In their development of curriculum for the humanizing of learning, Research for Better Schools, Inc., has required the reorganization, reordering, and creation of instrumentation for evaluation in the higher-order cognitive skills, the affective skills, and the interpersonal skills. As part of their design, a critical organization and review of the state of the art for test-like instruments was made with the goal in mind of identifying those instruments and techniques with auto-feedback formats appropriate to curriculum packages under development. A taxonomy of feedback devices based on degree of mechanical complexity and amount of feedback provided was developed. (Author)
ICAL SURVEY OF AUTO-FEEDER DEVICES IN EDUCATION

DeMuth and Ralph Hoepfner

GSEB REPORT No. 68
APRIL 1974
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Los Angeles, California 90024
A CRITICAL SURVEY OF AUTO-FEEDBACK DEVICES IN EDUCATION

by

Joyce DeMuth and Ralph Hoepfner

CSE Report No. 68
April 1971

In partial fulfillment of an agreement between

Center for the Study of Evaluation and
Humanizing Learning Program
Research for Better Schools, Inc.
Philadelphia, Pennsylvania

Published by Research for Better Schools, Inc., a private non-profit corporation supported in part as a regional education laboratory by funds from the United States Office of Education, Department of Health, Education, and Welfare, in cooperation with CSE. The opinions expressed in this publication do not necessarily reflect the position or policy of the Office of Education, and no official endorsement by the Office of Education should be inferred.
In their development of curriculum for the humanizing of learning, Research for Better Schools, Inc., has required the reorganization, re-ordering, and creation of instrumentation for evaluation in the curriculum areas of the higher-order cognitive skills, the affective skills, and the interpersonal skills. As part of the design for their necessarily innovative curriculum and evaluation materials, a critical organization and a review of the state of the art for test-like instruments and techniques were made with the goal in mind of identifying those instruments and techniques with auto-feedback formats appropriate to curriculum packages under development. Such formats were seen as fitting the needs of the humanized learning curricula and evaluations.

Test-Like Instruments Utilizeable as Auto-Feedback Devices

The search for test-like instruments which could be utilized as auto-feedback devices was concentrated in two areas:

(1) measurement instruments and

(2) self-instructional devices or materials which employ feedback as a part of their lesson format.

The examination of the first area yielded a dearth of information. Out of more than one thousand tests, published and unpublished, only two were identified as fitting into the "feedback-test" category. They are the Kuder Preference Record and the Self-Directed-Search, both of which are vocational interest surveys.

The Kuder instrument is not necessarily self-administered or self-scored, but the examinee may take the test by himself, score it by
counting pin holes in diagrams cleverly concealed in the answer pad, create his own profile of interest traits, and interpret it on the basis of the information provided in interpretation manuals. It is recommended by the author that anyone using the Kuder Preference Record should have at least a sixth-grade reading vocabulary. While such a reading vocabulary is adequate for responding to the schedule, it is not adequate for an understanding of the rather general interpretive advice found in the interpretation protocols. These protocols are not prescriptive, and to be useful they require considerable skill in making personnel and psychological inferences.

The Self-Directed-Search (SDS), developed by J. Holland, is administered, scored, profiled, and interpreted by the student. It is designed to show the student how closely he resembles each of six occupational personality types and then guides him in considering jobs that fit his profile. The author suggest that the test be used by high school or college students although he notes that children as young as nine years have successfully completed the SDS.

**Taxonomy of Auto-Feedback Devices**

Within the wide range of types of feedback employed by self-instructional devices, no test-like instruments were found. The nature of auto-instructional materials is usually such that feedback is supplied on a frame-by-frame or step-by-step basis during instruction rather than waiting until a substantial amount of information has been covered before testing and providing feedback. It is also generally felt, although the literature presents conflicting viewpoints,
that feedback should be provided immediately after the response has been made to the instructional unit. Therefore, the idea of supplying feedback only at the end of a test is in opposition to the concept of many self-instructional materials.

The mechanical complexity of the feedback devices which were identified and the amount of information supplied by these devices vary widely. For this reason, a taxonomy was developed and each auto-feedback device was classified according to the specific characteristics that defined a particular row and column of the taxonomy. (See Figure 1.)

**Mechanical Complexity.** The rows of the taxonomy of auto-feedback devices are defined by the complexity of the devices. The simplest devices (Row 1) are those which employ printed feedback not requiring special equipment to make responses. The majority of programmed texts would fit into this category. In these texts the question format is usually multiple choice, with the correct answer provided at the side of the page or at the beginning of the next frame.

The second level of mechanical complexity encompasses those printed feedback devices which require special equipment to make or interpret the responses (Row 2.) For example, Nobel and Nobel have developed a red acetate overlay which, when placed on an area of overprinting, will reveal the answer. This device falls into the category of devices which require special equipment to interpret the response. A feedback device which requires special equipment to make the response is the chemical feedback developed by A. B. Dick. This demands the use of a water pen which, when touched to a dot impregnated with a special ink, will cause the dot to turn green.
<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indicates that answer is right or wrong.</td>
<td>Indicates that answer is right or wrong and states why.</td>
<td>Indicates that answer is right or wrong and states why; for wrong answer gives additional info and questions again.</td>
<td>Ascertains level at which student passed or missed question--automatically branches student to appropriate level of instruction.</td>
<td>Student develops own pattern or profile which provides feedback about him.</td>
</tr>
<tr>
<td>2</td>
<td>Printed feedback device which does not require special equipment to make responses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Printed feedback device which requires special equipment to make or interpret the responses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Simple portable mechanical feedback device not requiring batteries or electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Portable mechanical feedback device requiring batteries or electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Non-portable, professionally-installed, electrical feedback device requiring periodic servicing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Cycloteacher is an example of a simple portable mechanical feedback device which does not require batteries or electricity to operate (Row 3.) Simple movement of a switch allows the student both to expose the next frame and to see the answer to the previous frame. These auto-feedback devices are usually lightweight enough to be handled by most elementary school children. There is a minimum of moving parts and care has been taken to child-proof the devices.

The majority of identified auto-feedback devices fall into the category of portable, mechanical feedback devices which require batteries or electricity (Row 4.) The cost of these devices rises sharply above those in Rows 1, 2, and 3; however, many offer multi-media programs in the form of a slide display coupled with a taped lesson. Although the devices are considered portable, most would require an adult to move them.

The Instroscope is an example of a non-portable, professionally installed, electrical auto-feedback device which would require periodic maintenance (Row 5.) This is mechanically the most complex type of device and also the most expensive. These devices can service a larger number of learners than the simpler devices and they are able to handle diverse presentations of information.

**Amount of Feedback.** The five columns of the taxonomy are defined by the amount of information feedback supplied by the auto-feedback devices. The least amount of feedback simply indicates to the student that his answer is right or wrong (Column A). Frequently the student matches his answers with one supplied at the bottom or side of the frame. In the case of the chemical feedback described earlier the learner would first be taught the "meaning" of the color of the feedback dot, i.e., red means the answer is wrong, green means the answer is right. This method is often used to supply feedback to non-readers.
The next level of feedback, Column B, contains devices which indicate whether the answer is right or wrong and state why. Devices in Column C, in addition to showing whether the answer is right or wrong, give additional information following an incorrect response and then question the student again. Frequently the same question is repeated on the second attempt although some writers try to develop parallel questions. This type of device could also be considered to include mini-branching feedback since the student is briefly removed from the mainstream of the program, supplied with corrective information and brought back into the mainstream again.

Feedback which ascertains the level at which the student passes or misses the question and then automatically branches him to the appropriate level of instruction is designated by Column D. This type of feedback demands a sophisticated mechanical device which is capable of handling numerous remedial branching sequences.

Column E designates devices whereby the student develops his own profile or a pattern which provides feedback about him. The feedback obtained by these devices contains some aspects which are not present in the other four types of feedback. First, a sequence of instruction is not necessarily provided prior to the response; usually it is just a test question. Consequently the student's answers are not viewed as being right or wrong but as a reflection of his attitudes or reactions. Second, it is necessary for the student to be able to follow what may be a complex set of directions to obtain feedback. This aspect may limit the use of this type of feedback to those who are capable of following sequential directions. The third and final characteristic of entries in Column E is that it is possible to obtain a great deal of feedback from this type of profile without using any type of mechanical device.
By far the majority of feedback devices fall in Column A of Rows 1, 2, 3, and 4. These rows cover a range of feedback devices from the simple printed type to portable devices which require batteries or electricity for operation; the column signifies that the feedback merely indicates that the answer is right or wrong. It can be seen that as the feedback devices become more complex mechanically they do not necessarily provide a greater amount of feedback information. However, the state of the art indicates that any feedback device which could ascertain the level at which a student passes or misses a question and then automatically branch him to the appropriate level of instruction would be a complex device. The cells of the taxonomy with their device entries listed appear in Appendix A.*

Implications of Available Auto-Feedback Devices

What are the implications related to the development and use of test-like instruments that can be utilized as auto-feedback to the learner? It is immediately obvious that the use of mechanically sophisticated devices is both impractical and unwarranted if the device is not to be used for instruction as well as testing. Our considerations, therefore, will be in light of the non-mechanical or mechanically simple auto-feedback devices and some of the problems in their use.

1. Age limitations. There is a very real difficulty in determining the minimum age at which a learner can utilize auto-feedback, whether in a teaching or testing situation. As noted earlier, the Kuder Preference Test

*It will be noted that there are only two entries in Row 5, Columns A, B, C, D, and E. This is not because these mechanically sophisticated feedback systems do not exist in larger numbers but rather that for this project such complex devices were not of primary interest and therefore no attempt was made to search them out.
requires a sixth-grade reading vocabulary level while the Self-Directed-Search is recommended for high school students. The key requirement, beyond taking the test, is the ability to follow the directions necessary to score, profile and interpret the test. Typically, the young learner's ability restricts him to a very simple routine which obtains what is unfortunately very simplistic feedback.

2. Test content restrictions. The more simple the auto-feedback device is mechanically, the less information and direction it can provide for the learner. This limits the instruction or testing to asking those types of questions which may be answered with "yes" or "no," or with the selection of a multiple-choice item. In either instance it may exclude the use of items which assess some of the higher-level cognitive skills.

3. Prescriptive feedback. The idea that feedback would allow the learner to modify his errors and increase the probability of future correct responses was one of the tenets of programmed instruction. However, it has become increasingly clear that the uniqueness of a learner and his past experience in handling information play a large part in the effectiveness of feedback. No one feedback system can be said to equally effective with learners who differ in race, age, cultural background, or perceived need for information acquisition.

The traditional role of feedback has been to confirm or negate a response the learner has made. However, it is possible to conceive of feedback as a system which supplies on-going directions for future actions. This type of feedback can be considered as a progression through which the learner is given increasingly more information on a step-by-step basis. This progression is approached by the Self-Directed-Search where the initial scoring is
the first step in obtaining feedback, the profiling is the second, and the interpreting is the third step.

Training programs could be developed to instruct learners, ranging from elementary school youngsters to adults, in the basic steps of dealing with a progression feedback system. This system could supply the learner with a greater amount of feedback than the average simple mechanical device; it would also allow for the building of complex sequences of questions. In addition, a feedback progression could be designed on a branching basis to meet some of the identified needs of individuals. After completing one step of a specified feedback progression, one learner's behavior might be reinforced by allowing him to select another activity; a second learner might be directed to an adult who would supply verbal praise; while a third learner could complete the progression and begin another without any such branching for reinforcement.
APPENDICES
APPENDIX A

CELLS OF THE AUTO-FEEDBACK TAXONOMY

AND THEIR DEVICE ENTRIES

This appendix allows one page for each cell of the taxonomy, with blanks for the entries. Those devices presently available are entered into the blanks. The remaining blanks are provided for devices either not uncovered by CSE in its review or those not yet developed or distributed.
CELL 1A

1 = Printed feedback device which does not require special equipment to make responses.

A = Indicates that the answer is right or wrong.

California Test Bureau, Scrambled Text
Coronet Learning Programs
Learning Incorporated Answer Panel
McGraw-Hill Book Company
Self-Scoring Flexilevel Test
Self-Trainer
TMI-Grolier Programmed Text
Trainor-Testor Response Card
CELL 1B

1 = Printed feedback device which does not require special equipment to make responses.

B = Indicates that answer is right or wrong and states why.
CELL 1C

1 = Printed feedback device which does not require special equipment to make responses.

C = Indicates that answer is right or wrong and states why; for wrong answer gives additional information and questions again.
CELL 1D

1 = Printed feedback device which does not require special equipment to make responses.

D = Ascertains level at which student passed or missed question--automatically branches student to appropriate level of instruction.
CELL 1E

1 = Printed feedback device which does not require special equipment to make responses.

E = Student develops own pattern or profile which provides feedback about him.

Kuder General Interest Survey

Self-Directed-Search
CELL 2A

2 = Printed feedback device which requires special equipment to make or interpret the responses.

A = Indicates that answer is right or wrong.

A. B. Dick Chemical Feedback

Docent Responsive Answer Sheets

Nobel & Nobel
CELL 2B

2 = Printed feedback device which requires special equipment to make or interpret the responses.

B = Indicates that answer is right or wrong and states why.
CELL 2C

2 = Printed feedback device which requires special equipment to make or interpret the responses.

C = Indicates that answer is right or wrong and states why; for wrong answer gives additional information and questions again.
CELL 2D

2 = Printed feedback device which requires special equipment to make or interpret the responses.

D = Ascertains level at which student passed or missed question--automatically branches student to appropriate level of instruction.
CELL 2E

2 = Printed feedback device which requires special equipment to make or interpret the responses.

E = Student develops own pattern or profile which provides feedback about him.
### CELL 3A

3 = Simple portable mechanical feedback device not requiring batteries or electricity.

A = Indicates that answer is right or wrong.

<table>
<thead>
<tr>
<th>Beseler Grade-O-Mat</th>
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<tbody>
<tr>
<td>Cycloteacher</td>
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<tr>
<td>ESA Canterbury Teaching Machine, Mark II</td>
</tr>
<tr>
<td>Telor</td>
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<tr>
<td>Testmate Responder</td>
</tr>
<tr>
<td>Touchtutor Teaching Machine</td>
</tr>
<tr>
<td>Tutorpack, Model B</td>
</tr>
</tbody>
</table>
CELL 3B

3 = Simple portable mechanical feedback device not requiring batteries or electricity.

B = Indicates that answer is right or wrong and states why.
CELL 3C

3 = Simple portable mechanical feedback device not requiring batteries or electricity.

C = Indicates that answer is right or wrong and states why; for wrong answer gives additional information and questions again.
CELL 3D

3 = Simple portable mechanical feedback device not requiring batteries or electricity.

D = Ascertains level at which student passed or missed question--automatically branches student to appropriate level of instruction.
CELL 3E

3 = Simple portable mechanical feedback device not requiring batteries or electricity.

E = Student develops own pattern or profile which provides feedback about him.
CELL 4A

4 = Portable mechanical feedback device requiring batteries or electricity.

A = Indicates that answer is right or wrong.

<table>
<thead>
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<th>Acoustitone</th>
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<tr>
<td>Audio Flashcard System</td>
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<tr>
<td>Automata 450</td>
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<tr>
<td>Bell &amp; Howell Language Master</td>
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<tr>
<td>Borg-Warner Educational Systems, System 80</td>
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<tr>
<td>Craig 8127</td>
</tr>
<tr>
<td>Craig Reader</td>
</tr>
<tr>
<td>Devereux Model 50</td>
</tr>
<tr>
<td>Educational Projections Corporation</td>
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<tr>
<td>Electronic Card Reader</td>
</tr>
<tr>
<td>Higgens Teledesk</td>
</tr>
<tr>
<td>Hoffman Audiovisual instructional system in reading</td>
</tr>
<tr>
<td>Honor Teaching Machine</td>
</tr>
<tr>
<td>Labo 12 + 2</td>
</tr>
<tr>
<td>Mast Teaching Machine</td>
</tr>
<tr>
<td>Math Mastery Tapes</td>
</tr>
<tr>
<td>MTA S-R 400 Stimulus Programmer</td>
</tr>
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<td>Norelco PIP System</td>
</tr>
<tr>
<td>Norelco Synchrotutor</td>
</tr>
<tr>
<td>SR - 400 Programmer</td>
</tr>
<tr>
<td>V-M Model 703 AV</td>
</tr>
</tbody>
</table>
4 = Portable mechanical feedback device requiring batteries or electricity.

B = Indicates that answer is right or wrong and states why.

EDL Basic Systems, Aud-X
4 = Portable mechanical feedback device requiring batteries or electricity.

C = Indicates that answer is right or wrong and states why; for wrong answer gives additional information and questions again.
CELL 4D

4 = Portable mechanical feedback device requiring batteries or electricity.

D = Ascertains level at which student passed or missed question--automatically branches student to appropriate level of instruction.
CELL 4E

4 = Portable mechanical feedback device requiring batteries or electricity.

E = Student develops own pattern or profile which provides feedback about him.
CELL 5A

5 = Non-portable, professionally-installed, electrical feedback device requiring periodic servicing.

A = Indicates that answer is right or wrong.

Instructoscope
CELL 5B

5 = Non-portable, professionally-installed, electrical feedback device requiring periodic servicing.

B = Indicates that answer is right or wrong and states why.
CELL 5C

5 = Non-portable, professionally-installed, electrical feedback device requiring periodic servicing.

C = Indicates that answer is right or wrong and states why; for wrong answer gives additional information and questions again.
CELL 5D

5 = Non-portable, professionally-installed, electrical feedback device requiring periodic servicing.

D = Ascertains level at which student passed or missed question--automatically branches student to appropriate level of instruction.

El 9000
CELL 5E

5 = Non-portable, professionally-installed, electrical feedback device requiring periodic servicing.

E = Student develops own pattern or profile which provides feedback about him.
Appendix B

AUTO-FEEDBACK SYSTEMS CATEGORIZED

ACCORDING TO THE TAXONOMY
California Test Bureau, Scrambled Text
Coronet Learning Programs
Learning Incorporated Answer Panel
McGraw-Hill Book Company
Self-Scoring Flexilevel Test
Self-Trainer
TMI-Grolier Programmed Text
Trainer-Testor Response Card

Kuder General Interest Survey
Self-Directed-Search

A. B. Dick Chemical Feedback
Docent Responsive Answer Sheets
Nobel & Nobel

Beseler Grade-O-Mat
Cycloteacher
ESA Canterbury Teaching Machine, Mark II
Telor
Testmate Responder
Touchtutor Teaching Machine
Tutorpack, Model B

Acoustitone
Audio Flashcard System
Automata 450
Bell & Howell Language Master
Borg-Warner Educational Systems, System 80
Craig 8127
Craig Reader
Devereux Model 50
Educational Projections Corporation
Electronic Card Reader
Higgins Teledesk
Hoffman Audiovisual instructional system in reading
Honor Teaching Machine
Labo 12 + 2
Mast Teaching Machine
Math Mastery Tapes
MTA S-R 400 Stimulus Programmer
Norelco PIP System
Norelco Synchrotutor
SR-400 Programmer
V-M Model 703 AV

EDL Basic Systems, Aud-X

Instructoscope

El 9000
Appendix C

ALPHABETIZED LISTING OF FEEDBACK SYSTEMS

AND TAXONOMY CATEGORIES
A. B. Dick Chemical Feedback 2A
Acoustitone 4A
Audio Flashcard System 4A
Automata 450 4A

Bell & Howell Language Master 4A
Beseler Grade-O-Mat 3A
Borg-Warner Educational Systems, System 80 4A

California Test Bureau, Scrambled Text 1A
Coronet Learning Programs 1A
Craig 8127 4A
Craig Reader 4A
Cycloteacher 3A

Devereux Model 50 4A
Docent Responsive Answer Sheets 2A

EDL Basic Systems, Aud-X 4B
Educational Projections Corporation 4A
El 9000 5D
Electronic Card Reader 4A
ESA Canterbury Teaching Machine, Mark II 3A

Higgins Teledesk 4A
Hoffman Audiovisual instructional system in reading 4A
Honor Teaching Machine 4A

Instructoscope 5A

Kuder General Interest Survey 1E

Labo 12 + 2 4A
Learning Incorporated Answer Panel 1A

Mast Teaching Machine 4A
Math Mastery Tapes 4A
McGraw-Hill Book Company 1A
MIA S-R 400 Stimulus Programmer 4A

Nobel & Nobel 2A
Norelco PIP System 4A
Norelco Synchrotutor 4A

Self-Directed-Search 1E
Self-Scoring Flexilevel Test 1A
Self-Trainer 1A
SR-400 Programmer 4A
Telor
Testmate Responder
TMI-Grolier Programmed Text
Touchtutor Teaching Machine
Trainer-Tester Response Card
Tutorpack, Model B

V-M Model 703 AV
APPENDIX D

ALPHABETIC LISTING OF PUBLISHERS
AND DISTRIBUTORS OF AJTO-FEEDBACK SYSTEMS

(Form letters were sent to all listed organizations, requesting information regarding their products.)
<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>City, State Zip</th>
</tr>
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<tbody>
<tr>
<td>JACK C. COFFEY COMPANY, INC.</td>
<td>104 Lake View Avenue</td>
<td>Waukegan, Illinois 60085</td>
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<td>COOPER FILMS AND RECORDS, INC.</td>
<td>Cooper Building</td>
<td>Winchendon, Massachusetts 01475</td>
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<td>CORONET FILMS</td>
<td>65 East South Water Street</td>
<td>Chicago, Illinois 60601</td>
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<td>CYBERVOX SYSTEMS INC.</td>
<td>2224 Hewlett Avenue</td>
<td>Merrick, New York 11566</td>
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<tr>
<td>DOUBLE SIXTEEN COMPANY</td>
<td>1028 College Avenue</td>
<td>Wheaton, Illinois 60187</td>
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<tr>
<td>DATA INSTITUTE, INC.</td>
<td>Suite 303E</td>
<td>New York, New York 10017</td>
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<td>DCA EDUCATIONAL PRODUCTS, INC.</td>
<td>4865 Stenton Avenue</td>
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<td>5235 Ravenswood Avenue</td>
<td>Chicago, Illinois 60640</td>
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<td>240 Madison Avenue</td>
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<td>800 Senora Avenue</td>
<td>Glendale, California 91201</td>
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<td>167 Wayne Street</td>
<td>Jersey City, New Jersey 07303</td>
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<td>DOUBLEDAY MULTIMEDIA</td>
<td>100 Park Avenue</td>
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<td>Merrick, New York 11566</td>
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<td>St. Paul, Minnesota 55101</td>
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<td>Bronx, New York 10458</td>
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