

The Quantum Relation Principle: Technological Implementation and Real World Application in Intercultural Conflict Detection and Management

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Abstract. The Quantum Relations Principle (QRP) is a theoretical and practical tool that guides us in building dynamic reality models that can measure the interactions of mutual causality among various observers and can make assumptions about how they may behave and affect each other in the future. The QRP approach redefines common computer intelligence (AI) into a n-dynamic (different dynamics in different frames of reference) and n-dimensional (quantum relational) parallel system, which is much more in tune with the way the human brain works. It has the advantage, however, of running on modern supercomputers, and therefore is highly scalable. In that way, it is poised to vastly outperform the human brain and thus greatly surpass human performance at all levels. QRP systems are ideally suited to model, analyze and offer solutions to very complex real-world problems, including interethnic and intercultural conflicts. The paper discusses a recent example from the Middle East to demonstrate both the predictive and the solution-oriented capabilities of the QRP systems. But similar QRP analytic methods can be applied to conflictive situations in other regions of the world, for example to the modeling of the historically tense relations between Hungarian and Romanian ethnic groups in Transylvania, or more generally, to the very complex intercultural relations in Central and Eastern Europe.

1. Introduction

The Quantum Relations Principle (QRP) is based on the view that reality is not unitary, but consists in ever-shifting configurations of events and phenomena within

ever-shifting and unique frames of reference amongst many observers. QRP is a theoretical and practical tool that allows us to take into account, simultaneously, both the experience of a mental observer, or the recorded findings of an observing physical entity, and the experiences of multiple observers. Quantum Relations (QR) guides us in building dynamic reality models that can measure the interactions of mutual causality among various observers and make assumptions about how they may behave and affect each other in the future.

To most readers, this sounds more like very abstract philosophy, and normally such philosophical ideas will be discussed in humanities courses at a university, but rarely will they find application in the real world. Nevertheless, this is exactly the point where we break with tradition. For example, we have applied the model of Quantum Relations to a real-world problem, intercultural conflict, showing how QRP can help us understand the problem and even to figure out how we can manage it with the set of tools that QR provides.

2. The Tools of Quantum Relations (QR)

The QR approach redefines in many ways common computer intelligence (AI)¹ into a n -dynamic (different dynamics in different frames of reference) and n -dimensional (quantum relational) parallel system, which is much more in tune with the way the human brain works. It has the advantage, however, of running on modern supercomputers, and therefore is highly scalable. In that way, it is poised to vastly outperform the human brain and thus greatly surpass human performance at all levels.

The QRP-guided computational environment is AI based, but with human-emulated characteristics and implemented as global brain and global data structures and sub-structures. Unlike the old, pre-QR computational models, which virtually all use hierarchical and deductive processes, the QR model does not follow a treelike course. Rather, in this model, an action or reaction that has to be carried out under certain circumstances and following a specific initial instruction may in fact be the result of a fusion or a synthesis of a variety of single processes; each weighted and quantized in n -dimensional and n -parallel approaches. These processes influence one another and eventually fit ideally together to produce a logical result that leads to the reaction on the initial local instruction, but from a global perspective.

A QR system delivers iterative machine thought-processes that end up in a saturated idea that the system selects through its imposed limitations (for security or for proactive outcome pruning purposes) to be eligible in a given situation, or to explain a momentary state of conditions or imposed question.

QR Systems not only think in syntheses of all instructions, all data and all known past outcomes of their computations, but also consider the potential future outcomes and consequences. With respect to globally valid and accepted values and results of a computation, a QR system regulates and, if necessary, modifies the instructional base until an acceptable outcome is archived. In this sense, the runtime system chooses its

¹See definitions and explanations of current levels in Artificial Intelligence Analysis as representative work of definitions in [3], [2], [4], [1].

software instructions, considers them and, when it finds them acceptable, compiles them to run as a program.

QR computation becomes even more sophisticated when it is optimized. The optimization takes place inside the thought synthesis; basically it expunges the shortcomings that are implied by pure human-like thinking, such as forgetting, making wrong decisions because of temporal misinterpretations, faulty implications, and so on. In a way, QR systems trend toward true intelligence and rationality.

QR defines a “frame of reference” for each data object that incorporates all other elements the object may interfere with. A QR process creates for itself an environment of relevant data and instructions in runtime (and runtime is 24/7), building multi-dimensional clusters of relations in a dynamic time and space.

3. The Quantum Relations Principle (QRP) is implemented as a practical technological system

The mission of QR-based information technology (IT) is to assist in the strategic and systemic solution of comprehensive tasks and complex problems,² especially within intercultural and transdisciplinary contexts. Such problems may arise in many diverse fields such as commerce and finance, government, NGOs, but also in the general areas of human development and human interrelations, including interethnic and interfaith relations.

The answers of IT systems of the 21st century must be evidence-based and also realtime. They must enable a process that parallels scientific standards in knowledge creation and solution development. The QR enabled system not only supports sound methods of scientific investigation in analytical environments, but also produces useful information and knowledge strategies that could not have been produced or verified by human brains, due to their complexities and depth of weighted parallel processes and calculations.

Such analytical technologies must be designed to be all-inclusive in terms of information domains and to provide real problem-solving advancements over current analytical IT systems, rather than just a partial patchwork of short-term benefits. Emerging advanced concepts in AI-driven information and communication processing play a central roll in this task.³ Inadequate or incomplete knowledge development and outdated or contaminated data acquisitions and data depositories often compromise standard analysis practices. The necessity of a most complete and clinical real-time data acquisition and processing environment is often underestimated. The modern computer scientist understands to pay particular attention to clinical data

²A problem may not always be defined as a condition of adversity, but also as a necessity to find opportunity or seek optimization of existing and working processes.

³AI; Artificial Intelligence is the intelligence of machines and the branch of computer science which aims to create it. AI is defined as “the study and design of intelligent agents,” where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success. John McCarthy, who coined the term Artificial Intelligence in 1956, defines it as “the science and engineering of making intelligent machines.”

preparation. All the same, QR systems assume the uncertainty principle,⁴ meaning therefore that information is necessarily inaccurate, either empirically wrong, or at least wrong against different frames of reference. Consequently, QR systems calculate statistically, and in parallel, if a given data set can be accurate, and to what degree or probability.

In the age of the Internet we must rely strongly on the incorporation of unfettered open-source information. Often it is such external open-source information that provides important context to internal processes and problem analyzes. Global political, economic and social problems of late emphasize the importance of this mantra. They also provide evidence how important real-time information and problem processing have become in our fast-paced world. In such a context, unsurprisingly, great emphasis is placed on the fact that modern technology solutions must incorporate, in their core strategy, domain-internal as well as domain-external, open-source data connectivity and must also establish a forensically precise data history. No less importantly, they must establish continuous real-time data feeding of equal high-quality data integrity, in order to qualify as modern problem processing systems at the highest level. It must be understood that such data is contaminated with lots of errors and subjectivities (intentionally and unintentionally), and therefore our IT solutions must migrate towards probabilistic analytic approaches in order to compensate for a rich but flawed real-time data environment. QR based systems are well suited to this task.

4. The Quantum Relations Technology (QRT)

All the technology that we describe in this paper is based on the QR principle⁵ and serves as analytics strategy for the problems presented here. QR based technology (QRT) is designed as a server framework with plug-ins of Artificial Intelligence (AI) software programs connected by a common communication mechanism. They together build the integrated QRT Architectures. The AI programs include problem-solving engines that can be used by other analysis processes. These Problem-Solving Engines (also referred to as PSEs) can perform many tasks, depending on their design. Real-time-real-world monitoring, situation awareness, response escalations, intelligent research, predictive computing, and analyzed open-source intelligence are just some

⁴In quantum mechanics, the uncertainty principle is any of a variety of mathematical inequalities asserting a fundamental limit to the precision with which certain pairs of physical properties of a particle known as complementary variables, such as position x and momentum p , can be known simultaneously. For instance, the more precisely the position of some particle is determined, the less precisely its momentum can be known, and vice versa. The original heuristic argument that such a limit should exist was given by Werner Heisenberg in 1927, after whom it is sometimes named the Heisenberg principle.

⁵Quantum Relation Technology is based on the Quantum Relations Principle by Hardy F. Schloer (first documented in Fall of 1987 and 1994,1998, 1999) and also again by Schloer and Philip Gagner (Theory Collaborator), published in Notes on Quantum Relations by Hardy F. Schloer and Philip Gagner in July 2000. The QR Theory has also since been reviewed and elaborated on by Mihai Spăriosu [5]. The Quantum Relations Theory is a practical approach on how to model complex objects and systems of conceptual and physical real-time reality inside a computational environment. The Quantum Relations Technology approach is used today in the financial industry and economic forecast models.

of the many options that come readily to mind.

Some of the PSE programs can have simple task definitions. They may, for example, simply count specific instances of specific types of information in a data stream. Others, however, may be very complex programs that can include thousands of data filters, process conditions, and many other complex instructions. PSEs can work with structured, or raw and unstructured, data. Some of them are linguistics and language parsing programs; others do complex statistics or related computations using such technologies as Bayesian Nets or Genetic Searches. PSEs can also classify images and binary data, or perform complex mathematical extractions and transformations such as Fourier Transforms or various forms of signal processing. All of these technologies can be well integrated into a QR system.

In turn, QRT can be designed for real-time processing of events, and therefore the concept of time series is fundamental. In many systems, time series are built from more elementary data types, such as integers, floating-point numbers, and arrays. In QRT, time series are themselves elementary data types that can also serve as functional operators. They are first class objects. This permits system optimizations and reduces the overhead in computing with time series and in passing time series from one part of the system to another. Therefore the QRT-PSE framework can host and operate thousands of PSE processors in both sequential and parallel modes.

Computation in QRT is computation on demand. Elements are not computed unless and until they are needed, or unless a subsystem has unallocated compute cycles (Processor availability). In such case QRT can pre-compute objects that may likely be needed in the future, statistically based on the most probable analytical needs of the future. Again, QRT selects and defines such pre-computational tasks automatically, based on an internal dynamic priority list, and this optimizes expensive supercomputer hardware.

QRT systems must be implemented fully scalable and therefore only the amount of hardware available limits the number of PSE tasks that a QRT can process at any one time. The problem solving tasks can be given to the PSE infrastructure in several ways:

1. Problem-Solving Requests (PSR) can be computed in sequential processing (refining the answer by routing it through several PSE processors one after the other and using the data results from one PSE in the next, and so on);
2. In parallel (comparing the various answers of each PSE separately and routing the outputs through a combination task); or
3. A combination of both sequential and parallel (looking at the results of each PSE and scheduling more PSE tasks as a result).

The problem-solving infrastructure is best integrated into coupled clusters of computers and supercomputers, and the individual processes are distributed onto problem solving server networks that work collectively on the problem tasks, preferably over cloud computing environments.

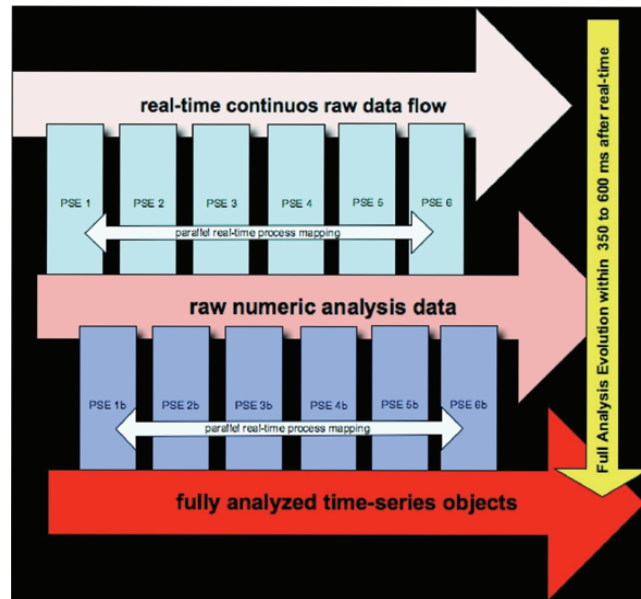


Fig. 1.

QRT was envisioned and designed to operate in real-time as a fully integrated AI processing framework. Its size, performance, scope, and features are dictated by the tasks to be solved. The development of QRT in real world applications has led to new AI tools and a computer language called Time Series Language (TSL), which is able to manage extremely large datasets that can include multi-dimensional time series objects as functional operators. Because these objects are built into the language, processes that involve the complex analysis of potentially billions of data-points in real-time (for example genetic searches, multi-layered Bayesian nets or other complex statistical processing tasks), can be expressed simply and directly.

Because TSL implements computation of these objects on demand, and because TSL performs symbolic simplification prior to calculation, such problems can be computed with the least computational expense possible. TSL is designed to reduce the programmer's workload by permitting natural tasks. The compiler first simplifies the programs, eliminating redundant expressions and combining terms and the parts of each expression, then calculates only the parts of each object that will be used in obtaining desired answers. This results in keeping processing times for very complex problems to a minimum. The "object as operator" approach implements the concepts of the QR fully.

The QRT approach to data is based on the DFO (Data Fusion Object) that finds its roots in Quantum Relations. The above-discussed TSL technology together with the PSE processing components is both designed and built from the roots up, to natively interface and manipulate computationally these DFO structures inside the entire system, which due to its hierarchical design is also a DFO (the DFO Super-

structure⁶). The results of computations in QRT are in fact DFOs, which in this way unify structured and unstructured data, native and dynamically changeable and continuously self- or system-optimizing computational instructions and procedures, properties, qualities, quantities, histories (therefore the extensive use of time-series) and other information that relates to the frame of reference (FOR) under which this DFO was computed.

In this context we can say, that the DFO Model is a method of creating, storing and processing complex knowledge, based on techniques and methods derived from modern mathematics and quantum physics. QRT implements the concept of Data Fusion Objects (DFOs), which permits a hierarchy of discrete knowledge and instruction items that interact within a structure of frames of reference. One should also note that, due to the interconnectivity of the entire DFO superstructure, any change (i.e., computation or data update) affects not only the local results, but is, at least potentially, considered by all DFOs inside the DFO superstructure. This brief paper describes only the overall philosophy of QRT and DFOs in this computational context.

As a conceptual model, each DFO can be considered as a “particle” of knowledge. These particles interact according to well-defined rules, and the result of their interaction becomes the computed function. Such a function can have side effects, including input and output, or storage of information on a database, or just the presentation of an HTML web page.

In turn, the DFO particles exist within multiple frames of reference (FORs). Each FOR is implemented as a metric space, that is, as a set of DFO elements and one or more functions (including always the distance function or metric). Because of the generality of the DFO model, each FOR is also a DFO, and can be used as an elementary element or “particle” in a higher-level frame of reference. Different FORs can have different metrics.

For DFOs representing physical objects, with established positions in the metric space, it is often useful to implement a Euclidean metric, which simply returns the distance between the objects. Such a metric is also useful when studying clusters of data where one correlation function is well known. Other frames of reference may have wholly different metrics, including the Hamming or Levenstein distance functions (useful in comparing strings).

Consider a set of DFOs, which has certain goals to accomplish. It may be useful to define a frame of reference with a “center point”, for example (0,0,0). DFOs in that frame of reference could have a distance defined from that center point where the lower the distance, the more “important” or “relevant” that DFO was to the goal. This is for example used to implement a sort of artificial subjectivity to the symbolic computations.

Such a metric is implemented in many ways. For example, if it is not obvious to the system from the problem definition what the metric function should be (and in many cases it will not be) then it can be implemented as the nth level set of results

⁶For more on DFO Superstructures see “Comments on Quantum Relations” 2001, Schloer, Gagner, republished by Spariosu, Remapping Knowledge, Berghahn Books, 2006 in the Appendix of the book.

from a classifier system learning approach to the problem. The QRT system can adopt different methods for different instances. Because the metric for each frame of reference is stored as a property of the FOR, it is easy to change metrics. Such a change is equivalent to asking for a different interpretation of the underlying data. Because DFOs (and therefore frames of reference) are implemented in a hierarchical fashion, one can change perspective on an entire data set of very large size with great ease. Because DFOs implement class inheritance, such changes may ripple down through various levels of sub-DFOs, causing re-computation of intermediate results in a controlled and natural fashion.

DFOs are capable of self-organization. This follows from the implementation of data and functions as sets of hierarchical objects. For example, if the metric of a frame of reference is differentiable over the set, the data in that set can be concentrated by finding the minimum of the differential, in a close analogy to physical models. The term “differentiation” is used here to mean the generation of a new set whose elements are the discrete difference function over the original set. DFO sets as actually implemented are obviously always finite and non-continuous, and a derivative will generally be taken along changes in one parameter of a DFO (similar to a partial derivative).

Distance functions for DFOs, like all metrics, always return a real number as a value, and thus the finite difference function always has at least one minimum with respect to any parameter of a DFO in a given state. As a practical matter, however, DFOs have memory and therefore computation of such a function may not always be possible until more instructive data arrives in the DFO system. It is important to note, that in QR based systems software and data are the same. Data is software, and software (instructions) is data.

A frame of reference containing DFO objects can also contain rules for the creation of new DFO objects, for interaction of its DFO objects, for calculating functions of those subobjects (including the creation of new objects which embody certain relationships between DFO objects), and so forth. Relationships can be expressed as positive (attraction) or negative (repulsion), and the effect of an interaction can be to change attributes of the DFO particles themselves, much as in a physical system an attraction is a function of space, which operates to change the position of objects. A reasonable DFO (for example a frame of reference) will implement certain rules of symmetry and conservation among its sub-DFO objects. In this way, the methods of mathematics and physics are also used to create a structure in which large-scale computations can be performed.

The DFO model is inherently parallel. Since DFOs are discrete objects, they can be implemented on multiple processor systems, and calculations can be performed in parallel. DFOs provide a natural model for general parallel computation.

The DFO model is not bound to Turing computable functions. The model conceptually provides methods for implementing quantum computing, provided only that hardware is available to implement such functions. There is no theoretical requirement that either the metric or other functions provided by a frame of reference be Turing computable functions. Any function that can take one or more data structures as arguments can be implemented within the DFO model. In addition, non-

local functions (such as certain quantum mechanical logics) can be simulated using a DFO model implemented on a Turing- Church type of processor such as a digital computer.

The DFO model is modular and extensible. That is, a set of computations on one data set can be transformed into another data set and used by the second data set by defining the set of functions which translate the first frame of reference into the other. In addition, a frame of reference can contain rules for logical inference and deduction, which operate on its component DFO objects. That frame of reference can then be viewed as a DFO itself, which can answer certain queries about the data it contains. The object that makes the queries is also a DFO, so the two exist in a higher-level frame of reference which can have defined goals and which will compute until those goals are achieved. In this manner, the DFO structure implements the artificial intelligence powers of functional and rule-based languages such as Prolog while still retaining efficiency of data storage and manipulation.

The DFO model is designed to be efficient. That is, it is designed to handle very large data sets, on the scales of gigabit and terabit sets, and to provide methods for manipulating such large quantities of data using parallel processing systems. DFO objects can be compiled, that is, reduced from a symbolic form into a compact set of machine instructions, and can also implement type restrictions on data to prevent database errors.

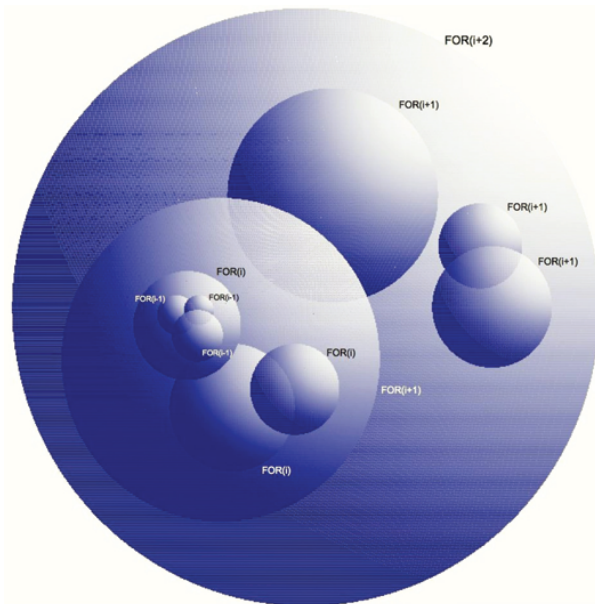


Fig. 2. DFO Hierarchy (DFO Superstructure) within the concept of FOR.

DFOs carry internal instructions that are considered and processed within the continuous synthesis of computational runtime (typically continuous). Different DFOs have different instructions. Root DFOs carry root instructions such as security, communication rules, computational restrictions, encryption, decision restrictions and

many other such functions. The DFO Synthesis, the continuous processing of the DFO model, includes sets of functions that calculate a mass/gravity/instruction model of a new element (a new DFO) and determine its purpose and instructions in relevance to the parent DFO, i.e. in the frame of reference of the host DFO or FOR. In most cases this calculation of a new and into the FOR absorbed DFO intrinsically bears a computational reaction and a new result that is preserved in the DFO Synthesis history (a time series).

An important element of the synthesis is the time t . Without any direct reference to the physical time, t acts as a basic determinant in the frame of reference created by the synthesis (each synthesis creates its own frame of reference that includes all DFOs that are used for the mass/gravity clustering). The abstract time of a DFO within a process of Synthesis starts at 0.0 and is gradually incremented until 1.0, describing the period during which an action can be derived from an initial instruction. This period can be hours in “real” time, or a fraction of a “real” second, or any other value.

The iterative process of the DFO Synthesis starts with the parameters that are taken from the initial DFO that initiated the synthesis. The FOR creates an “empty” DFO (DFO_{main}) that will be modified step by step to develop towards the desired final DFO to carry out the desired instruction (or contain a result); this DFO evolves throughout the subsequent calls of S. The synthesis terminates when the time reaches a value of 1.0. This is the case when DFO_{main} reaches its “critical mass”, which happens when the meaning of DFO_{new} (the DFO that will be emitted) has become so clear that a unique reaction can easily be selected. At time 1.0, DFO_{main} is accepted as the appropriate response to DFO_{init} and used as DFO_{new} . The point when this decision is made, i.e. when time 1.0 is accepted, is the DOCM (Decision of Critical Mass). An exception occurs when time 1.0 is reached, but the critical mass (a computational result) is not yet achieved. In this case, the synthesis could not filter out an appropriate reaction during a given time frame (determined by attributes of the environment); a default reaction (or the closest acceptable reaction) is carried out, while the initial DFO is kept to “reason” about it again and find a better reaction that could be used the next time, or after more data becomes available to guide a better decision process.

During the process of refining the DFO set of instructions, several parameters must be taken into account. These are the elements that form the FOR of that synthesis. The subjective attributes of the FOR that hosts the synthesis are always included in these calculations; this means the DFOs for the lower level FOR of the Synthesis are a subset of the DFOs that constitute the higher level FOR (the FOR of the host). Additional DFOs might be considered necessary in certain steps of the calculations. If they have to be kept for later steps of the process, they can also be passed to further recursions of the function.

What happens at an individual step of the synthesis is basically drawing relations between the DFOs that are present and trying to derive a better result DFO that might lead to a more desirable outcome, relative to its instructional FOR (next higher level DFO). Relationships can be expressed for example by:

- Matching (static) attributes: $a_1 = a_2$.

- “Similar” (static) attributes: $f_{sim}(a_1, a_2) \rightarrow 1$. The difficulty here is to determine a method to calculate similarity that can be applied in any case. Since there is a vast variety of the idea of similarity there are also many functions to compute associations and “neighborhood” of two DFOs attributes (similar to fuzzy logic, but much richer implemented, as the similarity between features or attributes can be filtered in many different ways, qualified, and quantified, to maintain a stricter implemented computational result direction, and in some cases limitation or enablement by reducing specific hurdles to clear the path to a result).
- Matching instructions: $f_{value}(i_1) = f_{value}(i_2)$. This is the case when the current main instructions of two DFOs – after being analyzed and evaluated – lead to exactly the same action to take, which is less likely than matching static attributes but, yet, possible.
- “Similar” instructions: $s_{sim}(f_{value}(i_1), f_{value}(i_2)) \rightarrow 1$. As with similar static attributes, the values of the result action of two DFOs are compared and associations between them are made (again, just as “Similar” (static) attributes above, its similar to fuzzy logic, but much richer implemented, as the similarity between features or attributes can be filtered in many different ways, qualified, and quantified, to maintain a stricter implemented computational result direction, and in some cases limitation or enablement by reducing specific hurdles to clear the path to a result).
- Interrelated methods: $f_{react}(DFO_1, DFO_2) = 1$. If a method of one DFO requires attributes or values of another DFO, they share a strong relationship. This is the case if the DFOs really depend on one another, or at least, if one DFO really can react on its counterpart (like in a chemical reaction). Another illustration of this matter is two patterns that can be overlaid and matched at a particular region, or create a new meaningful pattern at that point.

5. Application of QRT

The QRT model has been implemented and tested in applications such as financial data processing or real-time news analysis. It can provide competitive commercial real-time intelligence services and the crunching of very complex problems under loads of terabyte or even petabyte size data domains, with tens of thousands of individual data sets. But the QRT model is ideal for investigating problems in sociology and political science as well, including intercultural relations, because it can be built to resemble the model of the real world and then compute with it, or make predictions about its future behavior.

6. QRT Data Management

One of the key concepts of QRT is the Quantum-Sphere (QS). This is conceptually a very large real-time data depository, whose components are time series objects and a

set of mapping relationships between these components. It is a very different approach to store data, but it allows data and software instructions to become interchangeable and usable in parallel. QS mapping relationships are themselves QRT operators, so that expressing a new set of relationships is both natural and easy to implement.

Quantum-Sphere is a central building block of any QRT architecture. Content inside QS is normally data that is acquired through global computer networks such as the Internet, but also includes sets of data compiled by industry and governments and other research units. Pulling the data through search-and-pull processors should normally do some of the data collection, but other data can be delivered to Quantum-Sphere by external systems that push data to the QS infrastructure automatically.

The Quantum-Sphere concept drives the manner in which this data is stored. Each item of data, together with the operators that allow updating and retrieval, must be available to other QRT components. The QRT System was designed to serve as a global and centralized problem solving system. Philosophically we should recognize, that all problems and processes in the universe, and specifically on this planet are interrelated to some degree, and the way in which different data sets are related must itself change over time. Therefore, data relations themselves may be expressed as multi-dimensional and dynamic time series objects.

It is an explicit design goal of a QR system that the system itself can potentially compute the near and more distant effects and influences of any problem domain that one may want to investigate. This makes it necessary to build a complete data infrastructure, together with a clinically precise data history. Naturally, there will always be data that cannot be collected, or that has values that are simply missing, and there are always relationships that cannot be computed, or that will be missed. In some cases, these values and relationships can be approximated, and Quantum-Sphere includes methods for making such approximations. The real-time gathering approach of data for QS dictates a rather diligent and as complete as possible approach to the collection of global information. QRT therefore attempts automatically to collect everything and anything that it is possible to express as time series events or relationships, and then timestamps its data objects (by millisecond as to when it was collected and as to its source). This approach is not only valuable for data objects but (because relationships are often transitory) is also valuable for relationship objects.

Here are just some examples of data that QRT attempts to collect for Quantum-Sphere:

- Worldwide and regional news from over 1000 global news providers, collected second by second;
- Environmental data reports and statistics; history and projections collected from government and industry sources;
- Economic information, including decades of stock prices, micro and macro economic governmental data, economic reports, world bank data;
- Political information of every kind including transcripts of speeches, laws, court decisions, personal data, statistics and reports on crime and terrorism;

- Academic statistics; schools, universities, academic publications, doctoral dissertations, etc.;
- People and population data of every kind, including information on habitats, communication, nutrition, epidemiology, social behavior and other related statistics;
- Global and regional information and statistics on traffic and transport on land, water and air including information on infrastructure, facilities and related industries;
- Entertainment information including music, film, and art; sports statistics and history;
- Commercial information including commercial statistics, reports, publications of any type;
- Medical data such as diagnostic information, clinical trials, drug definitions and chemical compositions, toxicology and other related areas;
- Scientific data from all branches of science including astrophysics, chemistry, nanotechnology, biology to name just a few, including reports, tables, described processes and other such similar science data;
- Humanitarian information, aid work statistics, world bank information, and available data, globalization information and data, migration information;
- Agricultural information on all growing regions of the planet including reports, statistics, and projections;
- Weather data, local and global for the whole planet, including history for as deep as possible wherever possible;
- Anthropological and evolutionary information including social science data, data about observed behavior of all recorded species of the planet;
- Administrative information of all types of none-governmental administrative tasks;
- NGOs and all data and statistics that define their work and activities;
- Geographical information including GPS mapping data of everything on the planet down to the size of square feet, including buildings, facilities of all types, geographic texture, bodies of water and land, mountains, valleys and planes, cities, landmarks and any other named item found on any fixed geographical position; including current GPS positions of things that move and can be identified with some frequency by some technological solution, wherever and whenever possible.

The Quantum-Sphere Architecture is distributed and therefore should be able to access external data depositories throughout the global networks. The data search and collection of the Quantum-Sphere should be defined in a QRT environment systematic and fully automated.

QRT was clearly designed on a fundamentally different philosophy than traditional legacy systems. It is also different because of how information is processed and placed in context, and because of the variety of ways in which it can be presented to the user. For example, a process that is important enough to be computed once is probably important enough to be repeatedly computed with some appropriate frequency, so that the user can check if there is a change in the underlying real-time conditions, and if these conditions can change significantly enough the outcome of the computation, in order to re-evaluate the consequences.

QRT has a sophisticated data catching design that can consider the cost of calculating the datasets or data relationships, and, based on the cost, can decide whether the computation results should be stored for future use.

The frequency of such re-computation may be a month, a week, or a minute, or even less. Changes in results can have significant impacts on the actions we may take in response to them. Knowledge must be presented in a changeover-time tracking mode, if decisions that we take must be based on up-to-date information at all times. With that in mind, it appears that the best way to show the initial results of any computation is often to consider it inside a time-value domain. Here we can set value functions and value definitions for our computations and map them like a stock market index on a time-value chart that can be updated with a new value every time we compute again.

With the real-time infrastructure of QRT such a chart can easily be updated in real time and give a good historic and “now” view of any problem to its researcher. But there is more benefit to display information on a Time-Value Domain. Many of the computations of QRT and its analyzed information are predictive. For example, in econometric or social systems, QRT can make good predictions regularly between minutes and decades into the future, depending on the data-flow density and some other stochastic features. One should remember that the continuous tracking and updating and recording of the system results displayed a behavior of either the system itself, or also the observations the system is making; the consequence of this is, that the DFO based superstructure becomes a model of the real world, as it observes with such, and therefore, it is most perfectly prepared to enable “what-if” analysis requests). It is therefore possible to supply tools to the system user that show the predictive information in its context, and the real-time information in the same view window, so that the user can compare in real time the value and accuracy of the predictions and also the past performance to the prediction-to-reality history.

7. Quantum Relations and the Arab Spring

It has hopefully become clear that QR systems are ideally suited to model, analyze and offer solutions to very complex real-world problems, including interethnic and intercultural conflicts. We shall use a recent example from the Middle East, on which

we have already done some work, to demonstrate both the predictive and the solution-oriented capabilities of the QR systems. A controversial and, as this paper asserts, willfully induced crisis has by now befallen much of the Islamic world. This crisis is known as the “Arab Spring” and began toward the end of 2010. We shall focus on the methods by which a researcher could have identified its signs long before it happened and could have made recommendations on how to prevent it or at least manage its consequences. We shall make several claims as to the origins, conditions and meanings of the term “Arab Spring” and other concepts and events related to it. These claims are the direct results of computational analysis and machine-assisted human analysis. Due to the fact that some human element of analysis was involved, one cannot fully exclude human bias in its conclusions. Nevertheless, these conclusions have been reached with overwhelming computational evidence to back them up.

8. Introduction to the Arab Spring Phenomenon

The Arab Spring was branded as a revolutionary wave of demonstrations, protests, and civil wars occurring in the Arab world that began on 18 December 2010⁷. To date, rulers have been forced from power in Tunisia, Egypt, Libya, and Yemen. Extensive civil uprisings have erupted in Bahrain and in Syria, where now a full-scale war is raging.

Protests of various degrees have also broken out in Algeria, Iraq, Jordan, Kuwait, Morocco, and Sudan Lebanon, Mauritania, Oman, Saudi Arabia, Djibouti, and Western Sahara. There were also border clashes in Israel and in Iranian Khuzestan by the Arab minority; both erupted in 2011. Mali fighters, returning from the Libyan civil war stoked a simmering conflict in Mali, which has been described as “fallout” from the Arab Spring in North Africa.

The protests have been very similar in the way they have been conducted, sharing techniques of civil resistance in ongoing campaigns that involve labor strikes, demonstrations, and rallies. In addition, these uprisings have been greatly aided by the use of social media to organize, communicate, and raise awareness in the face of state attempts at repression and Internet censorship.

The uprisings have, predictably, been met with violent responses from authorities as well as from pro-government militias and counter-demonstrators. In some cases, they have been answered with violence by protestors as well. The common slogan of the demonstrators in the Arab world has been “Ash-shab yurid isqat an-nizam” (“the people want to bring down the regime”).

The “Arab Spring” is a term of Western political analysts⁸, similar to the terms used decades ago for nonviolent revolutions in Soviet client states (e.g., the Prague Spring), but it is more than just a term; it is in large part a well-organized and well-funded political battle. It is well known that this crisis has the potential of seriously damaging any state in the Arab Gulf region. While most knowledgeable analysts are

⁷Various news sources and online information incl. Wikipedia.

⁸The term Arab Spring was first detected by our QRT system in CNN and Aljazeera feeds, used by political analysts, in the same week in early 2011, several months after the phenomenon started in Tunisia in late 2010.

concerned about spread to Kuwait, Qatar and the UAE, it is in Saudi Arabia itself where a so-called “Arab Spring Movement” could turn into a global disaster, even for non-Western countries. Thus the Arab Spring is no longer just a local or a regional problem, but a global one, with very dangerous implications for the entire planet.

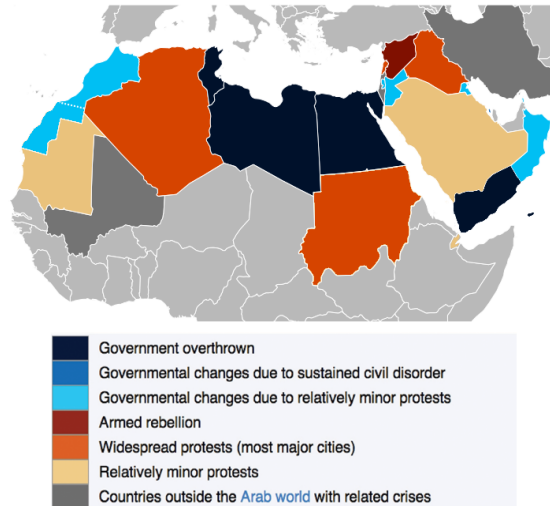


Fig. 3. Arab Spring movements (Graph by Wikipedia).

Arab Spring movements are portrayed in Western media as popular uprisings by oppressed people against oppressive leaders. This portrayal is false, and can be shown to be false. Countries that became affected by these phenomena often responded by engaging major western public relation firms⁹ to manage the perception of their countries and their leadership, hoping to neutralize the effects of social media frenzy to fuel conflict. Nevertheless, these PR responses did not yield much visible results, as most of their operators lacked a system that provided detailed knowledge and intercultural feedback to optimize such PR attempts. Western PR firms were overwhelmed by the cultural differences between Middle Eastern and Western societies, and thus experienced, in addition to a large time-lag in their “too little, too late” responses, a steep learning curve to cope with this task effectively. To capture linguistic data in unfamiliar cultures added to the difficulty for these operators.

For the sake of this paper, let us assume that we would be hired by the ruler of one of the countries that became affected by the Arab Spring movements. What would our methods be to deal with the problem? First of all, they would be realistic, scientific, and rather precise in their application, permitting analysis, forecast and a timely and effective response to the Arab Spring style development in that country.¹⁰

⁹The Arab Spring phenomenon is still in full force and far from over. We have therefore refrained from naming any companies or individuals in this essay that have been identified by our analysis, as this would not add to the substance of our analysis here and would be unhelpful to companies or individuals that would become exposed in a potentially negative interpretation.

¹⁰Let me provide some history and background here: In April of 2010 I was invited as a keynote

To manage our task successfully, we would capture and analyze the entire action and response matrix of the social dynamics in question. To manage or better influence the management of the problem from the perspective of the country's rulers, we would then develop engineered communication and coordinated action, locally and globally; and because we use the knowledge of intercultural communication, we would also do it peacefully, because violence is counterproductive and rarely works as a durable solution, only breeding more violence and unrest. Again, a successful operator must address the exact root core of the perception problems and solve issues in a surgical and strategic way, using culture and language, not violence, guns or incarceration of opposing groups.

Our strategy would be based on a comprehensive and in-depth analysis of geopolitical and social trends, using QR tools to manage "perception crisis" and social psychological behavior problems. The research would be based on public information to analyze political trends, other than polling and tracking companies, whose methods are quite different. We would rely on real-time and history news analysis. That is the collection and analysis of published news, in both archive and real-time form, to detect and determine patterns and to make predictions of future behaviors, by using the QR and the DFO methods of investigation.

In fact, we did perform some preliminary Arab Spring analyzes. From the beginning, it became obvious to us that some of these patterns were artificial, i.e., that some of the news was being engineered. This is, I think, an interesting discovery, but it is not directly relevant to the work we do, and the degree of engineering of news is not a dominant factor in our analyzes.

It is important to understand how the analysts of our QR team approach some of

speaker at the Forum Istanbul 2010. During the forum I was asked, in a live televised Q&A session, where I believed the next significant war would be, because at the time most participants were deeply concerned about the possible hostilities between the Western powers and Iran. I responded that the next wars would not be conventional wars between countries, but that we would very soon, possibly within months, see extensive civil disobedience outbreaks inside many countries. Furthermore, I said, civil unrest and revolutions would be a model of conflict for the next 20 years, and they would likely start in Northern Africa, or the Middle East, moving quickly to the entire region. I also went on record to say that if these outbreaks were not contained very early, they would spread throughout the world. I further stated that the economic crisis of 2008-2009 was only an overture to much deeper levels of crisis to follow by the end of 2012 and beyond, where systemic breakdowns, engineered communications, and negative expectations would fuel social uprisings. My statements were quoted on the front page of nearly every major Turkish newspaper, the next day. Only seven months after this speech, the pattern of violent social unrest, the now so called "Arab Spring", surfaced in Tunisia for the first time and spread, as was predicted by our model, into the entire Middle East, afflicting Arab states and kingdoms. Our successful prediction was not based on magic, sorcery, or soothsaying. It was firmly based on science, in particular, on QRT computer-assisted DFO modeling of human behavior with relations to speech, social trends, economics and political choice. In 1999 two of the current collaborators on QR (Schloer and Gagner) founded a company in the financial industry. This company implemented the QR research and its scientific methods to model economic and financial behavior. We chaired this company for nearly 8 years, and today nearly every major bank in the world is using our algorithmic real-time data streams in risk-management solutions and high-speed trading. The success in this area is well documented. Today, members of our research team use this same science to elaborate geopolitical strategies and to provide viable solutions to governments and other global stakeholders, based on a comprehensive understanding and peaceful management of social crises in different parts of the world.

these problems, how they track causes, and how they develop workable solutions: The QR team solves problems through a combination of QR based computational linguistics analysis, computer based DFO modeling, and strategic deployment of linguistic products to be used inside the DFO spaces. The result is effective enough to engage successfully in scientifically supported perception management. This may sound similar to PR, however, it is vastly different, because the product is differently created; results are, moreover, measured scientifically and quantitatively in the context of the DFO model, as described in the earlier part of this paper. The team operates the QR model in real time, to verify its effects and to further tune it for maximum effect and efficiency. To best explain our methodology, one could use a simple example from hydrodynamics:

Imagine a complex interconnected system of water pipes, with pumps, multijunctions, regulators, and reservoirs (each of them would be also a DFO and a Frame of Reference FOR, under the QR model). To analyze the various flow dynamics through calculations would be rather complex and computationally very expensive. However, one could inject red dye at some points of the model, and easily trace the flow of the dye through the system. One can learn several very useful measurements, such as flow directions, flow speed, and even distribution of volumes and pressures within the model.

Computational linguistics measurements in our QR methodology work exactly like that. We can establish how each DFO information flows inside the DFO superstructure, where it originates, where it becomes distributed, and how it is collected and transformed within the flow process¹¹. We don't use red paint in linguistics to trace the flow, but we use, instead, DFOs that are "loaded" with unique linguistic phrases, quantitative density measurements of keyword occurrences within the total flow of language (its direct Frame of Reference, and its higher level FOR, totally consistent with the QR DFO model). We can track originator-consumer- flow relationships (record them as n-dimensional time series inside each DFO) and can trace them in the entire system of observed language such as news, social media and commentary from various sources (in any language / Arabic and Non-Arabic / across all FORs and consistent with the QR approach described in the early part of the paper). For simple testing, we just completed in June of 2012 a very limited scope statistic DFO flow-model over a five-months period (January to May 2012) on Bahrain and its current problem space. We learn the following rather interesting facts from it:

1. A relatively small number of Arab-based groups and individuals (we might call these DFOs "concept generators") produce language and "memes" (DFOs or atoms of concept dynamics), that appear to be packaged for non-Arabic target audience consumption (mostly media, commentators, news writers and other potentially supportive targets, including social networks; a unique target FOR

¹¹Externally observed behavior becomes a quantitative default modeling instruction inside the internal computation model (reproducing behavior) within its DFO structures and DFO superstructures.

for these DFOs). We hypothesize, based of further quantitative language analysis, that this “content emission DFO” is created in an attempt to generate external pressures on Bahrain, and to generate sympathetic views in the non-Arabic audience of their “plight” and “just causes”. We furthermore detected that the cultural background structure of Arabic phrases used in such content emissions point more to having originated Persian language-culture structures, and less to Arabic language-culture structures.

IMPORTANT: *Without tracking quantitative and culture-specific attributes inside the DFO data structures, we would not detect such subtle language differences inside a dynamic system, across different cultural barriers, using the same languages Arabic and English. However, native spelling and grammar libraries in each DFO that become continuously compared with the FOR libraries, unmask such interesting facts, and deep-profile the origins or the cultural “DNA” of the language user (one user at the time, one conversation at the time). This technique leads continuously to discovery of new cultural aspects and behaviors (language being only one of them). Therefore, the QR approach, with its quantitative model-building of whole societies, is arguably the only and at least most appropriate tool to investigate and understand intercultural problems across geographic and linguistic barriers.*

2. This non-Arabic target audience becomes a reflector and intensifier element that now produces opinions and news coverage containing the same memes, primarily in English, French, and Spanish, with some German and Chinese.
3. These reflected opinions and news memes become absorbed very fast by Arabic language reflectors (FOR) and intensifiers (rise of energy inside the FOR) and become news with extensive coverage in the Arabic media, as well as in social media and underground media in various forms, including distortions of fact, and this happens in a predictable way.
4. This now intensified language DFOs, enriched with “enhancements” (added properties inside the DFO; usually by the same sources of emission FOR) feeds back into the same system (FOR) as described in (1), only to become intensified and loaded more with psychological language that leads to anarchistic or revolutionary behavior. (The level of energy can be measured through a time-series inside the DFO and it is predictive of when such action leads to anarchy and violence)
5. In some cases, the “meme” itself, the atom or DFO of conceptual meaning, appears in non-Arabic Western sources (government reports, for example) prior to being emitted from the supposedly Arabic group or individual.
6. In cases where the meme first appears in Western sources, Western governments have been very quick to “respond” to the news with statements of support and in other “Arab Spring” examples also with economic and even military aid to insurgent elements.

There are many things to be learned from this simple research model:

- (A) Attacking the originators of language and incarcerating them will generally not work. There are virtually unlimited new sources and virtually unlimited numbers of individuals and groups (DFOs in the same or parallel FORs) that, knowingly or unknowingly, become generators for more language (DFOs) of discontent (a FOR quality and quantity). In fact, every new generation of new “speakers of the cause” become braver (Quantitatively rising energy inside the DFO), speak with more conviction (rising negative energy), and add substantially more negative energy to the system FOR (an effect we believe is intended by its originators, as several DFO analyzes show).
- (B) The concept of “outside agitators” is both incomplete and misleading. The problem is not only that outside forces deliberately inject news memes (news DFOs) into the system (HLFOR), but also that there are weak points where the memes, once injected, rapidly grow and cause turbulence (uncontrolled or unmanaged social energy). As long as these weak points remain undetected by the managers of these problems and their PR companies, little can be done to control the spread of discontent. The whole process problematic is similar to infection control, and needs to be treated in a similar approach; except, the “medicine” is different.

Nevertheless, this is how revolutions are ignited. In our judgment, Bahrain was very close to this point at least one time last year, when a full-scale situation such as the one in Syria or Libya was a possible outcome, if the leaders had responded to the unrest with deadly force. In our judgment, based on recent events, deadly force does not succeed in combating the “Arab Spring” problem – this is a point worth stressing again and again. Bahrain has slowed down due to an expected fatiguing of social energy with less input energy detected in recent months, but the danger of a next energy outburst is very possible, given new language injections into the social space of the country.

One truth about Arab Spring is this: The actual situation, including economic conditions, political rights, employment, and so on in different countries is exactly the same as before. Nothing got worse. Only the language changed, the words used to describe the situation, and the methods of communication. But this change in language created the false notion (false observation by human observers) that conditions were deteriorating, when only the description about the situation and the psychological state deteriorated, not the actual situation itself. This, coupled with intensive and brilliant use of social media and electronic communication by insurgent elements, accelerated the social energy curve, driving it into exponential increase that would become explosive. By the time leaders knew that there was a true crisis, even moderates had been drawn into supporting radical change. By then it was much too late.

In our view, a much better way to manage such situations is to understand them, and then to compete very deliberately with the generators of language DFOs described above. If one understands a system, one can manage it, in this case, by injecting

scientifically composed competing language memes (with appropriate volume and intensity) into the system (FOR), to counter opposing language and to defuse the one-sided language generated by local “unhappy elements” and possibly by “outside groups”.

When we investigate such events as the Arab Spring, it is very important to understand that we are dealing with a “continuously changing phenomenon of perception” in exactly the sense that QR defines it. QR measures reality as a complex dynamic web of statistical functions and recorded ecological systems, involving not only traditional physical measurements, but also important measurements of observational behavior, such as the continuous transformations in observed dynamics of shifting external and internal relations of the observers and their observing experiences. Data and dynamic functions merge into Data Fusion Objects that give answers according to the state of all collective data and computation available at the time of the analysis.

In the age of digital communications, perception can be engineered as never before in history, and we are convinced that perceptions are, in fact, being engineered in today’s global arena. Therefore, one must develop a complex matrix of issues and linguistic tracking to follow each issue and argument through the stream of language travel, as well as methods to understand and counteract new issues surgically and effectively. Events such as the Arab Spring are phenomena of social energy. The QR systemic approach with its DFO and TSL tools is best prepared to capture the social energy shifts across different societies and cultures. To make social energy and its value better understood, we shall close this paper with a last example (see Fig. 4):

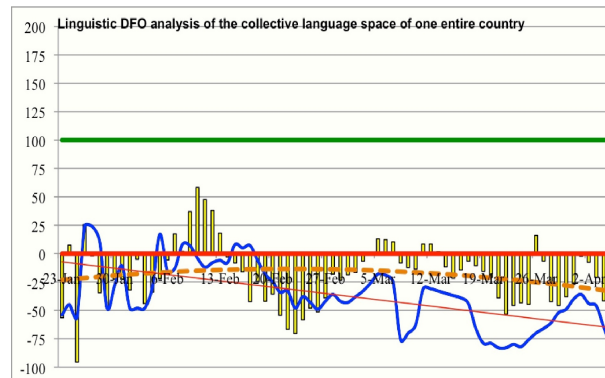


Fig. 4. 100-Day Collective Psychological Sentiment: President (Blue) Political Background Sentiment in Public (Yellow Bars).

How to read the graph from Fig. 4:

The Graph displays Quantitative QR based DFO machine analysis. The data and scales visually display the psychological sentiment in a given country from January 23, 2012 to April 5, 2012.

The data reflects the psychological state of society towards its politics and its leader. The graph is divided in 3 segments (values of -100 to 0 is Negative Sentiment; 1 to 100 is Neutral Sentiment; 101 to 200 is positive sentiment). Values at 50 are the most neutral center, and

measurements above signal a trend towards stability and acceptance; volumes below signal a trend towards chaos and rejection.

The yellow bars are called the Social Energy Index. Negative bars pointing down below the “Zero Line” are most concerning, and negative social energy is accelerating and unfolding towards public disobedience (revolution) and chaos. The Orange dashed line shows the overall long-term Trend of the social energy. Negative Values of -50 and more are very concerning, but values below -75 typically lead to violent revolution (physically or mentally), particularly, if they sustained for more then 5 to 8 consecutive days, as social energy is accumulative with a exponential decay value of approximately 14 days, depending on the input-factors of the “social energy drivers”. To no surprise, this particular country staged demonstrations until a leadership was archived.

The extreme negative values (yellow bars) created for the political challenger an extremely fertile environment, and he was predictably voted into office with a near 70% mandate. For reasons of confidentiality imposed by the client of this study we shall refrain from naming the country.

9. Concluding Remark

Although, in this paper, we have chosen a recent example from the Middle East (because funding was available for doing partial research on it), similar QR analytic methods can be applied to conflictive situations in other regions of the world, for example to the modeling of the historically tense relations between Hungarian and Romanian ethnic groups in Transylvania, or more generally, to the very complex intercultural relations in Central and Eastern Europe. Should appropriate funding become available, the QR-based comprehensive and in-depth analysis of that entire region could be a very useful project, especially in the context of the enlargement of the European Union and its complex (and little understood) interethnic problems, posed by its fast-changing intercultural dynamics.

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