The Responsa Storage and Retrieval System — Whither?

Aviezri Fraenkel

Department of Applied Mathematics and Computer Science
The Weizmann Institute of Science
Rehovot 76100, Israel

fraenkel@wisdom.weizmann.ac.il
http://www.wisdom.weizmann.ac.il/~fraenkel/fraenkel.html

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Apology

Never before did I have any urge to write down the history of *Respor* — The Responsa Storage and Retrieval System. In fact, a few years ago I threw out much Respor correspondence and documents when my office threatened to become a trash bin. The urge to write overcame me quite suddenly. I think the straw that broke the camel's back was when I heard recently that Respor has been unable to engage in any R & D activities for the past 6-7 months, because its funds have been blocked pending the outcome of yet another Bar Ilan University deliberation about it. (Respor *did* accrue, for Bar Ilan, a large revenue for the past few years due to the successful worldwide sale of the Respor CD-ROM.) The following isn't really a history; rather, it's a sketch of some highlights; those that I remember vividly and those that are backed up by documents which I still have.

Early Developments

The genesis of Respor was in Minneapolis, MN, in early 1963, where I went at the request of the late Prof. Chaim Pekeris, head of the Department of Applied Mathematics at the Weizmann Institute, to oversee the final testing of a CDC-1604 computer which the Institute had purchased. On Shabbatot I often enjoyed the generous hospitality of Mr. Irving Kutoff, who one day asked me: "What can a computer do for Jewish studies?" During our discussions it emerged that the huge Responsa literature, encompassing a large amount of time (17 centuries) and space (all of the globe), which is only locally and insufficiently indexed, could perhaps be exposed to the public by means of a clever computer system.

I did take this idea seriously, mainly because I had then recently "metamorphosized" from an electrical engineer to a mathematician, and felt it necessary, besides doing pure research which I enjoyed, to engage in "yishuvo shel olam" — some "immediately useful" activity. Already at that early stage I envisioned a system which, by pushing a few buttons, would give efficient answers to queries addressed to it.

Although Information Retrieval (IR) didn't particularly attract me, I did get into the thick of it with youthful fervor. I studied the subject from its foundations, such as Bar-Hillel's thesis [BaH1962], where he largely dismissed IR as non-feasible, to the last of the existing or emerging practical projects in the world. While I agreed with Bar-Hillel about the inherent complexity of the field, I thought that a practical mechanization procedure was nevertheless feasible.

In a nutshell, my thesis was (and still is) quite simple: IR systems can "exist practically" if and only if the parts that can be done "efficiently" by computer are mechanized, those in which man excels are done by man; and those in which "neither is good" are eliminated altogether! At an early stage I recognized intuitively that indexing and classifying belongs to the latter category. Therefore I recommended a *full-text* system. I was happy to learn that such a system was then under construction in Pittsburgh [Hor1962]. Indeed, IR systems inconsistent with the above thesis all phased out of existence sooner or later. The results of my study were published in a long manuscript [Fra1968]. Incidentally, the late Prof. Bar-Hillel sent me a very warm letter about this missive, though its conclusion opposed his own. (After formal complexity tools were developed in the 1970's, I was able to prove formally that the *easy* parts of natural models of indexing and classifying are indeed NP-complete [Fra1981].)

In the meantime I learned that the Hebrew University had just formally decided on and actually established an "Institute for Research in Jewish Law", headed by Dr. Menachem Elon, later Deputy President of the Supreme Court of Israel, and backed up by a scientific council headed by the late Prof. Ephraim Urbach. It was natural therefore to approach them and present to them my findings, in the hope that they would adopt my method and so fulfil the dream of disseminating the Responsa literature to a large audience of scholars and legal experts, and to the "general public". On Erev Rosh Hashanah Hatashkad, 33 years ago, Sept. 1963, I submitted a memorandum to Dr. Elon, in which I recommended to adopt a full-text method without indexing; it also contained advice about automatic indexing, as manual indexing was the method chosen and already begun with the aid of some 15 research assistants at the IRJL. I had hoped that we would only prove the feasibility of our method which would then be adopted by the IRJL, and then phase out of the picture.

It was clear to me from the onset that we would need efficient mechanized linguistic tools for handling Hebrew and Aramaic, because of their highly inflected and derivational nature [Fra1968]. I learned of the pioneering work of Dr. Yaacov Choueka, later professor of Computer Science at Bar Ilan, and Mr. Meir Shapiro [ChS1964], on the mechanical analysis of Hebrew words, which enables to group together all grammatical variants of a given word. At the same time I felt keenly that for a practical full-text Hebrew IR system we would also need an "inverse" tool, that of synthesizing words: given some "standard form" (SF) of a word, the tool ought to synthesize all variants by adding prefixes, suffixes, infixes, etc. Mr. Meir Cohen of the Ministry of Defense and a student at Tel Aviv University, now one of the directors of Bank Leumi, and myself, talked about this topic at the ILA (Israel Information Processing Society) meeting (*Proc. ILA Meeting*, April 1968, Abstract p. 173). We did develop such a tool [CCDFS1971]. As each of these methods has certain advantages and disadvantages, we ended up by merging them into a joint analysis-synthesis method; a global analysis of all words in the database is done, but without prepositions (otiyot shimush), in order to end up with a database of manageable size; the prepositions are left to the synthesis phase. See [AFCS1972] for full details.

I also set up a "Committee for the Mechanization in Jewish Law Research" whose first members were, I think, Dr. Choueka, Mr. Asa Kasher, later professor of Philosophy at Tel Aviv University, Mr. Joseph Dueck, a young lawyer and research assistant at the IRJL, who served as their representative, and assistants, to formulate procedures for pre-editing and post-editing texts to be inputted, and various algorithms needed for the work. (Many other persons, such as Mr. Reuven Mirkin of the Academy of the Hebrew Language, and research students, joined later.) I also felt the need to round out our group with experts in Jewish Law with an affinity to computers. In mid-1966 Rabbi Menachem Slae joined, who did invaluable work with his constructive criticism, representing the users' points of view, and, on the other hand, exposing the power of the system to them. In mid-1967 the late Rabbi Yitzchak Pechenik joined, who, in his quiet manner, added much to the enhancement of the system. Both began their work at the Weizmann Institute.

In 1966 or 1967, Meir Cohen wrote the first programs, run on Bar Ilan's main frame computer. They constituted, for many years, the skeleton for a first workable full-text Hebrew IR system. Meir presented the work as his M.Sc. thesis at Tel-Aviv University and I served as his external advisor. He did a very good job, and the first encouraging tests, run on the first 97 Responsa of Rivash, were soon available. (Recently Meir reminded me that four institutions were involved in his work: Weizmann, Bar Ilan, Hebrew U. and Tel Aviv U.!)

Early Problems

Budget problems plagued us throughout, and have continued to do so with ups and downs. At the beginning we applied for a minimal budget from the IRJL, but throughout they lived up to their pledges only partially and tardily. I learned only recently that the IRJL itself was most generously budgeted, since the head of the Academy of Sciences was one of the initiators and supporters of that undertaking.

I got permission from the US National Bureau of Standards, from whom I had a research grant for work in number theory, to divert part of the budget to our IR activities. (Later I got from them two additional research grants which were devoted entirely to IR.) Prof. Pekeris also helped by partially financing Choueka, Slae, Pechenik, as well as the keypunching, on IBM cards, of the Responsa of Rivash, Rosh and Rashba. I just came across some 1970 correspondence, from which I see that at that time at least Choueka, Slae and some keypunching were still financed by Pekeris. Also in 1973 Weizmann still financed the salary of 2 research associates, a keypunch machine and keypunch operator.

In the fall of 1966 I took a leave of absence from Weizmann for two years to establish the Math Department at Bar Ilan University, and also in later years I had some affiliation there. One of my preconditions was that Bar Ilan purchase a computer. This condition was met. But our Responsa IR activities were frowned upon, and I became the laughing stock of the bulk of the Faculty and administration with whom I dealt, and expressions like “Fraenkel is crazy” were said openly. A notable exception was Prof. Harold Fisch, Head of the English Department, who also headed the Research Committee in 1966. He encouraged me to submit a proposal to his Committee, which he thought he could get approved. But he later told me that *all* the referees said that the the retrieval and linguistic tools needed for processing Hebrew didn't yet exist, and preparatory work of a few years would be needed. In November 1966 I thus got a formal rejection letter stating these “facts”. (Analogously, but on a different topic, when in the middle of the Yom Kippur war a group of people from some Defense Establishment came to my office and asked me about the feasibility of a certain system, I proposed to them, after a few days of contemplation, a skeleton of my plan, to be realized within a year. When I later visited their offices, I found reports of some previous studies which concluded that it would take many years of preparatory work before the project could be contemplated. We had it working within a year. It has since grown exponentially and improved substantially; it continues to contribute significantly to the security of Israel.)

In those early days we were mostly abused. I do remember an exception. Judge Yaacov Bazak said a few good words of appreciation to us, and it helped us to overcome the feeling of helplessness and despair.

Our relations with the IRJL, which were never very good, began to deteriorate. On the one hand we needed more funds. In 1967 we applied for funds from the National Academy of Sciences via the late Mr. Shalhevet Freier, deputy director general at the Weizmann Institute at that time. But the Academy had backed the IRJL, and they considered our very application as an affront to the work of the IRJL. I was summoned to a meeting, where I got a severe personal reprimand from the Head of the Academy. At the same time, the IRJL expressed its doubts about the validity of our approach more and more loudly, and I was told that they had asked an anonymous computer scientist or expert about our approach and he said it was wrong. I asked to see his report or at least the essence of its scientific content, but my request was denied. On the other hand, I realized more and more the futility of their own approach. I pointed out to them that if in their method of a hierarchical index the different levels are permuted in almost every way, it meant exponential growth, so that the indexes would grow much more quickly than the volumes to be indexed; and if only few levels are permuted, then the user may not find the required information. To remarks of this type the answer was that they prepare their indexes according to a “systematic scientific method” and that therefore they were assured of success.

Finally in 1971, the IRJL broke off relations with us, and also threatened to take certain actions against us. This threw me into a black abyss of despair with thoughts I don't even dare to write about.

Not only with the Hebrew University did we have problems, but also with Bar Ilan, who didn't like the affiliation with Weizmann. Bar Ilan was very much concerned about the ownership of the tapes of the database we had constructed and about getting Respor out of Weizmann, whereas the latter never mentioned questions of this type, though they contributed much more money during the initial critical years. My ignorance in politics led me into deep waters, driving me often into despair. I leaned more and more on Choueka, who became a big help not only on the linguistic part which he led very capably, but also on political matters, though it seemed to me that his political talents were only marginally better than mine.

Sometimes also Choueka lost hope and wanted to abandon it all. Both of us considered it a siyata dishmaya — a heavenly bestowed aid, that we never despaired concurrently, and so we could and did console each other during spells of misery.

Further Developments in Telegraphic Style

In October 1968, Prof. Aaron Schreiber, then at the University of Maryland Law School, wrote to me about his intense interest in the Responsa System about which he had read in a Weizmann publication. See his paper [Sch1969] in which he describes our work. Schreiber also participated in a workshop-symposium on Legal Information Retrieval which I organized at Weizmann in the summer of 1969. Prof. Schreiber was later instrumental and the chief scientist of a large NEH grant that we obtained through his efforts.

Research at Respor prospered, as we always felt that this project could survive only in an environment of research — theoretical and applied. We had weekly meetings where scientific questions were discussed. I had several doctoral students, Moshe Mor, Tomi Shmuel Klein (both now on the Bar Ilan Faculty), Rony Attar (who founded the Perach Project while a doctoral student) and many M.Sc. students working on Respor-induced problems. All of them got their degrees from the Feinberg Graduate School at the Weizmann Institute. At a later stage also Prof. Choueka had a number of students at Bar Ilan University doing their M.Sc. thesis on Respor. Other students that worked at Respor included Nachum Dershowitz and David Harel, son of Harold Fisch, both now professors of computer science at the University of Illinois in Urbana-Champaign and Weizmann respectively.

As my affiliation with Bar-Ilan diminished in intensity, I was fired as the director of Respor by a dean at Bar Ilan in 1976 and replaced by Choueka. This in itself didn't cause any crisis, as the transition was smooth, and I continued to do scientific work about Respor. This same dean, when he later became president, caused the resignation of Choueka at the height of a major dispute about Respor, in 1986, and he also insisted that Respor reduce itself to a service unit, stopping all research work that had been going on. Before that he had visited at the headquarters of the NEH in Washington DC, and caused the crash of our research grant with them. Respor never recovered from these heavy blows.

The major achievement during Prof. Choueka's reign was the decision to transform the system into a self-contained CD-ROM based form; previously it had been run on a main-frame using terminals. (Also the IRJL had purchased a terminal, many years after the termination of our joint work!) The CD-ROM project was realized only a few years later, during the rectorship of Prof. Zvi Arad, and thanks to his fruitful efforts; I find that in March 1989 I wrote to Bar Ilan's rector Prof. J.A. Kraus, at his request, about the desired directions of Respor, in which I recommended, inter alia, to realize the CD-ROM system. After its realization in April 1992, the use of Respor increased dramatically! Since 1990 Dr. Uri Schield has been directing Respor very capably, and in the last year, during Uri's sabbatical absence, Prof. Amihood Amir shouldered the burden very skilfully. Rabbi Yaacov Weinberger has long since been, also through very difficult times, the devoted and capable deputy director. Among other things, he personally checks user complaints (and enjoys their praises), leading to improved new releases. Many additional people helped to achieve whatever was achieved until now, and I apologize profusely for any omissions I'm certain to be guilty of.

Summary of Recent Activities

Under the present constrained conditions, very little research is carried out. A mechanized "Tanach Encyclopædia" was prepared by Respor for "Steimatzky Books", which is on diskette, has various indexes, and permits to run searches on a copy of Respor's vocalized Tanach (Bible). Marketing by Steimatzky and Respor began in the fall of 1994. Another joint venture with Steimatzky was the mechanization of "Da'at Mikra", a "Harav Kuk Institute" edited (new) series of commentaries on the Bible the rights for which were purchased by Steimatzky.

In the past year the mechanization, including hypertext, of the Talmudic Encyclopædia was carried out under contract for the Talmudic Encyclopædia Institute. Also in the past year, version 4 of the Responsa CD-ROM was released. It contains software improvements such as, option for the automatic generation of all the variants of transcription from mele (k'tiv malei) to deficient (k'tiv chaseir), bibliographies of Responsa authors in English (in addition to the Hebrew which was available from the start), increase of some of the databases, running a search on up to 10 databases concurrently. The current list of databases consists of:

- Bible
- Bible commentaries: Targum On'klos, Rashi, Ramban on the Pentateuch; Rashi, R'dak, Ralbag, M'tzudat David, M'tzudat Tziyon on the rest
- Mishnah
- Tosefta: Liberman ed. through Bava Batra; Zuckermandel ed. for later tractates
- Minor tractates: Geirim, Derech Eretz, Kutim, Kalah, Kalah Rabati, M'zuzah, Sofrim, Seifer Torah, Avadim, Tzitzit, S'machot, T'filin
- Babylonian Talmud

- Rashi on Babylonian Talmud
- Y'rushalmi Talmud: chapters, pages and columns follow the Venice 1523 edition; division into halachot follows the Vilna edition
- Halachic Midrashim: M'chilta d'Rabbi Yishmaeil, M'chilta d'Rabbi Shimon Bar Yochai, Sifra, Sifrei, Sifrei Zuta, Midrash Tana'im on D'varim
- Aggadic Midrashim: Too long a list to present here
- Rambam: Hayad Hachazakah (Mishneh Torah)
- Tur
- Beit Yosef
- Shulchan Aruch
- Kitzur Shulchan Aruch
- Mishnah B'rurah
- Early Responsa (32 authors, and Gaonic and Tosafot authors, 47 volumes)
- 16th century Responsa (28 authors, 48 volumes)
- 17th – 19th centuries Responsa (48 authors, 87 volumes)
- Contemporary Responsa (15 authors, 82 volumes)

A small database system "Judaic Treasures" (also called: "Bar Mitzvah Gift" in the USA) has been released recently. It contains: Bible with its above mentioned commentaries (excluding Da'at Mikra), Midrash Rabba, Midrash Tanchuma, Babylonian Talmud with Rashi, Rambam, Kitzur Shulchan Aruch. Further details are available in Israel from: The Responsa Project, Bar Ilan University, Ramat Gan, Israel, Tel. 972-3-531-8411, 972-3-531-8343, 972-3-531-8626; Fax: 972-3-534-1850 (for Judaic Treasures: TAL (Technologya L'midah), Moshe Chasid, Tel. 972-3-932-0499). In the USA: TES (Torah Educational Software, Inc.), 21 Main Street, Monsey, NY 10952, Tel. 1-800-925-6853, 1-914-356-1485; Fax: 1-914-356-1343. For other countries, contact either of the above addresses.

The Tragic Irony of the Situation

The IRJL was formally decided upon by the top of the academic scientific echelon in Israel. It was established in 1963, and was well-budgeted. Its mission was announced with much fanfare — to index the Responsa literature. In mid-October, 1996, I heard from Prof. Eliav Shochetman, who was head of the IRJL until a year ago, and from Prof. Berachyahu Lifshitz of the Hebrew University Law Faculty, that after publishing indexes of the early Sephardic scholars, the IRJL still prepared indexes of the early Ashkenazic scholars, which were finished many years ago, and are to appear soon. After that its indexing activities were continued only on a very limited level. Nowadays the IRJL publishes an annual review on Jewish law, but it appears that not much additional activity goes on.

Respor was conceived solitarily. It never enjoyed much academic recognition or backing. It was and still is treated as a secretly kept mistress. Bar Ilan clings to it, yet doesn't let it live. There were times when it was partially supported by Bar Ilan, and we are very grateful for that, but we usually had to expend our energy to its last drop and more, to get it. Bar Ilan in turn should be thankful to us for bringing Respor to it! Respor is Bar Ilan's showcase, the gem in its crown. Yet it is torturing it. Respor is continuously given to the whims of changing rectors and presidents, each having their own opinions about it. Many times its expulsion from the University was considered. Whenever there was a change in some of the administration or yet another discussuion about Respor was initiated, we lost our sleep for many nights, being kept in nervous suspense as to the forthcoming decisions. A constant atmosphere of crisis, interspersed with temporary partial relief, lingers about Respor, which is very detrimental to its activities. (At the moment it seems that the revenues Respor accrues may be partly given to it (the frieze is still intact, no final decision has been taken), but no Bar Ilan support is given or contemplated currently to this only project it has which combines Torah and derech eretz — Jewish and secular studies which, allegedly, is the *raison d'être* for its existence.) It may be only wishful thinking, but a slight, very slow, improvement in Bar Ilan's attitude might perhaps be discernible, as the mid-age and younger Faculty, better capable of appreciating the power of Respor, is slowly gaining more control.

The indexing activities of the IRJL crumpled quietly. Experts tell me that their indexes are not used widely, but this may be a matter of subjective judgment. Respor is being used worldwide. It can be found, e.g., all over the US and Europe, including Eastern Europe, in many remote communities, such as Western Australia, and of course in Israel: in the chareidi community, national religious camp, in several hashomer hatzair kibbutzim, in the judiciary and batei din, among students and scholars. Bar Ilan law student Sinai Deutsch (later: dean of its Law Faculty) used the system for his thesis at an early stage of Respor's existence. At the beginning of 1978 he founded a special "Hebrew Legal Service" for the use of judges and lawyers, subsidized partly by the Israel Bar Association and the Ministries of Justice and Religion. Within the framework of HLS, Prof. Deutsch and Rabbi Meir Batist are engaged in running Responsa searches for current court-cases.

Does it follow that Respor achieved its goal of opening up the Responsa literature to the Jewish People? Unfortunately the answer is a categorical *No*. The users that seem to be satisfied with what they are getting, should know what they are missing!

At the beginning of this write-up I prided myself that already at the very start I envisioned a system which would respond efficiently to pushing a few buttons. But what I didn't anticipate at all was that software systems are inherently dynamic entities. You can never "finish" them. If you let them rest for a day, they become obsolete: "yom ta'azveini, yomayim e'ezveka" (Yerushalmi tractate

B'rachot, Ch. 9, Halachah 5, at the end of the g'mara) — if you abandon me for a day (the Torah), I'll abandon you for two. Moreover, taking the wrong decision today, can cause the system's demise after a few years. Not many undertakings, if any, have the financial buffer of IBM, which can survive a bad decision. Even under optimal conditions we would have to strive daily to make the dream true — just in order to *keep* it half true!

To give some example, we should urgently engage in the following researches: IR in an annotated text and hypertext environment, see [FrK≥1997], enhancement of the search formulation (which is still *very* primitive), special purpose optical character readers (Rashi script…tame the obstinate inputting problem), retrieval with vowels (some of our recent texts are vocalized), manuscript comparisons (dikdukei sofrim…alignments of texts) Babylonian Talmud standard page format display, expansion of the linguistic tools, better compression methods (we are at the limit of the CD-ROM capacity) and matching in compressed texts, security and encryption (our system has been broken in and is sold by the thieves), database mining, and many more. Many of the above are explained in greater detail in [Ami1966].

It is of course necessary to increase the database, especially with Responsa (we have stored only about 10% of the known Responsa — if those of most impact) and also statutory law. The system has clearly the potential of becoming a searchable information system for the entire rich heritage of the Jewish people. Masses of Rishonim and Acharonim (Early and Later Authorities), commentaries on the Talmud, and the statutes, such as Rambam, Tur, Shulchan Aruch are but a few examples.

Conclusion

Respor belongs to the Jewish people. It ought to be given the status of a national project, backed by bodies such as the National Academy of Sciences, the Knesset and Government, with a guaranteed budget, directed by a young talented and energetic person, under the guidance of an appropriate scientific council. It is a natural request after the years that Respor has proven itself despite the immense difficulties. The Jewish people will reap the fruit of such a move.

Presumably it's best if it will be housed at the campus of an existing University, similarly perhaps to the Academy of the Hebrew Language, which resides on the campus of the Hebrew University. It could possibly be Bar Ilan, but only if Respor's independence is guaranteed: its fate and operation would not be subject to any administrative decisions of Bar Ilan. The present exorbitant CD-ROM price, enforced by circumstances related to the very existence of Respor, should be lowered considerably when it becomes a national project. (In contrast, commercial enterprises such as were recently formed to market related Judaic databases, are motivated by profits, and many of their texts and programs, except those stolen from us, are deficient in several senses.)

We end by listing some of the publications that were generated by us. Of course there are numerous ones for whose creation the system was used, sometimes saving years of research. Some such authors gave and some didn't give credit; we don't list any of those. Also some Respor members exploited the system for research in Judaica, the humanities and social sciences. Appending a list of their papers and books would double the length of this note. A partial list is available [Wei1981]. To give just one example, we mention M. Slae's book *Insurance in Halachah*, sponsored by the Israel Insurance Association (Hebrew 1980, English 1982), who also edited the book *Seifer Hashut: Sh'mitah*, Beit Yesharim, Harei Yerushalayim, 1986, based on Respor-retrieved Responsa on sh'mitah — the 7th sabbatical year. Incidentally, many y'shivot, high schools, even some junior high-schools use our system nowadays, and some student teams prepare nice Respor-assisted pamphlets on Halachic and ethical projects.

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