set of important symptoms covered by medicine  $x$
- $nSI(x)$  Number of important symptoms covered by medicine  $x$
- $nMOD(x)$  Number of categories covered by medicine  $x$
- $nMOSANTA(x)$  Number of antagonistic categories of medicine  $x$
- $nSNI(x)$  Number of unimportant specific symptoms covered by medicine  $x$
- $nTOTSINT(x)$  Total number of symptoms covered by  $x$  (specific + category + field)
- $ST(x)$  Set of field symptoms covered by  $x$
- $A$  Set of medicines selected for specific symptoms. It changes as rules are fired and some medicines are selected and others excluded. At the beginning of the process, the set covers any important symptom.
- $B$  Set of medicines selected for the field. Like  $A$ , it changes when rules are fired. It initially covers any of the patient's characteristics or symptoms.

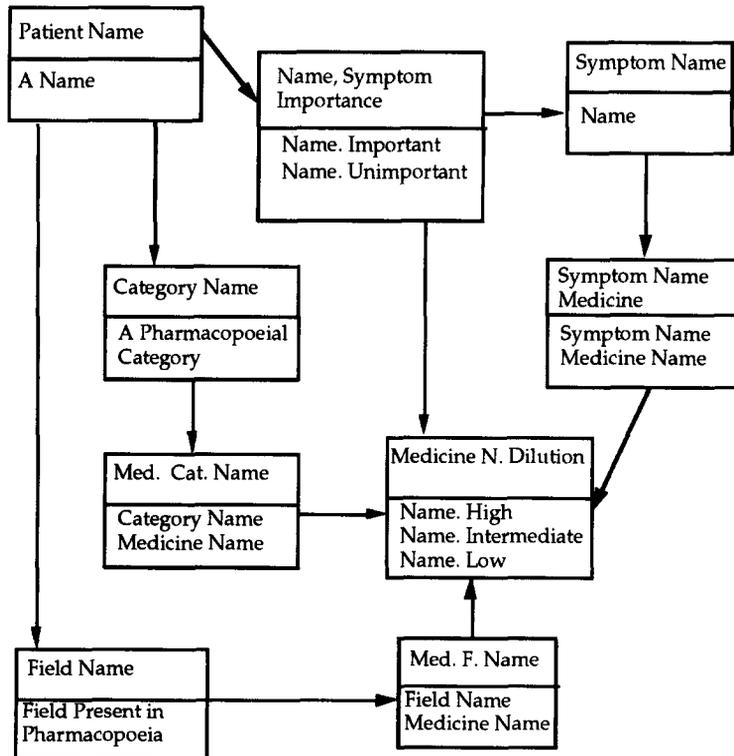


FIGURE 3. Knowledge map.

- The procedure followed by the expert for selecting the medicine to cover given symptoms is based on the following rules:

If  $x, y \in A$  and  $SI(x) \subset SI(y)$ , then select  $y$   
 If  $x, y \in A$  and  $SI(x) = SI(y)$  and  $nMODANTA(x) > nMODANTA(y)$ , then select  $y$   
 If  $x, y \in A$  and  $SI(x) = SI(y)$  and  $nMOD(x) > nMOD(y)$ , then select  $y$   
 If  $x, y \in A$  and  $SI(x) = SI(y)$  and  $nSNI(x) > nSNI(y)$ , then select  $x$   
 If  $x, y \in A$  and  $SI(x) = SI(y)$  and  $nST(x) > nST(y)$ , then select  $x$ .

The obtention of the minimum set in  $A$  is based on the rules below:

If  $x, y \in A$  and  $[x, y]$  covers the symptoms of  $[x, y, z]$ , then  $A = A - [z]$ .

If there is more than one minimum set, select the one whose medicines cover more, important symptoms.

- The selection of medicines for the field is centered on the following rules:

If  $x, y \in B$  and  $ST(x) \subset ST(y)$ , then select  $y$   
 If  $x, y \in B$  and  $ST(x) = ST(y)$  and  $nTOTSINT(x) > nTOTSINT(y)$ , then select  $x$ .

The obtention of the minimum set in  $B$  is based on the same rules as for the obtention of the minimum  $A$ , that is:

If  $x, y, z \in B$  and  $[x, y]$  covers the symptoms of  $[x, y, z]$ , then  $B = B - [z]$ . Select the minimum set that covers more, important symptoms.

**5.2. Assignment of Dilutions**

The goal pursued in this stage is the assignment of *scaled dilutions*. First a provisional assignment of the dilutions of the medicines obtained is taken, and the case-related optimum is sought.

If:

MH Set of high-dilution medicines

- ML Set of low-dilution medicines
- nH Number of medicines in MH
- nL Number of medicines in ML
- ML1 Set of medicines in ML that cover categories
- ML2 Set of ML1 medicines that cover most categories
- nLi Number of MLi medicines with  $i = 1, 2$ .
- MH1 Set of MH medicines that cover field symptoms
- MHi Set of MH1 medicines that cover most symptoms ( $i = 2 \dots 9$ )
- nHi Number of MHi medicines with  $i = 1 \dots 9$ .

The provisional dilutions are assigned according to the following rules:

If  $x \in A$  and  $x \in B$ , assign a low dilution to  $x$  and  $x \in ML$

If  $x \in A$ , assign a low dilution to  $x$  and  $x \in MH$

If  $A \neq 0$  and  $B \neq 0$ , then provisional dilutions = low

If  $B \neq 0$  and  $ML \neq 0$ , then provisional dilutions = low and high

If  $A = B$  and  $B \neq 0$  and  $A \neq 0$ , then provisional dilutions = high

The different paths taken to arrive at the goal (the suitable dilution), once the provisional dilutions have been obtained, are represented in the shape of a tree in Figures 4, 5, and 6.

The final treatment is based on the following rules:

If  $x$  is assigned a low dilution, prescribe 3 doses of a 4CH dilution of  $x$  per day.

If  $x$  is assigned an intermediate dilution, prescribe 4 doses of a 7CH dilution of  $x$  per day.

If  $x$  is assigned a high dilution, prescribe 5 doses of a 15CH dilution of  $x$  per day.

**6. SEHO SYSTEM IMPLEMENTATION**

The system prototype has been implemented using GURU as a development tool. In addition, an interface, incorporating a voice synthesizer and Braille line, has been designed to enable the blind to use the system.

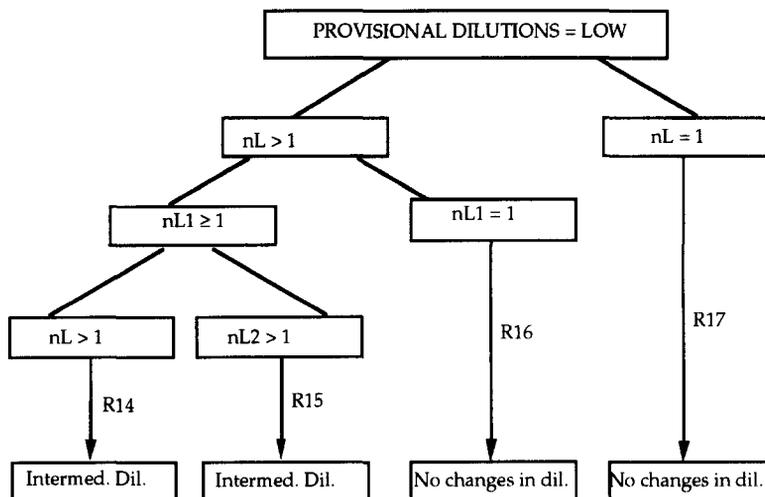


FIGURE 4. Dilution assignment I.

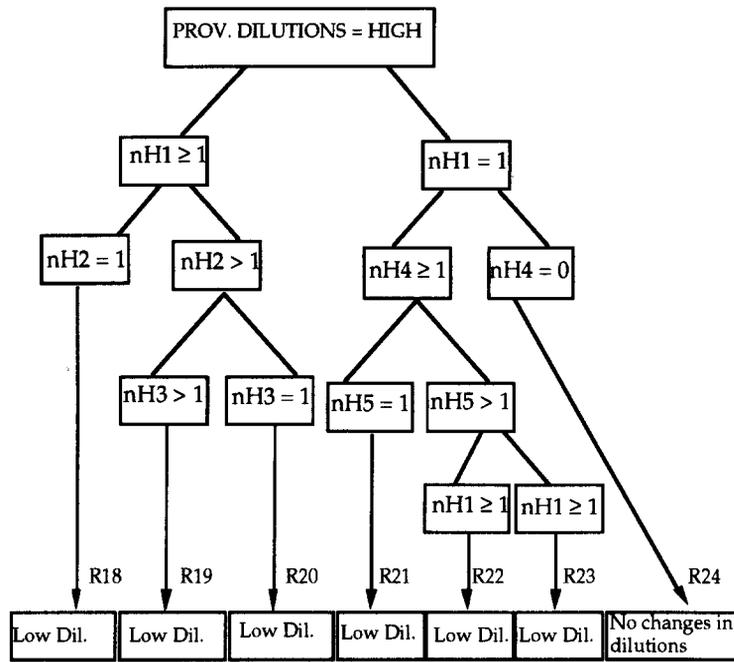


FIGURE 5. Dilution assignment II.

Its design and implementation matches the Structures Map in Figure 7, in which the modules describe the following actions:

- MSINS Generates the interface for recording patients' symptoms
- MMODS Generates the category interfaces
- MTERRS Generates the field interfaces
- MLEESIN Searches the data base for medicines that cover any patient symptom
- MLEEMOD Searches the data base for medicines that cover any patient category

- MLEETERR Searches the data base for medicines that cover any patient field
- ORDENA Obtains final medicines for particular symptoms
- MINIMOSA Obtains minimum sets of medicines for symptoms
- ORDENB Obtains final medicines for field
- MINIMOSB Obtains minimum sets of medicines for field
- MBUSDILU Defines provisional dilution
- MDILBYA Defines suitable dilution

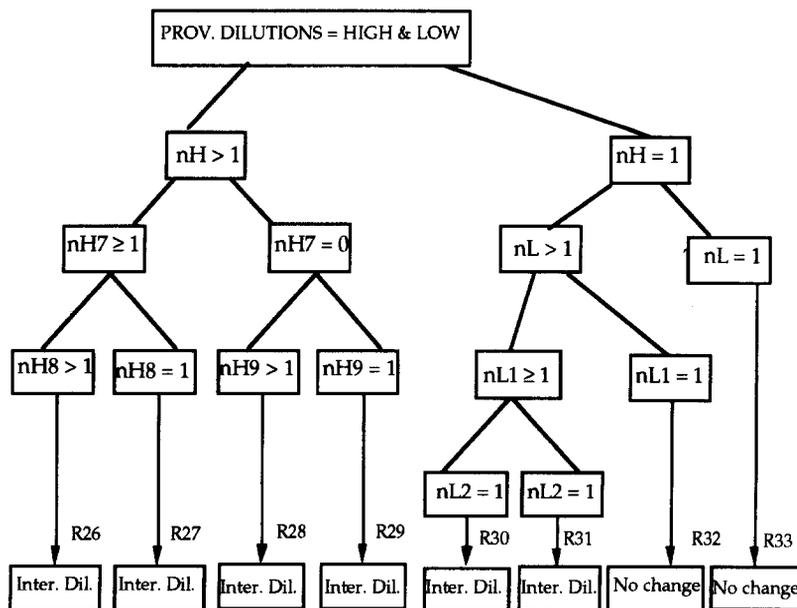


FIGURE 6. Dilution assignment III.

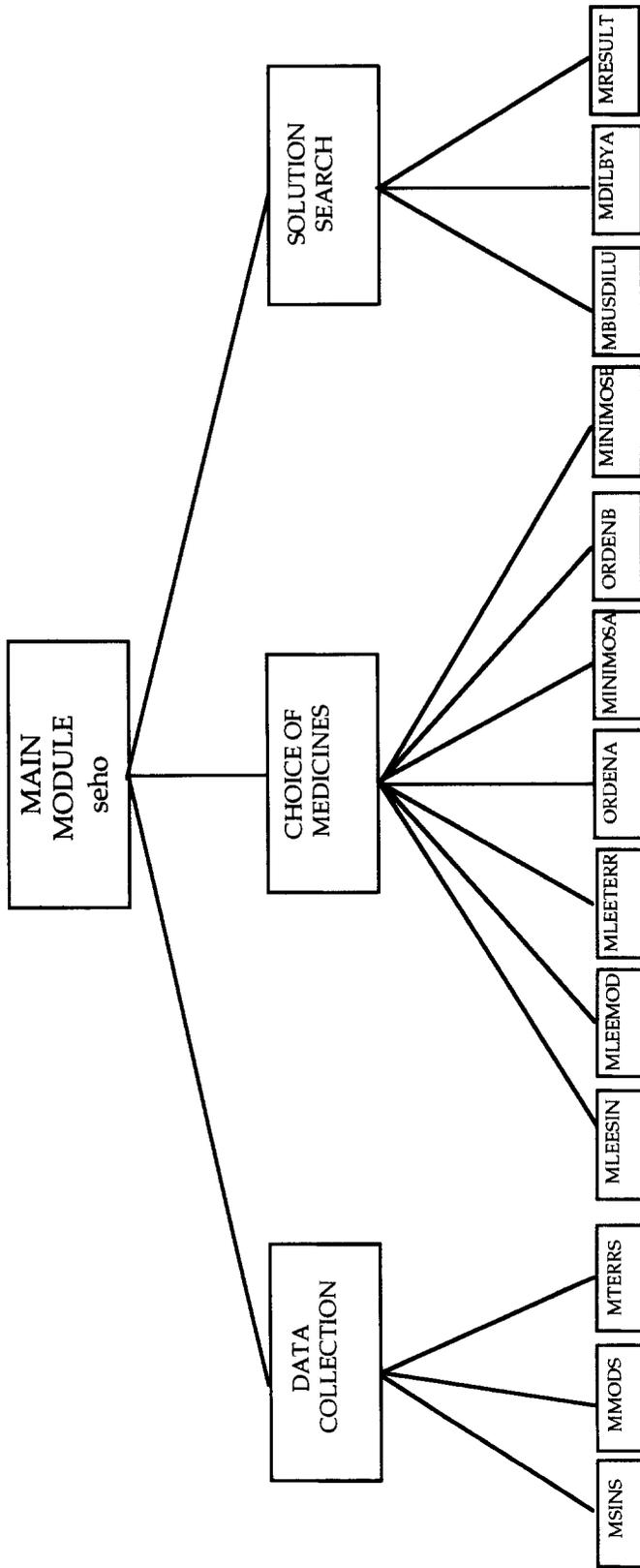


FIGURE 7. Structures map.

**MRESULT** Assigns the most appropriate treatment, including medicines, their dilutions, and the way of administering them.

## 7. EVALUATION

SEHO was evaluated in three phases in line with traditional methodological orientations.

### 7.1. Validation of System Decisions by the Expert

Fifteen test cases that had been selected by the expert and set out in the project success criteria, along with another 20 of the most frequent cases put forward by the expert were used for this purpose. Of the examples selected, 10% were extreme cases and generated artificially, 10% were ambiguous, and the remaining were typical cases. The expert approved the system's procedure in all of the cases.

As regards dilution assignment, the different modules were verified as follows.

**TABLE 2**  
**Typical Case, Case No. 6**

SS (Specific Symptoms)	
Nebulas	Important (I)
Photophobia	Unimportant (U)
Orbital pain	
Reduced vision	
Dilated pupils	
Stigmata on the cornea	
Categories	
Worsens when lying down	
Worsens in the morning	
Worsens with changes in the weather	
Improves in the open air	
Improves with warmth	
FT (field symptoms or characteristics)	
Depression	
Obesity	
Apathy	
Pessimism	
Shyness	
Skin irritations	
Fatigue	
Constipation	
Egotism	
Recommended medicines	
FLUORIC CALCAREA—low dilution	
SULPHUR—intermediate dilution	
CARBONIC CALCAREA—high dilution	
CAUSTICUM—high dilution	
Optimal treatment with	
GELSEMIUM—only high	
NUX VOMICA—only high	
AURUM METALICUM—only high	
COMOCLADIA—only high	

- A) Step from provisionally low dilutions to low and intermediate dilutions
- B) Step from provisionally high dilutions to low and high dilutions
- C) Step from provisionally low and high dilutions to low, intermediate, and high dilutions.

It was found that, as required by the expert, the dilutions are not fully scaled in two situations:

- When there are no field characteristics and, therefore, low dilutions are not assigned;
- It is impossible to assign intermediate dilutions on the basis of high and low dilutions, as the set of medicines counted in this case is equal to the total. This case is considered extreme.

Finally, it was found that the number of medicines assigned with a given dilution is never greater than 2, just as the expert stipulated.

A typical case is illustrated in Table 2, indicating the form they take.

### 7.2. Validation of Typical Cases by Experts Not Involved With System Development

Fifteen typical cases were put to them, and they only disagreed on one ambiguous case. This was due to the fact that there were two equally acceptable forms of treatment, and this was therefore a question of preferences. Moreover, the system had indicated the second possibility as an optional treatment.

The system has now been transferred to the Spanish National Organization for the Blind (ONCE) as an aid for therapists not specialized in homeopathic medicine.

## 8. FUTURE RESEARCH WORK

Although the results provided by SEHO are an important advance in the automated treatment of glaucoma using homeopathic techniques, we should not overlook the fact that SEHO is a prototype requiring further development.

This will involve two courses of action: one regarding the system's knowledge and the other, its computer structure. As regards the knowledge at present incorporated into SEHO, it is planned to extend the medicine and expert knowledge data bases. For this purpose, another expert in homeopathic medicine, likewise a member of the pluralist school, will join the research team, with a view to adding to the knowledge and comparing his approach with that of the former expert.

With respect to the SEHO's computer structure, three basic measures are envisaged.

- The new knowledge acquisition stage will make it possible to identify new rules and new forms of processing and handling the most useful aspects of the individual cases. For this stage, it is planned to incorporate an automated knowledge acquisition module that will equip the system with the capability

of analyzing any new information that comes to light, as well as facilitating the knowledge acquisition task. There are also plans to equip the final system with an intelligent interface capable of selecting the questions to be put to the expert.

- Adapt the user interface to a more flexible graphic environment for use by sighted personnel, while the present interface will be kept for the blind user. For this purpose, the screens of yes/no questions (62 on symptoms, 57 on category, and 66 on field characteristics) will be replaced by 4 multiple choice windows with a scroll bar (for symptoms, category, and field, and to select the important symptoms from those chosen).

The information will be output to an independent window controlled by the application, and new phases and explanations will be incorporated to make it easier to follow the system's logic.

- With a view to creating an easily extendible and reusable expert system, in place of the present GURU-based configuration that is difficult to alter, the SEHO prototype will be adapted to an object-oriented environment by transforming the present medicine and knowledge bases and rules into a class structure. The CLASER (Set of Open Libraries for the Development and Query of Reusable Expert Systems) (García, 1993), recently developed at CETICO in C++, will be employed to this end.

From experience with other systems, this measure should make the future SEHO system approximately 10 times faster than the present system, in addition to the above-mentioned advantages of extendibility and reusability.

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