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Computers: The Link to Missing Children, 7 Computer L.J. 73 (1986)

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NOTES

COMPUTERS: THE LINK TO MISSING CHILDREN

For many years this country has been confronted with the serious problem of crime. It has long been the government's role to protect its citizenry (from each other, if you will), as evidenced by state and federal law enforcement. Yet society has only recently recognized the importance of protecting a special class of crime victims—children. The number of runaway and abducted children who eventually become victims of abuse and murder is unacceptably high and seems to be ever increasing. This Note will explore and analyze the possible and proper role of computers in remedying the problem of missing and victimized children.

First, the extent of the problem that this country faces with the victimization of missing children will be elucidated, along with a discussion of the Missing Children Act and its ramifications. A brief overview of the functional capability of computers will provide a background to the analysis of the computer's role as a law enforcement tool, primarily within the National Crime Information Center (NCIC) network. The missing children index of the Missing Person File of the NCIC will also be examined.

There are weaknesses in the system and this Note will focus on the implications of and the prescriptions for three basic problems: underutilization of the system, ineffective time delay policies, and the prevalent mentality concerning missing children. Finally, the implementation of computer digital image printout will be suggested as an improvement in the NCIC network system.

I. OUR MISSING CHILDREN

According to CHILD FIND, INC.,¹ an estimated 1.8 million children (those persons under the age of eighteen) disappear in the United States each year.² Of these, 1.3 million are runaways, more than 100,000

1. CHILD FIND, INC. is a national clearinghouse of information for missing children, located in New Paltz, New York.

2. Reall, *Finding the Missing Children*, CHILDREN TODAY, Jan.-Feb. 1984, at 12, 13.

are abducted by a non-custodial parent, and, frighteningly enough, 50,000 disappear under what CHILD FIND calls "suspicious circumstances."³ These children become victims of "stranger abduction," a crime committed by pedophiles, pornographers, blackmarket baby peddlers, or childless psychotics.⁴ An estimated 4000 to 8000 of these children are murdered each year.⁵ Yet until recently, public awareness of this social tragedy was virtually nonexistent. Awareness of the problem did not rise to a national level until the case of Adam Walsh was brought to the attention of the media. Six-year old Adam disappeared from a shopping mall in Hollywood, Florida on July 27, 1981; two weeks later his severed head was discovered in a canal 100 miles away from his home. This incident, only one of thousands which occur each year, brought to the foreground the seriousness of the problem. Its scope was best summed up by the address given to the House of Representatives by Adam's father, John Walsh:

It is certainly evident the priorities of this great country are in some disorder. A country that can launch a space shuttle that can return to the earth and take off again, a country that can allocate millions of dollars to save a small fish, the snail darter in the Tennessee Valley River threatened with extinction, but does not have a centralized reporting system or a nationwide search system for missing children, certainly need[s] to reaffirm the very principles that this country was founded on, namely personal freedoms.⁶

A major step in confronting this national crisis was the enactment of the Missing Children Act ("the Act") in October of 1982.⁷ The Act created a national clearinghouse of information in child disappearance cases by establishing separate files for missing children and unidentified bodies in the FBI National Crime Information computer. Although the Act did not expand the investigative jurisdiction of the FBI, it did authorize parents of missing children to contact the FBI directly for entry into the computer file, if local agencies failed to do so. The Act was passed in response to the recognition that it was foolish not to utilize

3. *Id.* at 13.

4. Gelman, *Stolen Children*, NEWSWEEK, Mar. 19, 1984, at 78.

5. *Missing Children's Act: Hearings on H.R. 3781 Before the Subcomm. on Civil and Constitutional Rights of the House Comm. on the Judiciary*, 97th Cong., 1st Sess. 33 (1981) (statement of Rep. Paul Simon) [hereinafter *Hearings*].

6. *Id.* at 25. This "attack" on the priorities of this country operates on the assumption that it is the responsibility of the government to protect children. Law enforcement has always been an arm of the government in this country and if children are not considered citizens deserving of protection, they are at the very least, a valuable resource for the future worthy of preservation (under even the harshest of views).

7. Pub. L. No. 97-292, 96 Stat. 1259 (1982) (codified as amended at 28 U.S.C.A. § 534 (West Supp. 1986)). The Act authorizes the Attorney General to "acquire, collect, classify, and preserve any information which would assist in the identification of any deceased individual . . ." *Id.* § 2.

the available resources of computer technology. Accordingly, the computer has become an essential national link in identifying and finding missing children.

II. THE ROLE OF COMPUTERS

The use of computers for tasks such as recordkeeping, statistical data processing, and accounting by private businesses and government agencies has been a common practice for years.⁸ These systems, however, are generally off-line systems not linked to other computers. Law enforcement computers are on-line systems, meaning that they function with other computers in a network and operate on real time.⁹ Consequently, it is possible to have data processed and/or retrieved within seconds of input into the remote terminal of the computer.¹⁰ This concept provides the basis for the NCIC network of computer information exchange in law enforcement.

When used as a law enforcement tool, the computer generally serves at least two basic functions: (1) a data storage and retrieval device; and (2) a logical device serving as the hub of a complex message transmission network. In the former capacity, as a storage and retrieval device, the computer can supply pertinent information within seconds; in the latter capacity it serves as a message switching device, and thus, can serve as an exchange center for a network of terminals (i.e., for sources and recipients of the messages in the system).¹¹ The NCIC computer operates in both these capacities.

III. THE NATIONAL CRIME INFORMATION CENTER

The NCIC was created pursuant to 28 U.S.C. § 534 and became active in January of 1967.¹² The stated goal was to "place at law enforcements' disposal a computerized information system, national in scope, to complement the development of similar systems at local and state levels."¹³ The NCIC computer equipment is located at FBI headquarters in Washington, D.C., with connecting terminals throughout the United States, Canada, Puerto Rico, and the U.S. Virgin Islands.¹⁴ The NCIC is

8. NATIONAL INSTITUTE OF LAW ENFORCEMENT AND CRIMINAL JUSTICE, POLICE TELECOMMUNICATION SYSTEMS 113 (1971) [hereinafter POLICE SYSTEMS].

9. Operating in real time means that there is no time lapse between the inputting of instructions into the computer and its recognition of the desire for a solution. *Id.*

10. *Id.* at 114.

11. *Id.* at 110-11.

12. See *Hearings, supra* note 5, at 37 (statement of Kier T. Boyd, Inspector-Deputy Assistant Director, Technical Services Division).

13. POLICE SYSTEMS, *supra* note 8, at 117.

14. FED. BUREAU OF INVESTIGATION, NAT'L CRIME INFORMATION CENTER, U.S. DEP'T OF JUSTICE, THE INVESTIGATIVE TOOL 2 (June 1984) [hereinafter INVESTIGATIVE TOOL].

a national clearinghouse of criminal justice information and has the ability to furnish computerized data to any participating agency almost immediately upon request.¹⁵ Contained within the NCIC database are twelve files;¹⁶ NCIC can be thought of as a "large automated 'file cabinet,' with each file having its own label or classification."¹⁷ As noted previously, the Missing Children Act created the Unidentified Bodies File and added a special children's index to the Missing Persons File.¹⁸

The NCIC is managed by the FBI and is operated under the guidance of the NCIC Advisory Policy Board, which consists of thirty criminal justice administrators from various agencies throughout the country.¹⁹ The Advisory Policy Board gathers support, information, and advice from its four regional working groups ("RWG").²⁰ Each RWG is made up of one state appointed NCIC control terminal agency ("CTA") representative, from each of the states within the region, and six elected local criminal justice representatives.²¹ The CTA serves as liaison between the FBI and the local NCIC users within each state. By interacting with the RWGs, the Advisory Policy Board formulates policies and recommendations, which are then presented to the director of the FBI for approval.²²

15. *Id.*

16. Interstate Identification Index, U.S. Secret Service, Canadian Warrants, Stolen Securities, Stolen Boats, Stolen License Plates, Stolen and Felony Vehicles, and Stolen Vehicle Parts, Stolen and Recovered Guns, Wanted Persons, Stolen Articles, Missing Persons, and Unidentified Persons. FED. BUREAU OF INVESTIGATION, U.S. DEP'T OF JUSTICE, BREAKDOWN OF RECORDS IN NCIC COMPUTER (May 31, 1984).

17. FED. BUREAU OF INVESTIGATION, U.S. DEP'T OF JUSTICE, MAKE NCIC WORK FOR YOU 3 (1983).

18. *See supra* text accompanying note 7.

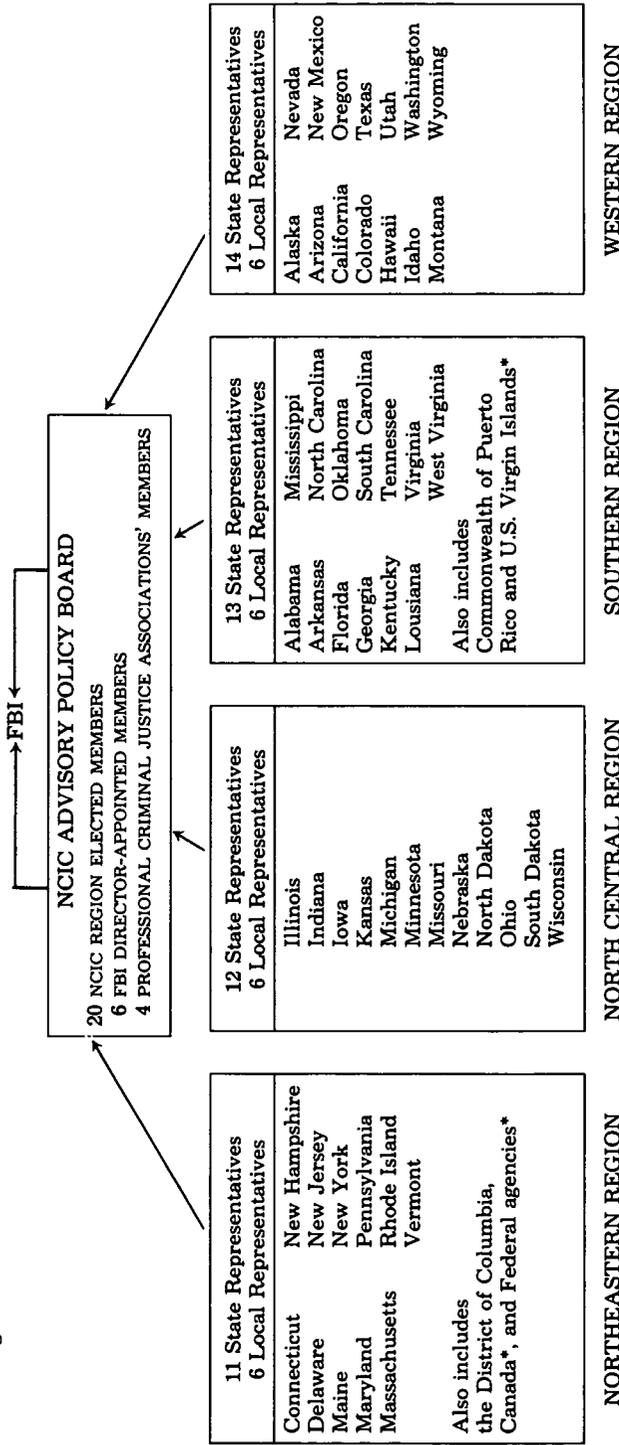
19. Fed. Bureau of Investigation, Nat'l Crime Information Center, U.S. Dep't of Justice, NCIC Newsletter, Summer 1983, at 4.

20. *Id.* See chart on next page.

21. *Id.*

22. *Id.*

*nonvoting members



11 State Representatives 6 Local Representatives	Connecticut Delaware Maine Maryland Massachusetts New Hampshire New Jersey New York Pennsylvania Rhode Island Vermont Also includes the District of Columbia, Canada*, and Federal agencies*
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NORTHEASTERN REGION

12 State Representatives 6 Local Representatives	Illinois Indiana Iowa Kansas Michigan Minnesota Missouri Nebraska North Dakota Ohio South Dakota Wisconsin
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NORTH CENTRAL REGION

13 State Representatives 6 Local Representatives	Alabama Arkansas Florida Georgia Kentucky Louisiana Mississippi North Carolina Oklahoma South Carolina Tennessee Virginia West Virginia Also includes Commonwealth of Puerto Rico and U.S. Virgin Islands*
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SOUTHERN REGION

14 State Representatives 6 Local Representatives	Alaska Arizona California Colorado Hawaii Idaho Montana Nevada New Mexico Oregon Texas Utah Washington Wyoming
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WESTERN REGION

A. THE MISSING PERSON FILE

The Missing Person File became part of the NCIC in 1975, pursuant to the authority set forth in 28 U.S.C. § 534.²³ The entry criteria established for the file are as follows:²⁴

- (1) A person of any age who is missing and under proven physical/mental disability or is senile, thereby subjecting himself or others to personal and immediate danger;
- (2) A person of any age who is missing and in the company of another person under circumstances indicating that his or her physical safety is in danger;
- (3) A person of any age who is missing under circumstances indicating that the disappearance was not voluntary;
- (4) A person who is missing and declared unemancipated, as defined by the laws of his state of residence, and does not meet any of the entry criteria as set forth in (1), (2), or (3) above.

Every record entered must be based on documentation supporting the stated conditions under which the person is declared missing.²⁵ Each must contain the entering agency's identity, the case number, the date of the last contact with the missing person, and any other relevant information.²⁶ Generally, when entering a record into the Missing Person File, it is important for the accessor to input as much data as possible.²⁷

The inquiry and entry of the pertinent information occur at local terminals. Initially, the terminal operator must input into the computer a standardized coded description of what function he or she desires.²⁸ The terminal operator must then identify the entering agency through an NCIC assigned code, furnish all relevant information, and subsequently transmit that information through the computer.²⁹ The entry data is then sent via high-speed telecommunication lines to the FBI computer for storage. Thereafter, any of the approximately 62,000 agencies³⁰ authorized to make inquiries of the NCIC could, upon encountering an individual who may be missing, make a terminal inquiry

23. *Hearings, supra* note 5, at 38 (statement of Kier T. Boyd, Inspector-Deputy Assistant Director, Technical Services Division).

24. FED. BUREAU OF INVESTIGATION, U.S. DEP'T OF JUSTICE, THE NATIONAL CRIME INFORMATION CENTER'S MISSING PERSON FILE 2 (1982) [hereinafter *MISSING PERSON*].

25. *Id.* An example of acceptable documentation is a written statement from a parent or legal guardian confirming that the person is missing with verification of his date of birth.

26. *INVESTIGATIVE TOOL, supra* note 14, at 4.

27. *Id.*

28. *Id.* at 5.

29. *Id.*

30. *Hearings, supra* note 5, at 40 (statement of Kier T. Boyd, Inspector-Deputy Assistant Director, Technical Services Division).

of the computer to determine the status of that individual. If a positive response (a hit) is made, the entering agency (the local entity, a police department, for example, making an inquiry about the status of a child they have found) is contacted either by telephone, National Law Enforcement Telecommunications Systems, Inc. (NLETS), or some other means, in order to confirm the accuracy of the inquiry.³¹ The accuracy of a "hit" is crucial and therefore it is essential that the agency making the inquiry immediately contact the originating agency (i.e., the agency that originally input information concerning a missing child).³² This crucial contact between agencies is embodied in the policy known as the "ten minute rule" which requires "the originating agency to, within ten minutes of the communication, either confirm the accuracy of the hit, inform the inquiring agency that the record is no longer accurate, or give notice of the specific amount of time necessary to confirm or reject."³³

From the inception of the Missing Person File in 1975³⁴ to January 1982, there were 791,403 records entered into the file,³⁵ with an average of 10,555 entries per month.³⁶ Of these, approximately seventy-six percent are in the juvenile category.³⁷ There were 601,466 records entered for missing juveniles,³⁸ with a monthly average of 8020 entries.³⁹ The statistics, however, necessarily indicate that the file is underutilized. For example, in 1982 there were over one million reported runaways, but only 114,000 juvenile records were entered into the Missing Person File.⁴⁰

IV. ANALYSIS OF THE SYSTEM

The ineffectiveness of the system lies not in the fact that children disappear at such an alarming rate (which simply evidences a much deeper social problem), but in the fact that such a low percentage of those that disappear are found.

In finding missing children, the present use of computers has three significant weaknesses, the correction of which would greatly enhance

31. INVESTIGATIVE TOOL, *supra* note 14, at 11.

32. Note, *Probable Cause Based On Inaccurate Information: Taking Judicial Notice Of NCIC Operating Policies and Procedures*, 10 FORDHAM URBAN L.J. 497, 507 (1982) (citing NCIC Operating Manual § 1.7, at Intro-7a (Nov. 1, 1981)).

33. *Id.*

34. MISSING PERSON, *supra* note 24, at 2.

35. *Id.* at 4.

36. *Id.*

37. *Id.*

38. *Id.*

39. *Id.*

40. *Id.* at 5.

the effectiveness of the system. These weaknesses are: (1) underutilization of the system; (2) the varying delay policies effecting the time a report is entered into the computer; and (3) the widespread presumptive mentality which perpetuates the erroneous belief that most missing children are runaways and not subject to danger (which is the underlying root of the first two shortcomings). These problems and proposed solutions will be the focus of the proceeding discussion.

A. UNDERUTILIZATION

As noted previously, underutilization of the NCIC computer network system, with regard to missing children, is a major problem. As with any computer system, utilization of the full potential is a sine qua non of efficiency and effectiveness. Although underutilization of the NCIC system may be attributable to many factors, there are four primarily identifiable, though not mutually exclusive ones:⁴¹ (1) undereducation of law enforcement agencies; (2) resource regulations of each state; (3) general presumptions made about missing children; and (4) a general misunderstanding about when the NCIC should be used.

The undereducation of law enforcement agencies is a crucial weakness in the network.⁴² Because use of the NCIC begins and ends with local and state law enforcement agencies, these agencies must establish substantial education and training programs in order to insure full comprehension of the goals, means, and effects of the NCIC network. Obviously, proper training is essential to the success of any system.⁴³ Many people distrust computers⁴⁴ and therefore, proper integration of people and machines can only be achieved if law enforcement personnel understand the system and the role that they play in it. All law enforcement agencies share the goal of finding missing children⁴⁵ and it must be demonstrated to them that the NCIC network can be an effective and efficient means to that end. This can best be achieved through training programs and vigorous information dissemination.

The NCIC Newsletter⁴⁶ is an information pamphlet, distributed through a user subscription process. Because it contains valuable infor-

41. *Hearings, supra* note 5, at 74 (statement by David F. Nemecek, Chief of NCIC).

42. Poor information dissemination and training breeds misunderstandings and ignorance of when and why to use the NCIC network.

43. STATE JUDICIAL INFORMATION SYSTEMS PROJECT, AUTOMATED INFORMATION SYSTEMS: IMPLEMENTATION GUIDELINES 9 (1983).

44. U.S. DEPT OF HEALTH AND HUMAN SERVICES, DATA ASPECTS OF CHILD PROTECTIVE SERVICES 5 (Sept. 1980).

45. This assumption is brought into question by the prevalent mentality regarding missing children. *See infra* text accompanying note 55.

46. The NCIC Newsletter is published quarterly by the FBI National Crime Information Center for the benefit of all criminal justice personnel nationwide.

mation concerning the functioning, management, and development of the network, it is imperative that it be thoroughly disseminated within each local recipient agency. Every level of law enforcement must be reached. Stronger policies emphasizing the importance of this information vehicle should be implemented within each agency. A strong recommendation by the NCIC might provide an impetus for such changes.

The resources, or lack thereof, available to local agencies is always a factor to be considered when making policy. However, the operation cost of the NCIC is minimal, only pennies per transaction,⁴⁷ and its efficiency would be overridingly enhanced by utilization of its full potential. A small investment in information dissemination and training would be worthwhile in numerous respects. It would help planners realize that the network is a sound use of finite resources, while simultaneously enhancing the efficiency of the network.

The erroneous presumptions made about missing children, discussed *infra*, and the misunderstandings about the proper use of the NCIC, can also be alleviated by proper education and the routine use of the system.

B. TIME DELAY POLICIES

There is a wide variance between the policies of police departments around the country with respect to the length of time that must elapse before entering an NCIC record for a missing person.⁴⁸ Some never get entered into the system. This not only results in underutilization but also heavily diminishes the effectiveness of the system.⁴⁹ It has generally been recognized by law enforcement that the first twenty-four hours after an abduction are critically important.⁵⁰ It is almost impossible to play catch-up after that. The common reporting time lapse of twenty-four to forty-eight hours usually enables an abductor to escape to another jurisdiction where the search is either non-existent or given very low priority.⁵¹ An elimination of the time delay policies must be made and local law enforcement should be required to enter a record regarding missing children immediately upon receiving the report. This should be done regardless of the manner in which the child has become missing. The key question should be, "[d]oes the legal custodian of the

47. The NCIC contains over 9,000,000 active records with a daily average of 342,000 transactions. The cost to the Federal Government is 4.8 cents per transaction. *Hearings, supra* note 5, at 38.

48. Fed. Bureau of Investigation, Nat'l Crime Information Center, U.S. Dep't of Justice, NCIC Newsletter, Spring 1983, at 2.

49. *Id.*

50. *Hearings, supra* note 5, at 74 (statement of Richard C. Dennis, Criminal Investigation Division of NCIC).

51. Gelman, *supra* note 4, at 79.

child know where the child is?"⁵² If not, then the child should be considered missing for purposes of immediate entry into the NCIC network.

A critical weakness of the Missing Children Act was that it did not *require* local law enforcement agencies to utilize the facilities of the NCIC.⁵³ The NCIC system operates on a voluntary basis, and therefore a user agency is not required to make an entry for every report. What is needed is a policy mandating entry of all missing children reports. As noted previously, the costs of the system are pennies per transaction and the mandatory entry of all reports would not significantly increase present costs. Any additional costs should be counterbalanced by the efficiency gains of full utilization.⁵⁴

C. PRESUMPTIVE MENTALITY

The problems of underutilization and time delay policies are both rooted in a very basic problem—the widespread presumptive mentality regarding missing children. Given the tremendous number of runaways each year, when a child is reported missing the general presumption is that the child has run away.⁵⁵ What this ignores is that every child that disappears, regardless of the manner in which he/she becomes missing, is a child in possible danger.⁵⁶ The vast majority become victims of physical and sexual abuse, and too often murder.⁵⁷ The lack of awareness of the scope of the problem has generated a dangerous mentality. The belief that a missing child is probably a runaway not only leaves too much margin for costly error, but it erroneously lowers the priority of the search. Every missing child is in possible danger and therefore should have top search priority. When allocating resources, what could be more important than protecting those most helpless in our society?⁵⁸ Eradication of the aforementioned mentality can be achieved through growth of awareness and, as noted previously, effective information dissemination.

The changes in policy and attitudes discussed can bring about mea-

52. *Hearings, supra* note 5, at 113 (statement of Kristin Cole Brown, Information Director of CHILD FIND, INC.).

53. This failure was recognized and considered at the hearings before the House subcommittee. *Id.* at 32 (statement of Mr. Sensenbrenner).

54. Note *supra* note 32, at 508.

55. Fed. Bureau of Investigation, Nat'l Crime Information Center, Dep't of Justice, NCIC Newsletter, Spring 1983, at 2.

56. According to CHILD FIND, INC., statistics do not reveal that a child who has run away or has been abducted by a parent is any safer than a child abducted by a stranger. Reall, *supra* note 2, at 13.

57. *Id.*

58. Such an assumption may meet with disagreement, however, even those unsympathetic to this view must realize the implications of their position.

surable success. This has been demonstrated concretely by the Indianapolis Police Department (IPD).⁵⁹ In 1982, the missing person unit of the IPD took 1592 reports on missing children.⁶⁰ These children were all found, most within a few weeks of their disappearance.⁶¹ Not all missing children, however, are found this easily. The success of the IPD is attributed to three factors:⁶² (1) a high priority is given to missing children, i.e., no waiting period and generally an assignment is made within twenty minutes of the report; (2) the police department encourages parents to file a report as soon as the child is missed; and (3) a bulletin of missing children photos is circulated monthly. The IPD's success certainly illustrates that a change in thinking and in policy can effectuate tremendous success in the protection of our children.

V. LEGISLATION

"The realization that children are a group of special people—individual constituents deserving special recognition, protection, and attention—is a new concept for American jurisprudence and for state legislators."⁶³

The State of Florida, a leading proponent of the protection of children, has enacted exemplary legislation in response to this realization. Currently, Florida law requires all law enforcement officials to receive training in the investigation of missing children.⁶⁴ It eliminates the police "waiting period" to file a missing child report and requires immediate dissemination of missing child information to all law enforcement agencies in surrounding areas.⁶⁵ In addition, Florida has established a state operated missing children computer file and a state missing children information clearinghouse.⁶⁶

59. Indianapolis, with an estimated population of 700,807, is America's 12th largest metropolis.

60. Turbak, *The City That Finds Its Missing Children*, READER'S DIG., Apr. 1984, at 2, 3.

61. *Id.* at 3.

62. *Id.* at 3-6.

63. Hoffenberg, *For The Sake Of Our Children: Selected Legislative Needs of Florida's Children*, 8 NOVA L.J. 223 (1984).

64. Adam Walsh Child Resource Center, *Recommended Child Protection Legislation For States* (1984).

65. *Id.*

66. *Id.* The state clearinghouse provides: a toll free, 24 hour number for reports of disappearance or sighting of a child; circulation of monthly bulletin; directory of resources; emergency fliers; training for public or private organizations; assistance to law enforcement for fingerprinting programs; information to news media; proper training to law enforcement in handling missing children cases; interstate liaison.

VI. COMPUTER DIGITAL IMAGE PRINTOUT

The aforementioned desired changes in policy and legislation are changes which take place outside of the computer system of the NCIC. This forces the realization that a system that effectively protects children must necessarily depend on people, as well as computers. A substantive change, however, can be made within the computer network system itself.

At present, the NCIC computer network is essentially a one dimensional verification tool. The input information has no effect until an inquiry is made. That is, the system is passive until a law enforcement officer finds a child whose status is in question, inquires into the system, and has a response relayed back to him based upon the information stored in the computer system. As a result, the computer has no immediate effect upon the facilitation of the search for a missing child.

The computer can play a more active positive role in the system through the implementation of digital image processing.⁶⁷ Filmless electronic imaging techniques have developed, using multispectral scanners and computer compatible tapes.⁶⁸ Dicta scans are converted by the electronic computer into data displays.⁶⁹ This type of digital image processing can capture and digitize images for storage,⁷⁰ which can then be retrieved by an operator for display, either on a video terminal or printed out on hard copy. Although image pattern recognition is not clearly outlined as a scientific discipline,⁷¹ the process of storing and transmitting digitized picture images of people has been established.⁷²

Summarily, this image—lift technology optically captures and digi-

67. Such technology is widespread in financial institutions, as illustrated by Automated Teller Machines and Point-of-Sale terminals. Vergari, *Evidential Value and Acceptability of Computer Digital-Image Printouts*, 9 RUTGERS COMP. & TECH. L.J. 343 (1983).

68. *Id.*

69. *Id.*

70. *Id.*

71. V. KOVALEVSKY, *IMAGE PATTERN RECOGNITION 1* (1980).

72. A monochrome or "black and white" image is a plane region in which a brightness is defined at every point as a function of the coordinates of that point. The coefficient of absorption at each point of the image is generally used rather than the brightness, given that the brightness of an image depends upon the illumination produced by the light source. Image recognition usually means the assignment of a given image to one of a set of image classes that are predefined. It is by a process of abstraction where details of a given image that are deemed inessential are discarded and principal properties are singled out. These principal properties are considered as defined characteristics of the image class.

An image is fully characterized by a function $v(x,y)$, specifying that spatial distribution of its gray shade. An image is necessarily prevented from having arbitrarily fine details by the wave nature of light and, therefore, the function can be defined with a prescribed precision by its digital representation, i.e., by an array of integers approximat-

ing the average gray shades in each of a finite number of small pieces of the plane that cover the image.

To obtain a digital representation of an image, a sampling process is used to measure the gray shades in many discrete points of the plane. Then a quantization process is applied to each result of the measurements, thereby converting them into corresponding integers. During the sampling, a field of view, i.e., an array of regularly spaced points, is constructed in the region of the plane containing the given image. The spacing between the points is called the "sampling step." Each of these points is surrounded by a small neighborhood called a "cell" or "resolution cell." The average gray shade of each cell is then measured and may be thought of as projecting the image on an array of small light-sensitive devices in such a way that each cell is exactly projected on the aperture of a single device. The array of light-sensitive devices can be analogized to the retina of the eye. The sampling procedure described above is the projection of the image onto the retina, therefore each resolution cell of an image can be considered as a back projection of the aperture of a single light-sensitive device onto the image plane and can be called a retina cell. The array of quantized samples is called the digital image or picture array. The measurements carried out on the original image, called initial features, may be in the form of input data or may be obtained by projecting an image such as a photograph through a transparency and measuring the integrated transparent light. *Id.* at 4-5. An example of the integer approximation:

tizes the image of a document or photograph as it is processed.⁷³ The stored digital images can be retrieved by an operator for display on a video terminal or on hard copies that are printed out on nonimpact printers.⁷⁴ A computer data printout is a legible copy of the contents within the computer storage device. Therefore, a computer digital image printout would be a faithful copy of the photograph that was cap-

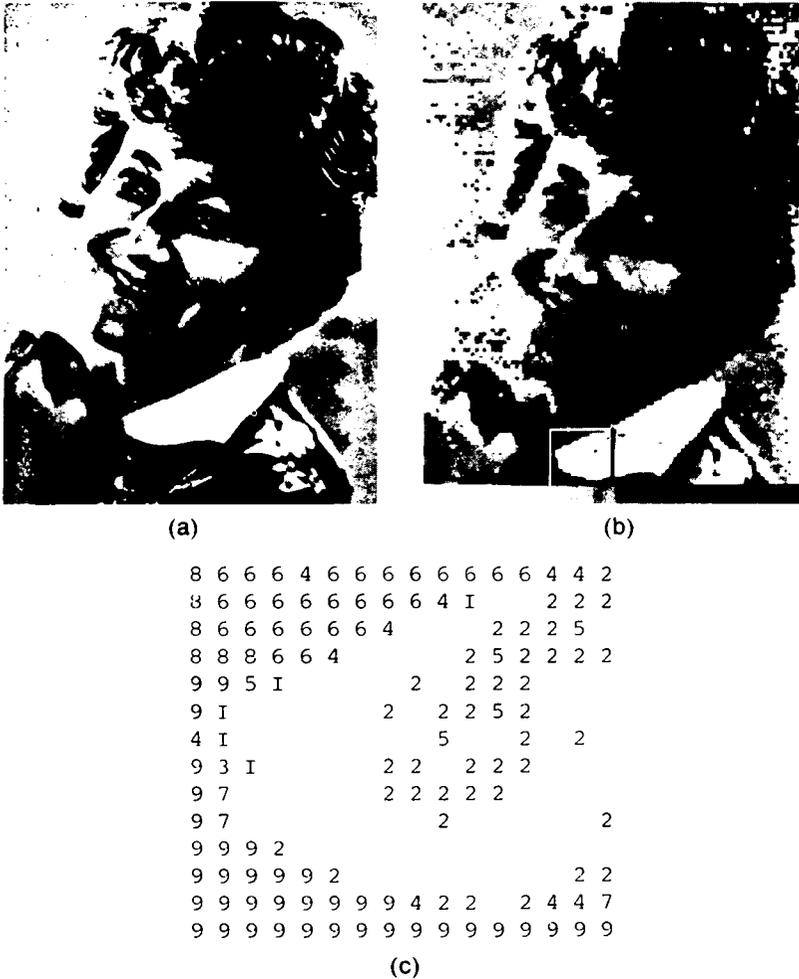


Figure 1.2 Digitization of an image: (a) original image; (b) digital image; (c) digitized gray shades for the square region indicated in (b).

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73. Vergari *supra* note 67, at 343-44.

74. *Id.* at 344.

tured by the dicta scans of the computer.⁷⁵

The advantages of using digital image printouts are obvious. They would enhance the recent ability of the NCIC to use non-unique identifiers⁷⁶ and would actively motivate the search for a missing child. Upon report of a missing child, a photograph could be entered into the system, digitized by the above-described process, and transmitted to prescribed terminals for printout. Although any type of report might initiate a search, a picture of the child would provide clearer identification and motivation to search, than would a simple list of unique and non-unique identifiers.

CONCLUSION

Through the Missing Children Act and its amendment to the NCIC, the computer has become an important factor in finding our missing children. The terrifying number of children who disappear each year has necessitated a closer look at the system which has been set up. Its weaknesses have been illuminated and solutions prescribed. Proper training and vigorous information dissemination can alleviate problems of underutilization, effectuate changes in policy and mentality, and eventually result in legislation within each state. The advent of computer digital image printout has presented the possibility of the addition of a new dimension to the NCIC system.

These types of changes, both offensive and defensive, must be made in order to have a strong and successful team, comprised of people and computers, to combat the national tragedy of our missing children.

Michelle M. Fujimoto

75. *Id.* at 346.

76. A recent enhancement to the Missing Person File is the ability to inquire using non-unique identifiers, such as age, sex, height, etc. This capability is useful when specific information is not available. INVESTIGATIVE TOOL *supra* note 16, at 25.

